



World Summit - from EARTH to URBAN - for Safe & Sustainable Cities
CIVIL ENGINEERING • ARCHITECTURE • URBAN PLANNING CONGRESS

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CAUSummit 2024

World Summit
from EARTH to URBAN - for Safe & Sustainable Cities

**CIVIL ENGINEERING • ARCHITECTURE • URBAN PLANNING
CONGRESS**

Eco-friendly Congress - CAUSummit

ABSTRACT BOOK

2-6 September, 2024 - Antalya (Turkiye)



"The Meeting Point for Civil Engineers, Architects, City & Urban Planners"

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Preface

This is the Abstract Collection Book of CAUSummit 2024 and consists of the abstracts of oral and poster presentations in the “World Summit: Civil Engineering-Architecture-Urban Planning Congress” in Antalya (Turkiye) which is the pearl of the Mediterranean and the Turkish Riviera during 2-6 September 2024. The main mission of the "World Summit: Civil Engineering-Architecture-Urban Planning Congress - CAUSummit" was to lead to contribute in multidisciplinary studies related with Civil Engineering, Architecture, City & Urban Planning and to improve interactions between people within these fields.

What makes a city safe and sustainable? We discussed and took a look at the world's most safe and sustainable cities to find out how they were created... from EARTH through DESIGN, CONSTRUCTION, PLANNING, URBANIZATION, ENVIRONMENT, ... to CITIES ... As another mission, CAUSummit provided a forum for this diverse range of studies report very latest results and document emerging understanding of the related systems and our place in it. By this way, we tried to find solutions and methods to establish better, safe & sustainable cities where our children will grow up.

"World Summit: Civil Engineering-Architecture-Urban Planning Congress - CAUSummit" provided a forum for discussion of the latest findings and technologies in different fields of Civil Engineering, Architecture and Urban Planning. It gave opportunities to the participants for collaboration in a platform by sharing knowledge and experiences in their fields. CAUSummit also lead to provide a forum for early career researchers for presentation of their work and discussion of their ideas with experts in different fields of Civil Engineering, Architecture and Urban Planning.

I would like to express my sincere gratitude to almost 100 submissions to CAUSummit 2024 from 27 different countries all over the world for their interests and contributions in CAUSummit 2024. I wish you enjoyed the "World Summit: Civil Engineering-Architecture-Urban Planning Congress" and had a pleasant stay in the city Antalya (Turkiye) which is the pearl of the Mediterranean and the Turkish Riviera, and it is one of the most popular congress tourism and tourist destinations in Turkey, Europe, and the World.

I hope to see you again during next event "World Summit: Civil Engineering-Architecture-Urban Planning Congress - CAUSummit 2025" which will be held in Antalya during 1-5 September 2025.

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Negative Effects of Alluvial and Gypsum Formations on Urbanization, Sivas - Hafik District Example, Turkey

Murat Şahin

Havza Yönetimi, İzleme ve Tahsisler Şube Md. Dsi 19. Bölge Müdürlüğü

ABSTRACT

In this study, the melting properties of the gypsum found in the Middle-Upper Miocene aged Hafik Formation, which spreads in the Sivas Tertiary Basin, and the bearing capacity and possible negative effects on the foundations of buildings due to the increase in the groundwater level in the Quaternary aged alluviums due to precipitation, were examined. Sivas Province has the second largest area in Turkey with an area of 28164 km². In terms of administrative and settlement units, it has 17 districts, 1222 villages, 29 towns and 722 hamlets. According to TÜİK 2023 census results, the population of our region is 634924 people, with 23 people per km². The population of the city center is 390318 people. The basin, which extends in a northeast-southwest direction in the central parts of the Sivas province area and has a length of approximately 250 km and a width of 50 km, is defined as the Sivas Tertiary Basin. The rocks outcropping in the study area are from old to young; Paleozoyik aged Karaçayır Formasyonu (PMk), Upper Cretaceous aged Refahiye Ophiolitic Complex, Oligo-Miocene aged Selimiye Formation (Yağbasan Üyesi, Zikri Üyesi), Lower Miocene aged Apa Formation, Lower-Middle Miocene aged Kemah Formation, Middle Miocene aged Hocabey Formation, Middle-Upper Miocene aged Hafik Formation, Upper Miocene-Pliocene aged İncesu Formation (Derindere Member, Aydoğmuş Member, Porsuk Member), Plio-Quaternary aged Formations, Quaternary aged travertine, Alluvium. Middle-Upper Miocene aged Hafik Formation, which is widely distributed in Sivas and its surroundings; The dominant rock unit in the unit, which consists of white colored gypsum and red, green and blue colored claystone-sandstone alternation, is gypsum. Quaternary alluvium; The unit consisting of gravel, sand and clay deposited on the banks of streams is distinguished as alluvium. It is widely spread especially in the Kızılırmak valley and plains. Some of the residential areas in the city are located on the alluvium of Kızılırmak or its side streams. According to the geophysical survey studies, the alluvium thickness varies between 30-35 m in the plain. 16 wells located in Sivas City and its surroundings were selected as observation wells and these wells were measured for approximately 3 years (2010-2012). The average static level value is around 3.91 m. This value is also the groundwater level of the Kızılırmak alluvium. It was aimed to examine the sinkhole that occurred on 19.10.2022 in the Çay neighborhood of Hafik district of Sivas province from a technical point of view. There are residential areas 2.5 km north and 1 km southwest of the sinkhole. Therefore, in the study, the effects of sinkhole formation on the environment and the necessary measures for its improvement (closure) were evaluated. The units spreading in and around Obruk are from the oldest to the youngest; Eocene volcanics are Lower Miocene gypsum, Middle Miocene conglomerate-sandstone-mudstone, Pliocene conglomerate-sandstone-mudstone and Quaternary alluvium. The thickness of the alluvium varies between 8-10 m. The upper levels of at least 6 m are silty and clayey, while the lower parts are sandy,



pebbly and blocky. Just below the alluvium, there are Lower Miocene aged massive, locally layered, cracked and melting cavities gypsum. The sinkhole structure was formed as a result of the formation of caves by the side stream waters and precipitation waters melting the gypsum under the alluvium and the collapse of the alluvial formation on the cave ceilings due to gravity. This sinkhole formation is approximately 6 m in diameter and 8 m in depth. The resulting sinkhole was filled with alluvial material by the in Hafik District Special Administration Directorate order to prevent its environmental effects. There are karstic formations and depressions in the region, including Hafik Lake, and it is possible to repeat the sinkhole formations both tectonically and hydrogeologically. Therefore, the regions where the Lower Miocene gypsum series are common should not be developed. Such karstic structures should be taken into account when creating new zoning areas in Hafik district. Since such sinkholes are likely to occur, especially Public Institutions (DSI, Highways, Special Provincial Administrations, Municipalities, etc.) should be very careful and necessary precautions should be taken while making projects. In addition, in future constructions (public housing, factories, shopping malls, public offices, hospitals, etc.) in Sivas city center and surrounding lands, alluvial soil and gypsum fields belonging to Kızılırmak and its side streams should be avoided. It is necessary to protect agricultural lands for the future of the country. Constructions; It must comply with the zoning law, environmental law and urbanization aesthetics.

A Concerted Proposal Based on an Imminent Collapse Scenario for Groundwater Management in an Overexploited Aquifer, Atacama Desert

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ABSTRACT

The overexploitation generated by the inefficiency for the application of the legislation on the closed state in the Caplina aquifer, has generated the progressive deterioration of the quality of groundwater due to salinization processes due to marine intrusion. Based on a review of causes and effects, there is an urgent need to incorporate a concerted proposal from the users themselves and the state entities for the comprehensive management of groundwater, which will prevent the deterioration of its quality. The concerted proposal is based on four key points (1) review of the current status of the aquifer system regarding the deterioration of its quality due to overexploitation of groundwater, (2) review of water use licenses, (3) reallocation of water use and of its net benefits and (4) verification and validation of the balance of the aquifer system. This simple proposal is expected to work in the face of the imminent collapse of the aquifer system.

Study of Dynamic Mechanical Properties for Urban Purposes: Alamein Area, Western Desert, Egypt

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ABSTRACT

The Northwestern part of Egypt is considered as a promising area for several national urban projects like the New El-Alamein City and El-Dabaa nuclear project. The main issue for any urban project is to measure and evaluate the degree of stability of the bedrock for these buildings. El-Alamein area lies in the northern portion of the Western Desert; about 100 kms west of Alexandria city. The New El-Alamein city is considered as an important new urban extension of the Northwestern part of Egypt. In the present work, thirty-two rock samples were collected from some shallow boreholes, representing a great part of the Marmarica Formation (Miocene). These samples were subjected to numerous laboratory measurements such as porosity, permeability, electrical resistivity, sonic wave velocity and dynamic mechanical properties. These laboratory measurements were conducted at Ain Shams University petrophysical lab. (PRU), the Egyptian Petroleum Research Institute (EPRI), and the British University in Egypt (BUE). The measured petrophysical parameters for the Miocene (Limestone) rocks, presented by the Marmarica Formation in New El-Alamein City show many fundamental rock properties. The sedimentological features of the Miocene limestone rocks were investigated using several thin sections to detect petrographical features and diagenesis. Some relationships between different elastic moduli and petrophysical properties were constructed to detect the different rock types based on material competence scales and material bearing Capacity. The material competence scales of the studied Middle Miocene limestone rocks show a very good relationship with the Poisson's ratio and velocity ratio. It ranges from weak to moderately competent. Depending on the ultimate bearing capacity the Middle Miocene limestone rocks are considered medium-weak to medium-hard rocks.

Geotechnical Condition of the Tekhuri River Gorge (Georgia): Implication for Interdisciplinary Approach

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ABSTRACT

The Tekhuri River Gorge is located in the Caucasus region, within two main tectonic zones: the southern slope of the Greater Caucasus and the Rioni foreland fold and thrust belt. The research aimed to determine the deformation structural style of the study area, but also to understand the geotechnical condition of it as a cascade of hydropower plants is planned to be constructed. For this reason, detailed geotechnical, engineering, and structural geological work has been done. The research consisted of several steps: processing and critical analysis of the field materials, conducting fracture analysis of base rocks, assessing geohazard condition of the river gorge, moreover, determining physical-mechanical, water-filtration, chemical, petrographic, seismic, and geotechnical parameters and properties of the rock samples taken during the fieldwork, other steps involved analyzing, modeling, and interpreting the data. Fault-related folding and wedge thrust folding theories were used to construct the regional balanced and restored cross-sections across the study area, also a conceptual model of fracture development in a folded structure was used to determine types of fracture in rock masses using the Move software. On the other hand, geotechnical classifications such as Geological Strength Index (GSI), Rock Mass Rating (RMR), and Q were used to characterize the geotechnical conditions of rock masses. Geohazards such as landslides, debris flows, and rockfalls were observed within the gorge and modeled using the RAMMS software. The study results once again clearly show the importance of using an interdisciplinary approach for seismically active territories and sustainable development of large infrastructure objects.

On the Black Sea Rise in Varna and Burgas Tide Gauges

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ABSTRACT

Ordinary least squares regression is a parametric technique that is commonly used for analysis of time series. This method is very popular when the long-term trend of the change in a sea-level has to be estimated on basis of mareograph data. The main advantage of ordinary least squares regression is that this approach allow us to estimate the slope and the intercept of a regression line by parametric methods that are relatively simple. However, the ordinary least squares regression relies on the assumption about the normality of data. If this assumption is not met, the regression results may not be correct. Another disadvantage of the method is that it is very sensitive to impact of outliers in data. Analysing the records of the Black Sea level, gathered by tide gauges in Varna in the period from 1929 to 2011, we can see that in 2005 and 2006 years we registered significantly low sea-levels, in comparison with those in the previous and in the next few years. Similarly, the Black Sea level in the vicinity of the tide gauge in Burgas, where the measurements was done in the period from 1928 to 2013, we also recorded significantly low sea-level in 2005. These facts have been taking into account by the Bulgarian scientists, who have estimated the trends of the mean sea levels in Varna and Burgas. The purpose of the current research is to recalculate these trends by the use of non-parametric regression, i.e., by the Theil-Sen robust estimator of simple linear regression. Using non-parametric regression, we calculated the slopes of the linear upward trends of the Black Sea in Varna and Burgas equal to 1.67 mm/year and 1.85 mm/year, respectively. Using ordinary least squares regression, we documented the results of our colleagues, who calculated that the slopes of the linear trends of the Black Sea in Varna and Burgas are about 1.2-1.4 mm/year and 1.5-1.6 mm/year, respectively. As one can calculate, the differences between the values of the slopes, obtained by both regression techniques, is approximately 25% of the magnitudes of sea-level rises. Another important point is, that the difference between sea level rises in Varna and Burgas, calculated by the Theil-Sen robust estimator, is less than the same difference, but based on the ordinary least squares regression. Therefore, when we analysed oceanic data, which is likely to contain extreme data points, it is preferable to give more trust to non-parametric techniques in order to obtain results that are more relevant than results obtained by ordinary regression under violation of its assumptions.

Multiple Regression in Help of the Precise Levelling

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ABSTRACT

The precise geometric levelling is the main method for solving many scientific and engineering tasks related to the recent vertical movements of the Earth's crust, the changes in slopes and levels of the oceans and seas, defining of continental and / or state reference height systems, validation of global geopotential models, monitoring of engineering construction, etc. Despite being in use more than a century, there are some incorrect beliefs about accumulation of uncertainties in the results obtained by this geodetic method. These mistaken theories cast their damage over the methodology of execution of measurements, the assessment of the accuracy, processing of the observation data and so on. The purpose of the current research is to throw light on one of the popular beliefs regarding accumulation of differences between both measurements of heights between terminal benchmarks in the precise levelling lines. In the research, the accumulation of the absolute values of the differences between both height measurements in the lines $|D|$ is analysed by multiple regression. As independent variables we use the square root of the length of leveling lines L , the length of leveling lines L , the sum of the absolute heights in levelling sections in the lines $|h|$, and the absolute value of the height difference between terminal benchmarks $|H|$. In the interest of plausibility, we analysed the levelling data from different campaigns in two countries with contrasting climate and geological formations, those of the Third precise levelling of Bulgaria /1975-1984/, the Second precise levelling of Finland /1935-1955/ and the Third precise levelling of Finland /1984-2006/. The results from our analyses show that the multiple coefficients of determination of the differences $|D|$ in respect of independent variables L , L , $|h|$ and $|H|$ are 0.29, 0.36 and 0.28 for the Third precise levelling of Bulgaria, the Second precise levelling of Finland and Third precise levelling of Finland, respectively. The most important independent variable for explaining the differences $|D|$ in the analysed levelling networks, which is the only one statistically significant at 99% confidence level, is the sum of the absolute heights in levelling sections in the lines $|h|$. The traditionally supposed variable, the square root of the length of leveling lines L , is not statistically significant even at 90% confidence level in the case of each mentioned above network. The major conclusion, which we can make on the basis of the research results, is that under 40% of accumulation of the differences $|D|$ between both measurements of heights in the precise levelling lines, we can explain by L , L , $|h|$ and $|H|$. Therefore, we need some new approaches in order to define the maximum accepted values of the differences $|D|$ and levelling accuracy estimators.

The Number of Set Ups in Lines as Weights in the Precise Levelling

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ABSTRACT

The main method for monitoring of vertical displacements of engineering constructions and estimation of deformation processes is the precise geometric levelling. This method is also essential for defining the state height systems, which are the base of any vertical engineering network. Extremely important factor about the final accuracy of a geometric levelling network is not only the accuracy of measurements, but also the choice of the weights, applied in its adjustment. The recent specification for the precise levelling in Bulgaria allows two type of weights. The first ones are the classical weights, which are inversely proportional to the lengths of levelling lines L , in the form $w=1/L$. The second type of weights are inversely proportional to the number of set ups in the lines n , i.e. $w=1/n$. The purpose of the current research is to show that there is not significant difference in the results, which would be produced with both type of weights, especially for the territory of Bulgaria. In order to prove this fact, we adjusted the network of the Third Levelling Bulgaria by both type of weights. The differences between the standard errors of the adjusted heights of the identical benchmarks in the network, produced by adjustments with both weights, vary in range ± 0.5 mm. The differences between the adjusted heights of the same benchmarks in the network, obtained in both variants of adjustment of the network, vary from -1.1 mm to 1.3 mm. The distributions of the last differences approximate normal distribution with the expectation $\mu = 0.12$ mm and standard deviation $\sigma = 0.61$ mm. These results can be explained with high correlation between the length of the levelling lines and the number of the set ups. We estimated that the coefficient of correlation between L and n in the case of the Third Levelling of Bulgaria is equal to 0.976. The general conclusion is that we cannot expect any significant increase of the adjustment accuracy of a levelling network, if we change the weights $w=1/L$ with the weights $w=1/n$. This conclusion is especially valid for networks developed through flat areas, where the most of lengths of the sights are approximately equal.

Performance of Precision Setting Out Works by Combining Different Geodetic Methods

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ABSTRACT

The current publication examines some suitable combinations of different geodetic methods - classical and modern, used in performing precision setting out works, during the construction process. Mainly, in choosing a balanced solution in terms of accuracy, execution time and logistics - available geodetic tools and team of specialists. Particular attention is paid to some, specific engineering structures, with a high degree of wide-ranging control, regarding the accuracy of fixed elements in plan, height and orientation of construction axes. The combination of conditions, namely for a specific geographical orientation and precise relative accuracy of the construction elements, requires the corresponding transformation from geodetic, ellipsoidal coordinates to a suitably selected projection plane, the basis for the Setting out plan of the site. In this regard, the allowable accuracies for determining the geodetic, ellipsoidal coordinates obtained by GNSS (Global Navigation Satellite Systems) have been investigated. Also, the necessary accuracies in the subsequent setting out works, in plan and height. An approach for preliminary assessment of the accuracy is presented, using some different variations of geodetic methods and tools. The presented way allows a science-based choice of the most appropriate geodetic method or combination of methods, during setting out activities for specific, engineering structures. Theoretical assessments are supported by results of geodetic works from the author's professional practice, realized by using different geodetic methods and tools.

Fluctuations in the Black Sea Level in Varna and Burgas Bays in the Period from 1928 to 2011

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ABSTRACT

The ordinary least squares regression is a parametric technique that is commonly used for analysis of time series. This method is very popular when the long-term trend of the change in a sea-level has to be estimated on basis of mareograph data. The main advantage of ordinary least squares regression is that this approach allow us to estimate the slope and the intercept of a regression line by parametric methods that are relatively simple. However, the ordinary least squares regression relies on the assumption about the normality of data. If this assumption is not met, the regression results may not be correct. Another disadvantage of the method is that it is very sensitive to impact of outliers in data. Analyzing the records of the Black Sea level, gathered by tide gauges in Varna in the period from 1929 to 2011, we can see that in 2005 and 2006 years we registered significantly low sea-levels, in comparison with those in the preview and in the next few years. Similarly, the Black Sea level near the tide gauge in Burgas, we also recorded significantly low sea-level in 2005 and 2006. The purpose of the current research is to recalculate these trends by the use of non-parametric regression, i.e., by the Theil-Sen robust estimator of simple linear regression. Using non-parametric regression, we calculated the slopes of the linear upward trends of the Black Sea in Varna and Burgas equal to 2.35 mm/year and 2.03 mm/year, respectively. The slopes of the linear trends of the Black Sea in Varna and Burgas, estimated by other Bulgarian researches, are about 1.2-1.4 mm/year and 1.5-1.6 mm/year, respectively. Contrary to the results, published by other researchers, we found that sea-uplift in Varna is greater than that in Burgas. Therefore, when we analyze oceanic data, which is likely to contain extreme data points, it is preferable to give more trust to non-parametric technics in order to obtain results that are more relevant than results obtained by ordinary regression under violation of its assumptions.

Designing Raised Intersections in Bulgaria: Challenges and Solutions in Grading Planning

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ABSTRACT

This paper investigates the grading planning aspects of designing raised intersections in Bulgaria. Drawing upon both local and international requirements, it presents a summary of the necessary design criteria. The article presents some practical challenges in implementing these requirements in the process of designing grading plans such as choosing the designed elevation of the raised intersection in the longitudinal profile and designing the grades of the approach and departure ramps. Based on this, some basic approaches have been proposed for the selection of designed elevations and ramp slopes to choose the optimal design surface of the intersection in vertical aspect and satisfy the requirements of traffic calming. Attention has also been paid to certain drainage requirements.



Accuracy of Area-Capacity Curves of Reservoirs Defined by Direct Geodetic and Hydrographic Measurements

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ABSTRACT

The report is dedicated to the accuracy of area-capacity curves, which are an essential tool for drawing up the water balance and managing the water resources of damlakes. The method of deriving the area-capacity curves through direct geodetic and hydrographic measurements is considered. The necessary accuracy of the storage capacity is determined based on the permissible discrepancy of the water balance equation, defined in a specialized ordinance. Formulas have been derived for estimating the accuracy of the storage capacities and flooded areas using the accuracy of the measurements taken. A modification of the above formulas is proposed to solve the inverse problem - a preliminary estimation of measurements accuracy at a determined accuracy of the storage capacities.



Determining Grate Inlet Locations in Grading Plans for New Streets in Bulgaria

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ABSTRACT

This paper presents research for determining the optimal maximum distances between grate inlets to ensure effective drainage of street sections. The defined distances are calculated using a hydraulic reasoned methodology with accepted criterion for maximum allowable water spread on the roadway, sewer system return period, longitudinal and cross slope of the street. All parameter values are in accordance with the relevant norms in Bulgaria. Tables with required distances between grate inlets are compiled and can be used to determine the grate inlet locations in grading plans for new streets. The proposed data is applicable to streets with varying widths and longitudinal slopes ranging from 0.3 to 12%. Such resources can be useful in both urban planning and investment design processes.



Coseismic Ground Displacement in Balkan Peninsula Determined from Sentinel-1

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ABSTRACT

We are motivated in this study by the fact that earthquakes are occurring constantly and are not possible to predict. The information and the size of these events is important for the local and national authorities responsible for mitigation of the post-event damages. It is important to establish the locations of ground displacements induced by catastrophic events for large areas, which can be used as an indicator of where infrastructure sites are expected to be more susceptible to damage. The main task of this study is to show how the magnitude of the ground deformations is registered and how displacement maps are produced. Satellite radar instruments deliver SAR data that are able to provide reliable information on the magnitude of ground motions in the range of centimeters since they deliver strictly quantitative measurements. Such information is of extreme importance in assessing the consequences of natural or man-made disasters. In principle, repeat pass InSAR is used to extract quantitative information on the scattering objects from complex interferograms produced by two or more sets of mutually correlated complex SAR images of a same scene. In this research presented are the results obtained after processing sets of SAR data by DInSAR method in order to study the subsidence/uplift or lateral deformation caused by several seismic events that happened in the region of Balkan Peninsula. Coseismic DInSAR processing of radar is an additional source of information on crustal deformation on Earth after an earthquake event. It is possible to obtain reliable information in short time after the event concerning large areas, which in some cases are inaccessible for in-situ surveys. Trustworthy information about the real ground displacements is obtained only after the precise satellite orbits. To determine the type of ground motion (E-W or vertical) both orbits are to be processed and merged.



Effect of Stemming Parameters on Blast- Induced Rock Fragmentation: A Case Study

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ABSTRACT

The size of rock fragmentation plays an important role in the economic efficiency of surface mining operations. It directly affects the costs associated with drilling, blasting, loading, and crushing. This study aims to explore the influence of blast design factors such as blast hole length, stemming length, and powder factor on rock fragmentation in a limestone quarry. Digital Image Analysis (DIA) was employed to determine the mean fragment sizes (MFS-X50) and maximum fragment size (MaxFS-X80) of the rock. Following each blast, several images of the entire muck pile were captured during the loading stages and subjected to fragmentation analysis using WipFrag software. The results obtained reveal that the optimal rock fragment size (MFS-X50, and MaxFS-X80) of rocks depends strongly on both blast design parameters and explosive factors.

Preliminary Assessment of the Effects of Controllable Factors on Rock Fragmentation: A Case Study

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ABSTRACT

The outcomes of blasting significantly impact subsequent operations in quarrying and mining. These outcomes hinge on controllable and non-controllable factors. To achieve desired fragmentation, controllable factors such as blast geometry and explosive properties must align with non-controllable factors like geological conditions and regulatory limitations. This research delves into how blast design parameters influence rock fragmentation. Five distinct blast designs were examined, and rock samples were collected from each blast site to assess their uniaxial compressive strength (UCS). Digital imagery of the resulting muck piles was captured and analyzed using WipFrag software to quantify fragmentation. Particle size distributions were determined for each blast, and the average fragment size was correlated with blast design parameters. For gyratory crushers with a feed size of 1200 mm, the cumulative passing percentage ranged from 91.6% to 100%. Notably, the stiffness ratio, powder factor, and rock UCS exhibited strong correlations with mean fragment size. Powder factor also correlated strongly with rock UCS, indicating that higher rock strength necessitated greater powder factors for achieving desired fragmentation. Interestingly, the spacing to burden ratio showed minimal correlation with fragment size in this study. Overall, all blast events examined resulted in favourable fragmentation, as indicated by uniformity indices ranging from 2.097 to 2.525.

Manufacturing and Testing of a New Column-Type Flotation Cell to Produce Concentrate from Poor Ores Containing Gold and Silver

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ABSTRACT

Both mechanical and hydrometallurgical beneficiation methods are used in the processing of precious metals. One of the common methods of gold and silver beneficiation is hydrometallurgy, where the risk of environmental pollution is high, due to the fact that toxic chemicals are mostly used. The environmentally friendly gravity beneficiation method is mainly used in the combined technology in the initial stage. The flotation beneficiation process cannot always ensure the maximum recovery of gold and silver in the concentrate, which in production is replaced by the above-mentioned environmentally hazardous hydrometallurgical process. Therefore, it is very important to obtain a high-quality concentrate by flotation beneficiation. This paper presents the results of obtaining high-quality precious metal concentrates by flotation beneficiation. Within the framework of the project, a column-type flotation cell was manufactured, in which the presence of an ascending airflow ensures the distribution of bubbles in the pulp and maintains their ascend rate, which determines the homogeneity of the pulp and helps to attach the reagent to hydrophobic minerals. In order to obtain a high-quality concentrate and reduce economic costs, the sample was divided into three thickness classes, a finished flotation class of -0.071 mm was isolated and each class was milled separately. As a result of milling the above-mentioned classes were combined. In order to obtain high-quality concentrate and reduce the loss of useful components, two collectors were used simultaneously. Potassium butyl xanthogenate and Aeroflot were chosen as collecting agents. Their ratio and costs were determined. As part of the research, chemical, silicate, sieve and mineralogical analyses of the sample were performed, as well as petrographic description was carried out. The optimal regime parameters of the flotation process were determined, as a result of which a high-quality concentrate of precious metals was obtained, with gold content of 14.25 g/t, silver - 19.05 g/t, recovery of useful components in the concentrate - 93.8. % and 90.4%, respectively.

Optimal Blast Design Considering the Effects of Geometric Blasting Parameters on Rock Fragmentation: A Case Study

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ABSTRACT

In quarrying and mining, drilling and blasting activities are an essential method of excavating rock. Blasting is an integral and important part of mining, and is an inherently destructive process for a number of advantages, including, efficiency, economy and the capability to break up even the hardest rock. The main aim of blasting design is to use explosives to break rock masses into sizes and shapes that can facilitate subsequent operations such as excavation, loading, transportation, crushing. The design of a blasting pattern depends on two types of variables: uncontrollable factors such as the geological structure and rock mass properties, and controllable factors as geometric pattern (Bench Height, charge length, diameter, spacing, burden, stemming ...), explosives properties (Types, strength, energy, ...etc.) and Time parameters (Delay timing and initiation sequence). The various techniques for analyzing blast fragmentation have inherent difficulties that result in varying levels of accuracy. In consequence, each technique is tailored to a specific aim. This study evaluates and compares the particle size distribution by blasting of rock limestone from the New Cement Quarry (NCQ) of Setif -NE of Algeria, using the numerical image processing software Wip Frag and the Kuz-Ram empirical model. Three different blasts from the quarry, using different design mesh of burden and spacing (rectangular, square and triangular) were analyzed using the two methods. Blast design parameters were obtained and evaluated as inputs to the Kuz-Ram model. Images of the pile were taken and downloaded to the computer for Wip Frag analysis. The results obtained in the case of a change in geometric blasting parameters give a significant reduction in the size of oversized products was observed by the numerical method. Furthermore, in this study, the ratio between spacing and burden in the triangular pattern case has a major influence on fragment size, and enables optimum use to be made of the explosive's distribution principle and energy quantity.



Impact of Illumination on Fragmentation Analysis Using Digital Image Processing (WipFrag)

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ABSTRACT

Rock fragmentation analysis is crucial for optimizing blasting operations. It involves different methods, classified as direct and indirect. Direct methods, such as sieving, are accurate but often difficult, time consuming, and impractical for large piles. Indirect methods, such as digital image analysis, have become popular due to technological advancements. They offer an effective way to evaluate fragmentation. This study aimed to assess the efficiency of quantifying fragmentation using digital image analysis with WipFrag software. To gauge WipFrag's capabilities, a real blast pile at Sour El Ghozlane Cement Company (SCSEG) was photographed and analyzed. The pictures were taken at different times of the day to study the influence of lighting on the results. The midday photos yielded superior results compared to those taken at other times. They excelled in terms of precision, lighting, and minimal shadows, setting them apart. The findings demonstrated that WipFrag software serves as a valuable and effective solution for quantifying fragmentation across diverse materials. It offers precise and comprehensive data on particle size distribution and shape characteristics. It is important to interpret the data in the context of the time of capture, taking into account how variation in daylight over the course of the day can affect the results of fragmentation analysis.

Peculiarities of Obtaining Complex Fe-Mn-B Ligature by SHS-Metallurgy Using Production Wastes

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ABSTRACT

By the method of SHS-metallurgy in Fe-Mn-B system complex ligatures with a wide range of alloying elements content have been developed and obtained. Traditional methods of obtaining ligatures, ferroalloys or modifiers are associated with the duration of the process, loss of valuable products, high energy consumption and environmental pollution. SHS-metallurgy method is devoid of these disadvantages and at the same time allows to form the target product consisting of both refractory and light-melting elements in one technological stage. In the process of synthesis of materials, the effect of self-purification - thermodesorption of volatile impurities is manifested, and the resulting products are cleaner than the initial reagents. In addition, technological methods of SHS metallurgy, centrifugal force and gas pressure lead to reduced losses of the target product. This leads to minimization of environmental pollution, which is very important in the current trends of environmental pollution. The content of alloying components varied widely. As iron, steel rolling waste in the form of magnetite was used. In addition, the carbide-forming elements V, W and Mo, both together and separately, were introduced into the complex ligature by SHS. Dosed introduction of the required number of alloying elements allows to achieve the required structure and properties of iron-carbon alloys due to the formation of strengthening phases in the structure of the metal matrix.

The work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSFG) [grant number STEM-22-761].

Development of Consolidated Material Containing Ceramic Nanostructure Based of Ti-B-C-N System and Influence of Mechanoactivation on Some Physical-Mechanical and Operational Properties

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ABSTRACT

One of the promising directions for saving electricity and reducing the duration of the technological cycle is the realization of synthesis processes based on the use of exothermic reaction energy. The purpose of this work is to develop consolidated materials containing ceramic nanostructure and innovative technologies for their preparation. self-propagating high-temperature synthesis - compaction. The work is devoted to the topical problem of obtaining multi-functional, nanostructured materials based on the Ti-B-C-N system (Ti-BN, Ti-BN-C, Ti-B₄C), which will have qualitatively improved properties, such as ductility, compressive strength, wear resistance, abrasion resistance, Resistance in aggressive areas, as well as being able to work in radiation conditions and be able to protect objects from both radiation and dynamic loads with high intensity and energy. In addition, deficit, expensive, limited materials and complex technologies will not be used to obtain ceramic material. As a result, the product produced by us will be competitive, cheap, easy to manufacture both from a technological and economical point of view. They will not have a high cost, will not require a large expenditure of material, energy and hardware resources, and will be characterized by high viability. The materials developed in the AR-22-955 project can be successfully used as materials for the protection of equipment, including police, banking and other - from damaging elements with increased penetration, as well as for protecting space objects from damaging elements with increased penetration and radiation.

This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSFG) [Grant Number AR-22-955, Project Title: "Development of consolidated material containing of ceramic nanostructure and preparation of pilot samples based on Ti-B-N system"]



Structure and Composition of Ceramic Materials Obtained by SHS Compaction of Mechanoactivated Chasms of Ti-BN, Ti-BN-C and Ti-B₄C Compositions in Ti-B-C-N System

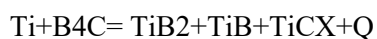
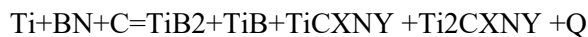
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ABSTRACT

Using the original technological scheme of SHS-compaction, the scientific group of the Institute of Metallurgy and Materials Science obtained synthetic composite ceramic materials "constructed" from hard Synthetic Ceramic Composite Materials (SCCM) in Ti-B-C-N system: SCCM-1 on the basis of Ti-BN composition, SCCM-2 on the basis of Ti-BN-C composition and SCCM-3 based on Ti-B₄C composition. Below are the possible chemical reactions between the initial components and the possible phase composition of the final products:



By changing the concentration of the initial components, it is possible to change the phase composition of the final product. The synthesis process can be conventionally divided into three parts: the heating zone, the active interaction or heat release zone and the final product formation or crystallization zone. In the heating zone, titanium melting and capillary flow begin in one case on boron nitride particles, in the second case on boron nitride and carbon particles, and in the third case on boron carbide particles. In the next zone, the zone of active heat release, there is intense interaction between titanium and boron nitride in one case, between titanium carbon and boron nitride in the second case, and between titanium and boron carbide in the third case. From all three components of the Ti-B-N-C system, Ti-BN, Ti-BN-C and Ti-B₄C ceramic materials with SHS compaction technology, in the production of synthetic ceramic composite materials (SCCM) and products from mechanoactivated chasm, determining the optimal technological parameters is of particular importance. These parameters are time and pressure characteristics and are determined experimentally. As a result of the correct selection of these characteristics and the influence of mechanoactivation in the Ti-B-N-C system, compacted with a porosity of 2% and 3.5% and 3% respectively, with a smoothness of 92.3 HRA and 93.2 HRA and 93.5



HRA with a density of 4.5 g/cm^3 and 4.7 g/cm^3 and 4.73 g/cm^3 materials. These materials can withstand a single dynamic impact with energy of 18000-20000 J, with a thickness of $\sim 11.5\text{-}12 \text{ mm}$ of the product's ceramic layer and, accordingly, at a value of 68-65 kg per square meter of the product. ($68\text{-}65 \text{ kg/m}^2$ $6.8\text{-}6.5 \text{ g/cm}^2$). The study of the phase structure and microstructure of the material allows to specifically determine the areas of possible use of the material and to make conclusions about its operational properties under extreme conditions.

This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSFG) [Grant Number AR-22-955, Project Title: "Development of consolidated material containing of ceramic nanostructure and preparation of pilot samples based on Ti-B-N system"]



Application of the Kuz-Ram Model to Predict the Size of Rocks Felled in the Ouenza Iron Mine; Algerian NE

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ABSTRACT

Algeria is one of the richest countries in iron mineral reserves, as it houses the Ghar Djebelilat mine, whose reserves are estimated at 4.5 billion tons, as well as other mines such as Ouenza and Boukhadra. The iron ore deposit in the Ouenza region, which is the second largest active mine in Algeria, with reserves of 120 million tonnes of ore and an average grade of 55% of iron, is currently operated by the company «Mines de fer de l'Est». Rock fragmentation is a complex concept in mining. It depends on several factors such as: The physico-mechanical properties of the rock; The specific consumption of the explosive ...etc. The effectiveness of a mine shot is crucial for any mining operation. Rock cutting operations must be carried out in such a way as to obtain an ideal grain size. In the Ouenza mine, the fragmentation of the rocks gives a high rate of out-of-gauge blocks, and the presence of step feet, all this influences the work of loading, transport, and the crushing station. To improve the fragmentation quality, it is necessary to study the heterogeneity of the rock massif by proposing another firing plan using the Kuz-Ram method to predict the rate of off-gauge blocks.

Impact of Mining on the Environment: Causes, Consequences and Possible Solutions -Case of the Algerian Mines

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ABSTRACT

Any underground project results in damage to structures on the surface caused by the subsidence of the overlying layers of land. If prohibitive safety and technological measures are not taken into consideration, the environment is also considerably affected. To this end, a comparative study by analytical and numerical model to ensure the reliability of the results, allows us to mitigate as much as possible any unforeseen damage that arise during/during and after the implementation of the operating project underground mining. The results obtained allowed us to quantify the subsidence basin in 3D and proposed a typical operating model with a safety factor which ensures the stability of the mines studied.

Evaluation of Stability of Some Landslide Bodies by Numerical-Analytical Method

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ABSTRACT

The history of calculating the stability of landslide-prone slopes dates back 250 years. Most of them are simplified methods for calculating the stability of landslide bodies of a sequent and consistent type. The weaknesses of this type of method were noted by the authors themselves. These shortcomings remain in several recently created computer programs, specially designed for landslides and do not consider the stress-deformed state analysis of the landslide body. In most of the methods, the stability of the slope is evaluated under the conditions of limit equilibrium, Coulomb-Mohr and similar strength theories, and the influence of the time factor can only be reflected indirectly. This was called the "Shear Strength Reduction Factor". Consideration of the "shear strength reduction factor" is very important when calculating the stability of block-type coherent and inconsistent landslide bodies that maintain a completely stable state for a long time and suddenly lose their stable equilibrium because of extreme meteorological or other effects. Creep plastic deformation is more rheological in nature because deformation can occur very rapidly/or slowly in periods ranging from a few hours to a hundred years. It depends not only on the strength but also the deformation characteristics of the rock. These can be determined by laboratory testing of samples of geological material. The means for its full use will be created after the creation of the apparatus for the direct analysis of self-creeping plastic landslides. So, in all these directions, the development of methods for calculating the stability of landslide bodies is a scientific-technical problem. By authors, the original numerical-analytical version of the method of assessment and calculation of stability of landslide bodies, both consequent and nonconsequent, has been developed, with the joint use of stress analysis equipment and computer programs. In contrast to the existing methods, the developed method enables the modelling of calculation schemes of various forms of possible collapse of landslide-prone bodies based on the analysis of the stress-deformed state of the stratified structure. It considers the necessary measures to ensure their stability in normal and extreme conditions under the action of gravitational and seismic forces should be calculated.

Pb-Zn Mineralisation in Northern West of Algeria

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ABSTRACT

The northern part of Algeria represents the most important metallogenic zone for Pb-Zn-Fe-Ba (Cu, F) ore-deposits. The mineral association consists of galena, sphalerite, barite, and celestite with gray copper, pyrite, chalcopyrite associated with a carbonate (dolomite and calcite) matrix. Quartz, siderite, fluorite, and oxidation products like hematite and limonite. The examination of the genetic models and interpretations proposed by different authors leads to a synthetic table including: the stratigraphic, geographical and lithological localization of the minerals; the processes (plutonic, volcanic, metamorphic, tectonic and paleogeographic) which controlled the formation of the deposits, and the types of mineral deposits and their paragenesis. Many small Pb-Zn-Fe-Ba (Cu, F,) ore-deposits are located in Setifian/Hodna, Batna/Aures, Tebessa, Ghar Rouban Mountains, and diapiric zone, majority hosted in Jurassic and lower Cretaceous (Hauterivian, Barremian, and Albo-Aptian) carbonate rocks. The mineral association consists of galena, sphalerite, barite, and celestite with accessory gray copper, pyrite, chalcopyrite, and marcasite associated with a carbonate (calcite and dolomite) matrix. Quartz, siderite, fluorite, and oxidation products (hematite, magnetite, limonite) are also abundant. The orebodies are dominated by veinlets ores, massive ores, and disseminated ores but fracture filling textures are also common in most orebodies. The fluid inclusions study was performed on minerals from ore-deposits that hosted in carbonate sedimentary rocks of lower Jurassic, ifrom Beni Bahdel (sphalerite; calcite), Beni Snouss (quartz; barite), Ghar Roubane (fluorite; barite). Eutectic temperatures measured in the fluid inclusions vary between -35 and -57 °C, indicating H₂O-NaCl-CaCl₂ system (Vanko et al. 1988; Roedder 1984; Crawford 1981; Chi et Ni, 1987). These temperatures indicate the presence of Na⁺ and Ca⁺⁺ in the aqueous solutions. Micro-thermometric results suggest that saline fluids responsible for mineralization are related to basin fluids (formation water) classified as “Mississippi Valley” type (Touray 1989), diluted locally by meteoric water.

Correction and validation of GPM-IMERG and CHIRPS Satellite Rainfall Data in The Lahor River Basin

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ABSTRACT

The availability of hydrological data is one of the challenges in water resources management. The expansion of satellite rainfall data has provided a solution with advantages in both spatial and temporal dimensions. This study aims to correct and validate satellite rainfall data (GPM-IMERG and CHIRPS) against observed data to determine the suitability of satellite rainfall data usage. Correcting satellite rainfall data bias is conducted using regression, distribution mapping, and average ratio methods. The validation stage employs the Root Mean Squared Error (RMSE) method, Nash-Sutcliffe Efficiency (NSE), Correlation Coefficient (R), and Relative Error Test (KR). The Lahor River basin is used as a case study due to the availability of adequate data. The research is conducted on monthly and daily data for each data source with three calibration and validation periods, each spanning 19 years. The analysis results indicate that the validation of CHIRPS before and after correction is better than GPM-IMERG. The GPM-IMERG data is best corrected using the distribution mapping method with a linear intercept equation. Meanwhile, the most suitable method for the CHIRPS data is a regression with a polynomial intercept equation.



Innovative Energy Efficient Vending Systems for Use in Sustainable Cities

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ABSTRACT

The future of urban areas means developing new systems and technologies to optimise resources and services while ensuring a high quality of life for its citizens. The sustainable city of the future must be efficient and environmentally friendly - the green city. We present research into the development of energy-independent vending equipment that delivers cold or hot products with low energy consumption, equipment for use in urban areas. The energy independence of the equipment is ensured by powering it with an array of photovoltaic panels. Research has been carried out to reduce the energy consumption of the entire system to ensure the highest possible operating autonomy. The innovative vending system is a complex one that integrates systems for producing and storing electricity, cooling and heating products, delivering products, and integrating into an urban network of vending machines. The results obtained, summarized in the paper, ensure the integration of the innovative vending system in the concept of sustainable city and try to solve a socio-economic problem of providing healthy food for the population, food delivered without producing greenhouse gas emissions and promoting renewable energies.

Bernoulli Effect and its Applications in the Future of Fluid Technology

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ABSTRACT

In this paper I set out to analyze Bernoulli's theorem, from how it is determined in the laboratory to the most recent applications in the field of drinking water. In the first part of the article, I will present the laboratory equipment to determine Bernoulli's theorem, and in the second part specialized literature will be analyzed to highlight the most current applications of this theorem. Clarivate Analytics database and keywords: efficient desalination, Venturi Bernoulli effect, water waves, nanoscale fluids and reverse flow will be used. The purpose of the paper is to bring to the fore the most recent applications of Bernoulli's theorem in the field of drinking water.



Evaluation of Contamination by Heavy Metals from Phosphate Processing of Djebel Onk, Northeastern of Algeria

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ABSTRACT

In the mining industry, all separation and enrichment processes generated not only a rich concentrate of the mineral species, but also a large quantity of the waste in the form of liquid or solid. Their storage in open air in tailings ponds can cause several environmental impacts. Heavy metals are metal micro pollutants that can contaminate the environment. The latter are a concern when they are involved in water and soil pollution, their toxicity may be highly damaging to the environment, but their accumulation along the food chain could have adverse effects on human health, the animals and plants. Our work concentrates on the characterization of phosphate waste from Djebel Onk, northeastern of Algeria, which confirms the contamination of soils and plants in the region mainly by Pb, Zn and Cd. The risk assessment of heavy metals has shown that crude phosphates and their mining waste produce dangerously trace metal elements TME exceeding soil standards (for example, U, Cd, Cr, Mo, V and Tl). As a result, exposure to mining waste and the mobilization of the finest particulate matter by wind and rain could have adverse effects on the environment and human health.

Management of the Leachate Generated in Compliant Landfills

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ABSTRACT

The leachate is mostly formed by the infiltration of water into the mass of waste and by the natural process of decomposition of organic substances from waste, the percolation of waste. It is collected through a drainage system and sent to the leachate treatment station within the warehouse. The treatment station receives the leachate from the drainage system, the waste water from the sanitary groups and the water from the surface water drainage system. The construction of the leachate treatment station aims to protect the environment against contamination with leachate compounds. The provisions of the European Directive on waste deposits and of the Framework Directive of the European Union on water are thus respected. According to these legislative acts, only the water resulting from the treatment of the leachate can be discharged from a compliant landfill, and the water resulting from the treatment of the leachate with the Treatment Plant will meet the norms imposed by NTPA-001 for discharge into natural receptors. Many factors influence the production and composition of the leachate, but a major one is the climate of the landfill. For example: when the climate has a high degree of precipitation, there will be more water and therefore, more leachate will be generated. Another factor is the topography of the place where the landfill is located; this influences the landfill design models and the water table of the location.

Soils Characterization from Ain Mimoun Mine to Optimize Its Suitability for Successful Phytostabilization Endeavors

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ABSTRACT

First, barite is an interesting mineral substance. In Algeria, the National Company for Non-Ferrous Products and Useful Substances exploits the two barite deposits: Ain Mimoun (Khenchela) and Boukaid (Tissemsilt). Moreover, Ain Mimoun deposit was discovered in 1968, its annual production is 20 mT, the chemical composition of the ore includes 4.4g/cm³, the exploitation of the deposit is combined (open-pit and underground). In addition, the recovery facility contains the mechanical preparation followed by a gravimetric separation process. The site is distinguished by a short, very hot summer and a long, very cold and partly cloudy winter with average rainfall, the hydrogeological network is intrinsic. However, the environmental effects linked to the exploitation of the deposit may include: alteration of water quality, soil degradation, impacts on fauna and flora, risks for human health, aesthetic problems, modification of the hydrological regime, geotechnical risks, AMD. Therefore, the rehabilitation of the site requires restoring disturbed ecosystems by replanting native vegetation, shaping the land to promote appropriate drainage and reducing erosion, and implementing a monitoring program to assess residual impacts. In fact, phytostabilization is the use of plants to reduce the mobility and diffusion of pollutants contained in soil into the environment. The method is effective for the treatment of soils contaminated by heavy metals (Cu, Zn, Pd, Cd and Ba). Arabidopsis halleri plant can help accumulate these metals in its leaves and consequently remedy the polluted site.



Optimization of the Use Rate of Uncooked Clinker in The Cement Manufacturing in Algeria

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ABSTRACT

Current research in the field of cements aims to optimize the manufacturing process, as well as the quality of the finished product and even the recovery of waste generate from the production chain. The cement manufacturing process involves a series of manipulations or transformations of raw materials. Each of these steps is of importance and directly affects the quality of the finished product. The crucial step of the cement manufacturing process consists in producing clinker by carefully controlled firing of a precisely measured and ground mixture of clay and limestone, under appropriate conditions of temperature and time. Sometimes, the clinker can be unfired after it comes out of the kiln due to technical problems (drop in temperature, blockage of the preheater pipes, etc.). In such cases, the company eliminates the uncooked, which represents a significant part of the waste. The objective of our work is to find an easy and profitable solution to recover unburnt clinker in a sustainable eco-environmental context. Our study focuses on the optimization of the rate of uncooked added to the cement by using different percentages, while guaranteeing the conformity of the finished product to national and international standards.

Removal of a Pharmaceutical Residue from the Aqueous Medium Using a Biomaterial

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ABSTRACT

Algeria is well aware of the problems that will arise in the future with regard to water scarcity, and has therefore undertaken to reuse wastewater after treatment. Even with all today's water treatment methods, there are still large quantities of chemicals in so-called "clean" water. It's a problem that's getting worse all the time, especially with the amount of pharmaceutical compounds found in water. Hospital effluents and the pharmaceutical industry are the main sources of pharmaceutical residues in the environment and particularly in water sources. The presence of these drug substances, their persistence in aquatic environments, and their biological interest create concerns for the health of living species and their ecosystems. These compounds, considered emerging pollutants, are a new cause for concern in the water sector. In fact, studies carried out in recent years have shown the presence of these micropollutants in drinking water. Among these contaminants, antibiotics pose a threat to the health of aquatic organisms and humans alike, despite their presence at very low concentrations. Amoxicillin is one of the antibiotics most often used in healthcare establishments. This work was carried out to study the adsorption capacity of a biomaterial, sawdust, to treat a synthesized water loaded with amoxicillin likely to be present in surface water, groundwater and even drinking water, in order to improve a new method applicable on a large scale in the field of clarification of water containing pharmaceutical residues. Our results show that the application of sawdust as a low-cost, renewable, ecological adsorbent is highly effective in the purification of amoxicillin-laden water.

Issues Faced by Environmental Impact Assessment Practices in Jordan: Insights from Construction Industry Professionals

Ghanim Bakr

Civil Engineering Dept. Zarqa University

ABSTRACT

The rapid growth of the construction industry in Jordan necessitates a closer examination of its integration with the environment. The industry's activities can have significant adverse effects on the environment and the well-being of individuals. This study aims to investigate the key challenges faced by construction industry professionals in conducting Environmental Impact Assessments (EIA) in Jordan. The aim was achieved by employing a mixed-methods approach, quantitative data was analyzed using descriptive statistics, while qualitative data underwent content analysis. The primary challenges identified in the findings include avoiding expenses by neglecting environmental concern and disregarded laws and regulations, limited awareness of Environmental Impact Assessment among stakeholders, Environmental Impact Assessment engages numerous stakeholders with diverse interest. This study's results aim to enhance understanding of these challenges, facilitating the development of solutions to improve EIA practices in Jordan. Moreover, addressing these challenges will contribute to promoting environmental sustainability in developing countries like Jordan.

Challenges Encountered in Environmental Impact Assessment Procedures in Jordan: Perspectives from Construction Industry Experts

Ghanim Bakr

Civil Engineering Dept. Zarqa University

ABSTRACT

The rapid growth of the construction industry in Jordan necessitates a closer examination of its integration with the environment. The industry's activities can have significant adverse environmental impacts and the well-being of individuals. The aim of this research is to investigate the primary obstacles encountered by construction industry professionals when carrying out Environmental Impact Assessments (EIA) in Jordan. The aim was achieved by employing a mixed-methods approach. Descriptive statistics were utilized to analyze the quantitative data. During the analysis, the quantitative data underwent content analysis. The primary challenges identified in the findings include avoiding expenses by neglecting environmental concerns and disregarding legislation and regulatory frameworks limited awareness of Environmental Impact Assessment among stakeholders, Environmental Impact Assessment engages numerous stakeholders with diverse interests. This study's results aim to enhance understanding of these challenges, facilitating the development of solutions to improve EIA practices in Jordan. Moreover, addressing these challenges will contribute to promoting environmental sustainability in developing countries like Jordan.



Determination of the Pozzolanic Activity of Wasted Activated Sludge at Different Temperature of Calcination and Particle Sizes

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ABSTRACT

In Chile, different types of cement are produced, among which are produced are Portland Pozzolanic and Pozzolanic. These cements use natural occurring pozzolana that are mined from quarries. Due to environmental pressures, presenting new pozzolana extraction projects has become more difficult. As an alternative of using natural occurring pozzolana, wasted activated sludge ashes where analyzes as an alternative. For this purpose, different calcination temperatures were employed to determine the pozzolanic activity. The pozzolanic activity was determined by a modification of the Rapid determination of pozzolanic activity Methodology (Dalinaidu et al, 2007), in conjunction with the Testing methodology for pozzolanic materials: determination of the reactivity of lime (Indian Standard Institute, 1996), Evaluation of pozzolanic activity by methods based on the measurement of electrical conductive of suspension of Portland cement and pozzolans (Velázquez et al, 2014), and Determination of pozzolanic characteristics of hazelnut shell ashes (Córdoba, 2023). The temperature range analyzed for the ashes generated were between 550°C to 900°C. Additionally, the ashes were churched and separated on an ASTM N°40 and ASTM 200 sieves, in order to evaluate their pozzolanic capacity undier different particle sis and calcination temperature. From the experiment it was determine the optimum temperature range was between 550°C to 600°C. With regards to the particle size, ashes that passed the sieve N° 40 presented a higher activity than the ashes that passed sieve N° 200.

Analysis of the Pozzolanic Activity Potential of Hazelnut Husk Ash

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ABSTRACT

Hazelnut husks are considered as a waste with little commercial value in Chile, resulting in their disposal in landfill or sold as biofuel. The use of this waste as fuel generates ashes as a bioproduct. In this regard, previous research has demonstrated that different types of ashes can be used as additives in mortars and concrete. The objective of this study is to determine the pozzolanic potential of hazelnut ashes, using an adaptation of the Rapid Determination of Pozzolanic Activity and along with catalysts and other recommendation. The chemical principle of the methodology is based on the loss of the electroconductivity due to the loss of Ca^{2+} . The research analyzed crushed ashes that passed through ASTM N° 200 sieved at three different temperatures: 550 °C, 650 °C and 750 °C. From the analysis it was possible to observe all the ashes presented pozzolanic activity. The highest potential was observed at 750°C.



Mechanical and Durability Performance of Hematite-Rich Calcined Clay Cement Mortar

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ABSTRACT

The contemporary trend in nowadays construction industry is to reduce the use of clinker cement and promote the use of alternative cementitious materials that have less environmental impact and may also enhance structure durability. Calcined clay is one of the emerging viable alternatives to ordinary Portland cement. To produce blended mortar, clay locally sourced from Fanja (Oman) that has been characterized, ground to a powder size, and burned at a specific temperature has been utilized in partial replacement of normal Portland cement (OPC). In order to observe the lowest possible environmental impact and the best possible reactivity of the calcined clay Fanja (CCF), the raw clay burning process was optimized using the outcome of thermogravimetric analysis (TGA). The resulting clay-pozzolana was employed in mortar in amounts ranging from 0 to 50% to replace part of the OPC. The mortar spread diameter, compressive strength, and durability characteristics of the blended mortar were assessed both in its fresh and hardened forms. The results indicate that the different CCF contents increased the compressive strength while decreasing the flow diameter of the mortar. In the meantime, the permeability and porosity of the mortar were reduced. When compared to plain mortar, the CCF-mortar mixes demonstrated remarkable resistance to chloride ingress. In addition to the notable improvements in the mechanical and durability performance of the mortar, the proposed cementitious system is more economical and ecologically friendly than the plain cement mortar. This study promotes the use of eco-friendly, locally obtained building materials since they improve building longevity and performance while having little negative impact on the environment or ecosystem.

Effects of Synthetic Wax and Surface-Active Additive on the Ageing Process of Foamed Asphalt Binder

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ABSTRACT

One of the main priorities of present industrial activities is to reduce associated emissions, fulfilling the requirements to preserve the natural environment. Also, the road construction industry undertakes efforts to develop technologies permitting more sustainable production of asphalt mixtures, e.g. by utilizing reduced production and paving temperatures. The most effective technology in this respect is the half-warm mix asphalt technique (HWMA) with foamed bitumen, enabling the production temperature to be decreased to as low as 90°C - 110°C depending on the type of mixture, which is approximately 60°C lower than the production temperature of traditional hot mix asphalt (HMA). The present study evaluated a 50/70 asphalt binder foamed with water, intended to produce asphalt concrete. In order to ensure the most favorable characteristics of the foamed binder, i.e. maximum expansion ratio (ER) and half-life (HL), Fisher Tropsch synthetic wax was used in the amounts of 1.0, 1.5, 2.0 and 2.5% and a surfactant in the amount 0.2, 0.4 and 0.6% in relation to asphalt by weight before foaming. The utilization of the additives significantly improved the foaming characteristics of the investigated binder. Due to the fact that the asphalt binder is subject to aging, which affects the properties of the produced asphalt mixture and the durability of the asphalt pavement, the binders were subjected to short-term (RTFOT) and long term ageing (PAV). The effects of the additives on the basic characteristics of the binders were evaluated after aging. The tests included penetration, softening point, and Frass breaking point. Statistical analysis of test results was performed using the ANOVA test. Certain compositions of the foamed asphalt binder were identified, which were characterized by more favorable properties than the reference asphalt binder. This permitted to conclude that it is possible to produce an asphalt mixture with high quality parameters using low-temperature technology with water-foamed asphalt.



Mechanical Behavior of Glass Fiber-Reinforced Polyester (GFRP) in a Humid Environment

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ABSTRACT

The characteristics of Glass fiber-reinforced Polyester (GFRP) depend on the contained fibers, the matrix used, and the fiber-to-total volume ratio. GFRP is a polymer material used in various fields; it is generally preferred for its ease of installation and its very long lifespan, even in the presence of aggressive fluids. The aim of this research is to investigate the evolution of key mechanical properties, such as tensile and flexural strength, of Glass Fiber-Reinforced Polyester (GFRP) exposed to different environments: open air (control), freshwater (drinking water), and seawater (harsh environment). The study will employ diverse characterization techniques, including mechanical testing, chemical analysis, and Scanning Electron Microscopy (SEM) of the resin, to gain a comprehensive understanding of material degradation mechanisms. The research will particularly focus on assessing the long-term chemical stability of GFRP in seawater within a one-year timeframe.



Numerical Study of the Static Bending Response of Functionally Graded Material Beams Using the 3D Finite Element Method and the 3D Exact Beam Theory

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ABSTRACT

In this paper, we study the static bending behaviour of a functional graded material beam, in which the mechanical properties are assumed to vary continuously along the beam thickness according to the power-law distribution with linear elastic behaviour. The 3D finite element method is used to studied response of this composite beam, in which the hexahedral element type C3D20R (continuum stress/displacement, three dimensional, 20-node, reduced integration) is used via the Abaqus code. The numerical results obtained (normal stress distribution, shear stress distribution and the deflection) are compared with those obtained by the 3D exact beam theory built on 3D Saint-Venant's solution, in which the kinematic model includes sectional Poisson's effects and out-of plane warpings. Since it is independent of any kinematic or static assumption. This theory is quite different from the classical theories of Euler-Bernoulli, Timoshenko, and their extensions. This theory is based on a displacement model that allows the deformation of the section in and out of its plane via the main own displacement modes. The latters are specific to the section nature (shape and materials). These results show a high performance of the method used in this work to model the mechanical behaviour of functional gradient material beams.



Hygrothermal Simulation of Buildings: A Study on the Different Types of Weather Files

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ABSTRACT

One of the major factors impacting the hygrothermal study of buildings using numerical simulation tools is the local weather at the building's location. Usually, this weather is defined in a climate data file that refers to a weather representative year for the site under consideration. Numerical simulation tools such as Energy Plus or WUFI Plus, among others, have their own database of weather files representing different locations, but for studies in more specific locations or for model validation, these databases may not provide the desired weather files and/or these files are missing several important climate data parameters (e.g. relative humidity, wind, radiation, rain, atmospheric pressure, etc.), making it difficult to adequately characterize the climate where the numerical simulation is to be performed. In this sense, in most studies it is necessary to create personalized climate files in order to have control over the climate data to be used in the simulation. The aim of this study is to evaluate the types of weather data available, the mathematical methods used to generate them, and the types of climate parameters involved. To this end, the statistical accuracy between climate variables obtained from international climate databases and those obtained from a national database was evaluated, using the Python for this analysis. The climate file created as part of this study allowed to measure with greater accuracy the climate parameters, the mathematical methods used to create weather files, and the type of climate data to use as input in each hygrothermal analysis program.

Dynamic Condensation for Reduction of Large-Scale Model

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ABSTRACT

This paper discusses model reduction formulations for the computation of large structural model. The simplest method of model reduction is by using static condensation methods. However, this method might not capture the dynamic properties of the structures. A reduction model based on dynamic analysis is performed to reduce the size of structural computation. Assuming that the damping matrix is in proportion to the mass and/or stiffness matrix, the free vibration analysis is used as a starting point for the structural model analysis. The transformed matrices are obtained by partitioning the matrices in the equations of motion, considering the retained and condensed degrees of freedom. The retained degrees of freedom can be considered as master degrees of freedom, where the size of the system matrices is expected. By several manipulations, the reduced order model is achieved. The computation starts using Guyan's reduction method, and then the system matrices are updated iteratively. The convergence is defined by comparing the eigenvalues of the successive computations. Numerical examples to four and ten-story shear building models are conducted to show the applicability of the methods. The numerical results show that the reduced-order model obtained using this method can predict the actual model's behavior.



Amplitude Scaling for Ground Motion Modification Using Firefly Algorithm

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ABSTRACT

One step in the nonlinear response time history analysis technique used in the designing of earthquake-resistant structural buildings is the selection and modification of ground motion. In Indonesia, this clause is found in SNI 8899:2020 which deals with procedures for selecting and modifying surface ground motion for designing earthquake-resistant buildings. This research will discuss ground motion modification based on historical earthquake recordings and spectrum targets. Amplitude scaling and spectral matching are the two common techniques utilized in ground motion modification. Amplitude scaling is a straightforward technique that lowers computing costs. The firefly algorithm will be used in this study to approximate the scale factor in the amplitude scaling method. Eleven sets of earthquake recordings were utilized, following the examples found in SNI 8899:2020. The objective function is to reduce the limit ratio between the target spectrum and the average spectrum of recorded earthquakes. A comparison will be made between the scale factor found in SNI 8899:2020 and the scale factor obtained by the firefly method. The scale factors in the periods 0.2T_{1B} – 2T_{1A} and 0.2T_{1B} – 1.5T_{1A} are the two that will be compared.

Effect of Size of Holes on Flexural Response of Strengthened Concrete Beams with CFRP Rope

Ala Obaidat

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ABSTRACT

The electro-mechanical pipe systems that run through longitudinal or transverse holes in the secondary reinforced concrete (RC) beams can enhance the maximum floor height of the building. In this work, the effect of longitudinal hole size on the flexural behavior of RC beams has been studied experimentally. Furthermore, studies were conducted to determine whether carbon fiber reinforced polymer (CFRP) may enhance the flexural response of hollow-sectioned reinforced concrete (RC) beams. The ultimate load and related deflections were reduced by the holes, regardless of their size. Regardless of the size of the hole and the CFRP arrangement, the application of CFRP increased the ultimate loads and cracking loads of beams by a maximum of 22% and 14%, respectively. Every tested solid beam exhibited flexural shear behavior. In the end, using CFRP rope for strengthening led to a 22% increase in energy dissipation; however, as the hole's size increased, this increase reduced.

The Load Carrying Capacity of Reinforced Concrete Beam to Beam Connection: An Experimental Program

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ABSTRACT

Demand of precast concrete in the building construction is increasing because the precast concrete is faster in construction and higher quality control compared to the site-cast concrete. The weight of precast concrete sometimes must be under consideration due to the reasoning of the erection precast concrete element into the building construction. If the span of reinforced concrete beam is quite long, therefore the beam needs to be divided into two or more segments so that the segment can be easily carried and put in the building construction. This experimental program to study about the capacity of reinforced concrete beam to beam connection. Three beams were cast and tested under monotonic loading. The first beam was the beam without any connection as a reference beam. The second beam had the connection at the middle span using steel plate at the top and the bottom of the beam. While the third beam had the connection at the middle span with the connection was using the steel plate which was fully covering the connection. The dimensions of all beams were (150 mm × 250 mm) and the span of the beam is 3000 mm. Four longitudinal bars with diameter of 10 mm were used as tension reinforcements and two longitudinal bars with diameter of 10 mm as compression reinforcements. Reinforcements with diameter of 8 mm were used as stirrups. The result shows that the load-carrying capacity of the beam with the connection of the steel plate at the top and the bottom connection was lower compared to the reference beam. However, the beam with the connection of the steel plates that was fully covering the connection showed higher load-carrying capacity compared to the reference beam. Demand of precast concrete in the building construction is increasing because the precast concrete is faster in construction and higher quality control compared to the site-cast concrete. The weight of precast concrete sometimes must be under consideration due to the reasoning of the erection precast concrete element into the building construction. If the span of reinforced concrete beam is quite long, therefore the beam needs to be divided into two or more segments so that the segment can be easily carried and put in the building construction. This experimental program to study about the capacity of reinforced concrete beam to beam connection. Three beams were cast and tested under monotonic loading. The first beam was the beam without any connection as a reference beam. The second beam had the connection at the middle span using steel plate at the top and the bottom of the beam. While the third beam had the connection at the middle span with the connection was using the steel plate which was fully covering the connection. The dimensions of all beams were (150 mm × 250 mm) and the span of the beam is 3000 mm. Four longitudinal bars with diameter of 10 mm were used as tension reinforcements and two longitudinal bars with diameter of 10 mm as compression reinforcements. Reinforcements with diameter of 8 mm were used as stirrups. The result shows that the load-carrying

capacity of the beam with the connection of the steel plate at the top and the bottom connection was lower compared to the reference beam. However, the beam with the connection of the steel plates that was fully covering the connection showed higher load-carrying capacity compared to the reference beam.



Specific Risks of Fragile Cargo Transportation in Crisis Situations in Urban Agglomerations

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ABSTRACT

The paper deals with ensuring the road transport of fragile or sensitive cargo, which is an increasingly topical problem for forwarding companies, which often use modern sensors for this purpose. The advantage of modern sensors is the relatively cheap feedback given by the collection of data during road (or any other modes of) transport, including the subsequent evaluation and possible adoption of appropriate corrective measures. A key aspect is the provision of adequate cargo securing during road transport (basically during any type of transport – i.e. with the use of multimodal transport). A specific area is the transport of such material during crisis situations or extraordinary events, when the transport infrastructure is disrupted and the material must be transported non-standard (e.g. on off-road vehicles, using available improvised means of material fastening). For the purpose of investigating aspects of the transport of fragile and sensitive cargo, a road transport experiment was carried out using a Tatra off-road truck equipped with appropriate sensors (three-axis accelerometers). Part of the experiment is the measurement and evaluation of acceleration coefficients in the urban agglomeration (Brno, Czech Republic) for pallet units using improvised material to absorb shocks and standard material (polystyrene foam). Statistical hypothesis tests showed that even in normal conditions, i.e. without the negative influence of disrupted transport infrastructure, the improvised fixation material does not absorb shocks as well as the standard one, and a statistically significant difference was found between the two measured data sets. In addition, the hygroscopicity of the improvised material, which would further reduce the effectiveness of protection against shocks, is not included in the experiment. The results show that the use of improvised material for fragile or sensitive cargo increases the risk of its damage during road transport, which further increased transport over damaged transport infrastructure in crisis situations, or extraordinary events.



Seismic Performance of Isolation Bearing Devices in Dynamic Behavior of Typical Boxe Girder Bridge

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ABSTRACT

In this study, three seismic isolation systems made of elastomeric laminated are examined in order to illustrate their performance in the three-dimensional dynamic behavior of variable inertia box-section bridges and the particularities of their modeling. In this work, the energy dissipation bearings, such as conventional neoprene bearings with high damping bearing (NRB), neoprene bearings with high damping (HDRB) and neoprene bearings lead core (LRB) are considered for better seismic design performance and rational sizing of this particular category of bridge structures. For the purpose of the study, a 3-D finite element numerical model of a typical bridge is developed for this purpose. The nonlinear dynamic analysis is carried out using models of bilinear hysteretic behaviors of the anti-seismic isolators. The results indicate, among other things, that isolators have a significant effect on seismic response in the longitudinal direction and can effectively reduce seismic demand in bridge structures.

Modeling Urban Travel Distribution Using Mobile Network Big Data: Insights from Jakarta, Indonesia

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ABSTRACT

This research aims to model the distribution of urban travel using Mobile Network Big Data (MNBD) in Jakarta, Indonesia, addressing the complexity of understanding human movement patterns, particularly during the Covid-19 pandemic and the implementation of Large-Scale Social Restrictions (PSBB). Leveraging mobile device data, MNBD provides a detailed view of people's movements and interactions through anonymous data about location, timestamps, and network activity. The study utilizes MNBD data originating from mobile device movements to gain insights into people's movements and interactions, collecting anonymous data about location, timestamps, and network activity from various sources, such as GPS trackers, mobile apps, and cellular networks, acquired from the citydata.ai platform. The data spans multiple periods, including February 16-17, 2020, March 15-16, 2020, and October 2022, representing conditions before, during, and after the Covid-19 pandemic. The research methodology employs percentile algorithms to filter out invalid data and applies machine learning techniques for human mobility analysis by determining Stay Trip Purpose and Movement Trip Purpose. The results include the creation of an Origin-Destination (OD) Matrix and visualization of weekly travel destination patterns and travel frequency. Using this method, the research effectively models travel distribution, explains travel patterns in detail, and detects anomalies in individual movement through classification and clustering techniques. These findings are significant for developing an understanding of travel patterns, enhancing transportation planning, improving decision-making, and formulating policies related to travel demand models. The methodology and findings of this research have broader implications and can be applied in similar studies in other locations using MNBD as a relevant data source. Urban travel distribution modeling is crucial for urban planners, policymakers, and transportation authorities to understand the dynamics of urban mobility and make informed decisions. By analyzing MNBD, which provides real-time and large-scale data, this research contributes to a better understanding of travel behavior and patterns, particularly in the context of the Covid-19 pandemic and PSBB implementation. Furthermore, the research provides insights into the effectiveness of transportation policies and interventions, such as traffic management strategies, public transportation improvements, and urban planning initiatives. By identifying travel patterns and behaviors, policymakers can develop targeted interventions to address specific transportation challenges, enhance accessibility, and promote sustainable urban mobility. The research methodology involves several key steps. First, MNBD data is collected from various sources, including GPS trackers, mobile apps, and cellular networks, and processed to extract relevant information about human mobility. Next, percentile algorithms are applied to filter out invalid data and ensure data quality. Machine learning techniques, such as clustering and classification, are then employed to analyze the data and

identify travel patterns and anomalies. The creation of an Origin-Destination (OD) Matrix provides insights into travel flows between different locations within Jakarta. Visualizations of weekly travel destination patterns and travel frequency further enhance the understanding of travel behavior and dynamics. The research findings are validated through rigorous data analysis and statistical techniques, ensuring the reliability and accuracy of the results. The implications of this research extend beyond academic contributions to practical applications in transportation planning and policy-making. By understanding travel patterns and behaviors, policymakers and urban planners can design more effective and sustainable transportation systems, improve traffic management strategies, and enhance overall urban mobility. In conclusion, this research contributes to advancing our understanding of urban travel distribution using MNBD and provides valuable insights into travel patterns, behaviors, and dynamics. By leveraging real-time and large-scale data, the research offers actionable recommendations for improving transportation planning and policy-making, ultimately contributing to the development of more sustainable and resilient cities.

The Revitalization of Some Old Projects for the Creation of New Waterways in Romania

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ABSTRACT

The article presents some aspects regarding the updating of some older studies for the navigation on the Arges river, a tributary of the Danube River in Southern Romania. The new waterways are planned to connect Bucharest, the capital city of the country with Danube River. The initial project was conceived in the 1980s, but was abandoned immediately after the 1990s. More than 30 years after its abandonment, the complex hydraulic development scheme was proposed to be updated, in order to provide a series of water uses that will ensure the sustainable development of the area: a. Navigation; the new waterways will be part of the VII Pan European Corridor, the main river infrastructure artery of the European Union; b. Production of electricity from renewable sources in the planned HPPs of the hydraulic facilities; c. Flood protection of 11 localities, lifeline and industrial facilities etc; d. Aquaculture; e. Irrigation; f. Tourism, leisure etc. The article presents how the updated project was modernized and improved to comply with the current European requirements for environmental protection, biodiversity, energy, sustainable development etc.



Effect of Combined Voronoi DFN Model with Finite Element Method in Rock Slope Stability Analysis: A Case Study

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ABSTRACT

This work aims to study the effect of the Discrete Fracture Network (DFN) model combined with the finite element method to analyze the stability of the rock slope of our study case: the Kef Essenoun open pit (Northeast of Algeria). At first, an analysis of rock slope stability using the Finite Element Method (FEM) considering a continuous media is carried out, showing a critical strength reduction factor (SRF) value of 1.14. This value reflects a critical state of stability, and results show that the failure surface crosses the marl layer. From the in-situ investigations, the Rock Quality Designation (RQD) of the marl layer indicates a value of 40%; therefore, the marl layer is fractured. To take into account the presence of fractures in the model during simulation. The Discrete Fracture network model is combined with the FEM to investigate the effect of the fracturing state of the marl layer. Then, the Voronoi model represents the DFN model. After simulations in these pseudo-continuous conditions, the SRF decreased to 1.04. We can conclude that a DFN model combined with FEM affects rock slope analysis.



A Novel Prediction Technique for the Resilient Modulus of Unbound Aggregates Combined Xgboost Algorithm with Bayesian Optimization

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ABSTRACT

A novel prediction model for the resilient modulus of unbound aggregate bases using eXtreme Gradient Boosting (XGBoost) and Bayesian optimisation (BO) is presented in this study. First, a local dataset containing 260 samples of some common tests, including sieve analysis, Atterberg limits tests, compaction tests, and repeated load triaxial tests of unbound aggregate materials, is collected. Then, the proposed BO-XGBoost model is trained on the collected dataset. Multiple evaluation metrics, including Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and coefficient of determination (R^2), were used to assess the performance of the BO-XGBoost model. By computing these metrics for both training and testing datasets, the model's accuracy and generalization abilities were assessed. The findings of this study, clearly showed that the combined BO-XGBoost model outperformed other state-of-the-art machine learning or even deep learning models, in predicting the resilient modulus of unbound aggregate base. Finally, the permutation method was used to conduct feature importance analysis and determine the impact of different input features on the resilient modulus of the unbound aggregate base. This latter was highly influenced by stress, moisture content, and liquidity limit, as demonstrated by the results of the feature importance analysis.

Evaluation of the Effect of Aquatic Vegetation on the Accuracy of ADCP Discharge Measurements in Lowland Streams

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ABSTRACT

Discharge dynamics in natural streams can be influenced by aquatic vegetation, and therefore its precise evaluation is crucial for effective river management especially in lowland environments. This paper investigates the accuracy of discharge measurements in lowland natural streams with aquatic vegetation using an Acoustic Doppler Current Profiler (ADCP). The research highlights the challenges and issues of using ADCP in areas with aquatic vegetation, which cause inaccuracies and deviations in the measuring sections. Field measurements carried out on the Gabčíkovo – Topoľníky channel stream during the growing seasons of 2018 and 2023 recorded differences in accuracy and calculated discharges and flow velocity attributes due to denser vegetation.

Non-Linear Dynamic Response of a Raft Placed on the Surface of a Compressible Soil Reinforced with Stone Columns and Using Geogrids Subjected to Variable Loading Frequencies

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ABSTRACT

The analysis of foundation behavior under dynamic loads has developed considerably over the last four decades. The stringent safety requirements imposed on the design of certain types of structures have played a particularly important role in the development of analytical and numerical methods. In order to understand the non-linear dynamic behavior of the foundations, a series of axisymmetric models were produced using **PLAXIS 3D** finite element software. Considering the soil-structure interaction when analyzing the dynamic behavior of foundations means that the influence of the soil on vibrations can be considered in a realistic way. Different configurations of soil rheology models will be studied (linear and non-linear). In addition, the propagation of vibrations on the surrounding ground was studied. To reduce calculation time, only a quarter of the global geometry is modeled, using symmetry boundary conditions along the lines of symmetry. Physical damping due to viscous effects is considered via Rayleigh damping. Furthermore, due to radial wave propagation, geometric damping can be important in attenuating vibration. Boundary modeling is one of the key points in the calculation of dynamics. In order to avoid spurious wave reflections at the boundaries of the model, special conditions must be applied to absorb waves reaching the boundaries. A comparative study was carried out between the two models and conclusions were drawn. The results obtained showed that considering the non-linearity of the soil plays an important role in the dynamic response of the foundation.



Study on Slope Potential and Vulnerability to Landslides in Sikunir Area, Dieng Plateau, Central Java, Indonesia Based on Minister of Public Works Regulation

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ABSTRACT

This study explores the slope potential and vulnerability to landslides in the Sikunir Area, located within the panoramic landscape of the Dieng Plateau in Central Java, Indonesia. It employs the framework outlined in Minister of Public Works Regulation No. 22/PRT/M/2007, which provides guidelines for spatial planning in landslide-prone areas. The primary objective is to assess Sikunir's susceptibility to landslides, considering both natural and anthropogenic factors. The area is categorized into different zones based on slope characteristics and elevation through field surveys and data collection. Analysis reveals that Sikunir falls within zone B, indicating a moderate risk of landslides. This zone encompasses mountain foothills, hillsides, hill bases, and riverbanks with slope inclinations ranging from 21% to 40% and elevations between 500 and 2000 meters above sea level. Further investigation delves into the vulnerability of Sikunir to landslides, considering both natural and human-induced factors. The study evaluates the physical characteristics of the terrain, such as soil composition, geological features, and hydrological conditions, to understand the inherent risks of slope instability. Additionally, it examines human activities in the area, including land use practices, deforestation, agriculture, and infrastructure development, which can exacerbate landslide susceptibility. Slope conditions are mapped across five distinct areas within Sikunir to assess the terrain's topographical features. These maps integrate elevation data and slope angles to overview the landscape's topographic variations comprehensively. Analysis of these maps enables the identification of areas with heightened landslide potential, guiding targeted intervention strategies. The vulnerability assessment combines findings from the physical terrain analysis and human activity review. Results indicate a moderate vulnerability to landslides in Sikunir, driven by a combination of natural and anthropogenic factors. The study underscores the importance of preventive measures and conservation efforts to mitigate landslide risks and preserve the region's ecological integrity. In conclusion, this research contributes valuable insights into understanding the dynamics of landslide susceptibility in Sikunir, Dieng Plateau. Integrating spatial planning guidelines and comprehensive vulnerability assessments offers a framework for informed decision-making and proactive measures to enhance the resilience of landslide-prone areas. However, ongoing monitoring and adaptive management strategies are essential to address evolving environmental challenges and ensure the long-term sustainability of the Sikunir landscape.



Numerical Modelling of Surface and Groundwater Interaction Affected with Bottom Sediments in the Canals of the Rye Island (Slovakia)

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ABSTRACT

Natural water resources are in continuous dynamic interaction with each other. Hydrodynamic processes between surface water and groundwater are very complex, and they are influenced by many factors and conditions (topography, climatic conditions, hydrogeology, stream hydrology and morphology, etc.). Groundwater – surface water interactions are also influenced by riverbed sedimentation and clogging processes. The thickness and hydraulic conductivity of bed sediments can significantly affect the temporal and spatial patterns of hyporheic exchange. The aim of this study was to investigate the influence of riverbed clogging on groundwater – surface water interaction in a lowland area with intensive agricultural production (Rye Island, Slovakia). In this locality, a canal network was constructed for draining the excessive GW from the adjacent farmlands. Due to the topography, land use and climatic conditions the canals are exposed to intensive aggradation, what may negatively affect their draining function. Therefore, regular field monitoring of the canal bottom sediments should be performed. In this study, the sediment deposits in the Gabčíkovo – Topolníky canal were investigated. The thickness of sediments was measured along the canal by 1 km step, and undisturbed sediment samples were taken in selected cross sections. From the samples the saturated hydraulic conductivity of bottom sediments was assessed by laboratory methods. The collected data were used for numerical modelling. The impact of canal sediments on the groundwater – surface water interaction was simulated by the TRIWACO model. Several model scenarios were considered for different sediment thicknesses. The results of the numerical simulations confirmed the influence of canal bottom sediments on groundwater – surface water interaction along the Gabčíkovo – Topolníky canal. It was shown, that thicker sediment deposits (>0.5 m) would obstruct the canals drainage function in a great extent, possibly even cut off the communication between the canal and the aquifer. The results suggest that bottom sediments should be regularly removed to ensure the hydraulic connection between the canals and the surrounding aquifer, and hence guarantee the canals proper draining ability and the protection of adjacent agricultural areas from flood hazard.

Estimation of Concrete Carbonation Depth through Durability Indicators

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ABSTRACT

The durability of the Reinforced Concrete (RC) depends on the capability of the com-posed materials to resist the different types of degradation. The dangerous deterioration mechanism that threatens the service life of the RC structure is reinforcement corrosion. The two main factors of steel corrosion are carbonation and penetration of chlorides. In this case, as best as the estimation is, the durability of RC structures can be ensured. In this paper, the carbonation-induced corrosion is investigated and to achieve the objective, several specimens from different concrete mixtures were prepared. The durability indicators on non-carbonated specimens were determined such as the oxygen permeability, concrete strength, capillarity, and porosity. Then, the specimens were subjected to accelerated conditions of carbonation to determine the carbonation depth. The results found for each indicator were analyzed and compared then several models were suggested to estimate the carbonation depth. The results found from the models were compared with the previous ones found in the literature. Based on the findings, using multiple indicators in a model can contribute to a better estimation of concrete carbonation depth rather using one indicator.



Adopting Vernacular Building Design Strategies for Contemporary Green Buildings

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ABSTRACT

The demand for more energy-efficient buildings has increased, driven by the need to reduce energy consumption and mitigate climate change. Recently, the use of vernacular building strategies has gained increasing attention because such strategies are often based on local knowledge and practices developed over time to respond to specific environmental conditions and cultural contexts. In Jordan, there is a rising interest in integrating vernacular design strategies into contemporary buildings, aiming to enhance indoor environmental quality and minimize energy consumption. This study employs a case study approach to investigate the adoption of vernacular design techniques in contemporary green buildings in Jordan while also exploring the underlying factors influencing their selection and implementation. The findings reveal that contemporary green buildings employ diverse vernacular design strategies, including the use of stone as a building material, incorporation of thermal mass, implementation of shading features, and careful positioning of windows to optimize natural lighting, ventilation, and energy efficiency. These design strategies have the potential to contribute to sustainable development goals, preserve cultural heritage, and serve as a guiding model for future modern building designs in Jordan.



Engaging Residents in Housing Retrofitting Decisions Through Advanced e-Participatory Techniques: A Case Study in Ain, UAE

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ABSTRACT

The immense stock of existing Emirati public housing built before applying sustainability measures represents a significant challenge due to the high rate of Energy Use Intensity (EUI) and its associated environmental drawbacks. Achieving local Sustainable Development Goals (SDGs) 11 and 13 in the housing sector in the UAE necessitates applying sustainable retrofitting of this housing stock. As well acknowledged now, such effort cannot be successfully fulfilled without genuine engagement of residents. On the other hand, the limitedly experienced conventional engagement methods have failed to effectively achieve this goal. In response, this research has examined a proposed advanced e-participatory tool as a more efficient residents engagement method that could overcome traditional barriers to participation, such as geographical constraints and accessibility issues. In the e-participation sessions, the residents, including men, women, youth, and the elderly, alongside researchers, were convened in a virtual environment that showcased the professional scenarios for retrofitting their houses. In this immersive and collaborative digital virtual environment, the participating residents were asked to evaluate the alternative professionally prepared retrofitting scenarios expressing their views. The residents were introduced to the details of each retrofitting scenario, represented in a full virtual detailed scale digital model, allowing participants to visualize the proposed retrofitting changes and their potential impact. The results of these e-participatory sessions proved to be largely successful where the involved residents fully comprehended the technical aspects easily when visualized in the virtual environment. They, hence, managed to get the opportunity to contribute their insights and preferences about housing retrofitting decisions. On the other hand, based on the recorded difficulties during the e-participatory process pertaining to consumed time, technical glitches, and other issues, some recommendations to enhance this advanced process for future wider practice are suggested.



Application of New Technologies for Prefabrication of Glued Timber Houses for Residential Construction in Northern European Countries

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ABSTRACT

The building sector is under load with the high amount of carbon dioxide emission. In order to reduce it, and at the same time searching for solutions to reduce the increasingly expensive costs of housing construction, various technologies are being tested that could speed up the construction time and reduce the costs of production of multi-family residential houses. Currently, many countries are testing the construction of multi-family residential houses in the prefabrication system from glued massive pine wood. This technology allows for reduced labor involvement on the construction site and the use of basic building materials from renewable sources. The subject of the article is the analysis of several examples of residential buildings constructed using glued timber systems in order to determine the real advantages of this technology as well as the difficulties and threats. The development of this technology is at a key point for its further development and dissemination - or abandonment. It is also important to determine the boundary requirements for the location of this type of construction. An important boundary condition is the legal system in force in a given country, especially regarding fire protection of buildings, possession of local wood resources, as well as the necessary transport distance between the place of obtaining the raw wood material, the place of production of thick-walled plywood, the place of elements prefabrication, and the location of the final building site. Transportation logistic is one of the basic factors that can significantly contribute to reducing the costs of housing construction constructed in this system. A separate problem to consider is overcoming the mental barrier in a society accustomed to the fact that the real durability of a residential building is ensured by a concrete or brick structure, and wood is associated with impermanence. In the case of glued wood and the highly advanced technologies used to produce elements and connect them, we are dealing with a product and technology that meets all the necessary technical requirements and secures the welcomed home climate inside.

Design Strategy of Underground Layered Sports Building Based on Intensive Theory

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ABSTRACT

With the continuous advancement of urbanization, cities are faced with the problem of land shortage and low per capita utilization rate of sports land. As a part of the urbanization process, how to design comfortable sports buildings in the limited space for teachers and students has become a new problem. Taking the gymnasium of North China Electric Power University as an example, this paper introduces the concept and strategy of underground dense layering layout to explain the practical problems faced in the design of university sports venues.

The Impact of Biophilic Design on the Well-Being and Stress Levels of Resident Doctors

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ABSTRACT

Resident doctors often suffer from stress and anxiety due to the nature of long, stressful work hours within hospital environments. One influential factor is being away from natural environments within hospital environments. This paper explores interior design, focusing on the intrusion of biophilic design and its impact on resident doctors' well-being and stress levels. A mixed-methods approach and a concurrent triangulation design were used to collect quantitative data to test the hypothesis and qualitative data to provide context and a foundation for situating and explaining the quantitative results. This methodology includes a photographic survey, observation, questionnaire, and VR experiment. The result of this paper is shown to confirm the effect of biophilic design elements within the hospital environment and their impact on enhancing the well-being of residents and reducing their stress levels. There is a need for more research on the internal environment of hospitals and their strengthening through biophilic design. This study provides insights into the well-being and stress levels of resident doctors related to the nature of the internal environment within the hospital.

A Multi Objective Rule – Based Decision Support System of Marble selection for Residential Buildings in Jordan

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ABSTRACT

Selecting finishing building materials is a hard task to the architect due to the many variables affecting such process, as more than one dominating objective may arise, such as achieving sustainability, aesthetic, economic factors, social factors, environmental impact context and many other factors. This article will try to develop a multi objective rule-based system that enables the architect to select the most suitable marble type suitable to a specific project in relation to desired specific objectives. A multi layered data storage will be based upon the data collected from Jordanian market regarding, cost, environmental impact, maintenance, replacement period, installation expertise for each type of marble available in the market. The system will be based upon weighting factors technique that will compute the weighting of a list of decisions according to a preset objective being selected by the user. Also the system will be able to recompute weightings due to a change in the objectives accordingly. Data collection will include all the marble in the Jordanian market with all the physical, aesthetic, economic, and environmental characteristics, local or imported marbles. Data regarding the social environment of the residential sector will be reorganized so that the decision support system will be able to match users' objectives with the best marble alternative for any specific project

Internally Displaced Persons in Tigray (Northern Ethiopia): Appraisal of Shelter Typology, Settlement Morphology, Management and Sustainability

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ABSTRACT

In 2022 nearly 71.1 million people are forcibly displaced internally across the globe due to conflict, climate change, disaster, and insecurity. Due to the war between Tigray and Ethiopian federal forces (2020 to 2022), more than 2 million of Tigray population (40% of the total) have been displaced into different places, mainly to the urban areas of Mekelle and Shire. Construction of emergency shelter within a short period of time, available shelter partners, logistical capacity, and limited resources were among the greatest difficulties. And that, besides a lack of a comprehensive assessment on existing shelter/housing typologies and traditional construction technologies. The main objective of this research is to appraise the emergency shelter typologies, construction devices, settlement physical and social organization, looking at efficiency, effectiveness, and sustainability of management approaches. Based on length of stay, permanency of the location, expected lifespan, and material used, six shelter categories have been identified: emergency shelters, temporary shelters, temporary housing, transitional shelters, core shelters and progressive shelter. Classes are not mutually exclusive. A multi-site case study, along with within- and cross-case analysis, made the classification possible and highlighted untapped potentials between construction processes and outcomes. These are mostly related to sustainability components, vernacular technologies, and knowledge of the society of the host and the displaced communities. Not only the emergency shelter and permanent house model but also the rehabilitation and reconstruction housing should respect the vernacular house settlement or come up with a new style or improve and transform the traditional ones.

Architecture as (Lived) Experience

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ABSTRACT

In his *Art as Experience* (1934), John Dewey coined the slogan "learning by doing," emphasizing the need for art to return to its aesthetic root in the proper sense, which is the experiential one, where experience is not mere sensation, it is on the contrary interaction of the living with the environment, an integral event for both the author of the work and the user. The paper intends to bring attention back to the experiential dimension of architecture, highlighting the need for a necessary shift from the formal structure of the work to the lived experience that can take place within it, to configure, as Harry F. Mallgrave (2013) writes, "palpable environments." within which our mind-body systems are intertwined and highly stimulated. It is therefore a matter of involving in the design process that perceptual, emotional, and even spiritual dimension, by its nature multisensory, interactive, synaesthetic, and multimodal, capable of stimulating the prefiguration of a more sensitive and sustainable space-world, where sustainability is not the exclusive property of technical thinking, rather it embraces all aspects of our existence. Within a fruitful relationship between affective and cognitive neuroscience, starting in particular with the discovery of mirror neurons under the leadership of G. Rizzolatti, neurophenomenology by F.J. Varela, New Phenomenology by H. Schmitz, and atmospherology by G. Böhme and T. Griffero, the paper aims to emphasize the pivotal role that empathy can play in the design and reception of space, bringing attention back to that experiential dimension based on the extensive involvement of the body in its psycho-sensory globality. The focus is not so much on the 'given' reality, as on that "state of things" (material or not) whose actual reality is currently and subjectively established. Therefore, the return is to the phenomenon as a state of things that, by affectively involving us, "we cannot not admit". A difficult topic to address, the empathic relationship between the producer of work and the user/users can assist design choices by focusing attention on the perceptual and emotional aspects that always accompany our cognitive processes. The emphasis on embodied cognition, as a necessary premise for the development of an empathic space, can help us understand more clearly the fundamental role that our lived body has in interacting with the built environment to implement physical and psychological well-being, both individual and collective.

Understanding Place - Boosting the Circular Economy Through Urban Art: The Case of Trancoso, Portugal

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ABSTRACT

This article shows how some cities have been developing ways of attracting people back to their historic centers and cultural or tourist areas, focuses its study on Trancoso, a small town in the interior of Portugal, where the loss of population and attractiveness for business has been decreasing over the last few decades. Based on a participatory methodology, the aim was to create an event based on the town's history/culture/people and climate, which would promote and be able to make the town more attractive. Indeed, in recent years, some cities in Portugal have opted for artistic manifestations that seek to enhance their streets, either through urban art, the most widely used, or through creative initiatives such as "Águeda", with Umbrella Sky, a festival that fills the city's streets with colorful umbrellas, or the Wood Festival in Covilhã, The use of marketing and communication techniques, combined with new digital technologies, has been an essential tool in disseminating local memory and cultural identity, and the main aim of these initiatives is to attract visitors and beautify the city. The use of new materials, new digital tools can be an instrument that, while always bearing in mind that the city is ultimately a human creation, of the zeitgeist and of human knowledge, can and should contribute to greater sustainability in time and space of agglomerations, taking up good practices and based on reflective practice and the uniqueness of people. However, we wanted to go further and meet the Portugal 2030 strategy, looking for a solution that would boost the circular economy of the city and its surrounding region, without neglecting the participation of all and the maintenance of the city's heritage, in its broadest sense, increasing the happiness of its inhabitants in an intelligent way.

Terrestrial Laser Scanning (TLS) Survey and Building Information Modeling (BIM) of the Edmund Pettus Bridge: A Case Study

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ABSTRACT

The Edmund Pettus Bridge, a national symbol of the American Modern Civil Rights Movement, is a historically significant landmark located in Selma, Alabama, USA. Finished in 1940, this bridge has been a witness to critical events in American history, notably the 1965 Selma to Montgomery marches for voting rights. A comprehensive digital documentation project was carried out to assess and preserve the bridge's current state. The objective of the project was for historical and structural analysis, aiding in its conservation and serving as a digital archive for future generations. The project employed Terrestrial Laser Scanning (TLS) using a FARO Focus3D X-330 HDR scanner to capture high-resolution, three-dimensional data of the bridge's structure, supplemented by other Reality Capture (RC) techniques, such as 360-degree photography and Unmanned Aerial Vehicle (UAV). The FARO scanner's capability to capture fine details at a long range allowed for an accurate representation of the bridge's complex architectural and structural features. Multiple scans were conducted from different angles to ensure complete coverage, with a focus on areas showing signs of aging or structural stress. Following the TLS survey, the point cloud data was processed and transformed into a detailed Building Information Model (BIM) using Autodesk Revit. This BIM model represented the bridge's physical and functional characteristics, providing a digital twin for analysis and preservation planning. Further, the BIM model was also used to develop a set of 2D Historic American Engineering Record drawings. Due to the page limitation, this article will only focus on the TLS survey and the creation of the BIM model of the Edmund Pettus Bridge. The TLS survey revealed critical insights into the bridge's condition, including areas of material degradation and structural vulnerabilities not visible to the naked eye. The BIM model facilitated virtual assessments of the bridge's structural integrity and provided a platform for simulating restoration and maintenance strategies. The integration of TLS and BIM technologies in documenting the Edmund Pettus Bridge represents a significant advancement in the field of heritage conservation. This project preserves the digital memory of an important historical structure and sets a precedent for the use of these technologies in the documentation and preservation of other heritage sites. The detailed digital model serves as a valuable resource for historians, architects, engineers, and conservationists, ensuring the bridge's legacy endures for future generations.

A Case Study of Digital Preservation and Public Engagement at the Old Depot Museum

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ABSTRACT

This paper presents a comprehensive case study on the application of Terrestrial Laser Scanning (TLS) and Heritage Building Information Modeling (HBIM) in the documentation and preservation of the Old Depot Museum in Selma, Alabama. Listed on the National Register of Historic Places, the museum serves as a key cultural landmark, capturing significant periods of American history, especially the Civil Rights Movement. The project aimed to use TLS, HBIM, and a set of Historic American Buildings Survey (HABS) drawings to produce an accurate digital representation of the museum. These digital artifacts are pivotal for guiding restoration efforts, enhancing building maintenance strategies, and improving public interpretation and accessibility of this historic building. By employing TLS and HBIM, this study addressed both the technical challenges and solutions in capturing and modeling the complex architectural features of the museum, emphasizing the role of digital technologies in preserving historical integrity and fostering global engagement. The outcomes of this project demonstrated the effectiveness of digital technologies in heritage conservation. They also highlighted the potential for digital documentation to enrich public understanding and appreciation of the built heritages. The research contributes to integrating advanced reality capture and BIM technologies in historic preservation and demonstrates how the technologies can be leveraged to protect and promote cultural heritage in the digital era.

Inclusive Adaptive Reuse of Coal Mining Heritage as Aa Regenerative Source for The Sustainable Development of Local Communities

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ABSTRACT

As achieving the goals of the 2030 Agenda for Sustainable Development (SDG 2030) and the European Green Deal calls for making the most of the existing buildings, it is essential to pursue projects that feature all the characteristics of a regenerative approach. This, unlike the sustainable and circular economy, ensures a positive carbon footprint. Thus, it is possible to accelerate the green transformation processes, as all indicators show that the process is too slow globally to reach the Sustainable Development Goals by 2030. In this regard, the contribution of heritage, especially those without use, must be taken into account. In doing so, it is necessary to take into account both the importance of heritage and, on the other hand, a fair transition must be ensured for everyone, which means that all four aspects of sustainability – the social, cultural, environmental, and economic must be considered equally. This contribution aims to present the potentials and opportunities that the abandoned industrial heritage offers for the smaller post mining communities. As a case study, we will focus on Hrastnik, a central Slovenian municipality with 10,000 inhabitants, where the local coal mine used to represent a crucial source of development for more than a century. It was part of a larger system of coal mines in the Zasavje region, and its closure adversely affected not only the town of Hrastnik but the entire region. The socio-economic situation after the closure of the coal mine has brought many challenges. The contribution will present the characteristics of the restructuring processes and the introduction of the adaptive reuse of the abandoned coal mining site in the heart of the town. The heritage and coal mining tradition are seen as an important starting point and a new development source, which the local community has also accepted. A comparison between two projects developed to guide the restructuring in a sustainable and inclusive manner and reveal the potentials of the abandoned coal mining heritage will be present. The first project, titled Strategy for the Sustainable Revitalisation of the RTH Company's Coal Mining Heritage, was developed in 2017. The second example is the national research project titled Heritage for Inclusive Sustainable Transformation (HEI-TRANSFORM), which uses the abandoned coal mining site as a case study for one of its Revitalisation Labs and aims to obtain concrete adaptive reuse project proposals to ensure a green transformation of the coal mining site through inclusive planning. The two projects are interconnected, and the presentation will include, alongside concrete development opportunities, an analysis of the local situation over a period of about seven years. It will highlight the features revealing the profound importance of strategic and continuous research that, through inclusive and collaborative efforts, supports incremental revitalization and a more equitable social transformation of the community to ensure a green transition.

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The cities of Mزاب: An Urban Civilization Built by a Community of Refugees since the 11th CE

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ABSTRACT

The world heritage site of the Mزاب valley is the location of a community-based urban development that started in the turn of the 11th century CE. Seven self-contained and self-supported cities were established progressively along the valley of the Wadi Mزاب, in the actual Algeria. The builders of these cities established themselves in an unforgiving site, to flee the aggressions they were victim of by the Fatimid during their expansion in North Africa during the last years of the 10th century. Before their “Mزاب period”, the Ibadi community who built the Cities of Mزاب were living in the region of Tahart under the thriving Ibadi Imamate of the Rustemid. Their capital city was sacked and so was every major city they built during and immediately after the Rustemid Imamate. Their Cities in Mزاب Valley however survived and continue to thrive until today, still inhabited by their descendants. Founded on precedent studies and primary sources, the present article discusses the conditions of formation of the world heritage site of Mزاب, its socio-economic and cultural characteristics. It aims at initiating a novel way to learn from the built heritage and past human experiences in building sustainable cities for refugees. It is also meant to trigger a debate on the practical ways and actionable solutions to transform the challenges faced by any refugee population into prospects for new beginnings for them and their descendants. Some strategies will be formulated from this case study to foster resilience, peace and community building for actual populations victim of armed conflicts, especially in the Middle-East.



Climate Change and the Effect of Natural Disasters on the Tourism of Architectural, Cultural Heritage Sites: The Case of Broader Area of Thessaly, Greece

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ABSTRACT

Climate change, as revealed by gradual changes in temperature, atmospheric humidity, rainfall and wind intensity, as well as rising sea levels together with the occurrence of extreme weather events, has already affected cultural heritage sites worldwide. Although these areas have always been and will continue to be subject to interactions with their environment, climate change is an additional potential threat, expected decay rates and/or contributing to the formation of new ones. Additionally, the occurrence of natural disasters, because of climate change, is a situation that threatens people's lives, causes damage to their property, and leads societies to face serious socio-economic and cultural problems. Although technology has developed a lot and has facilitated people's lives to a considerable extent, the occurrence of natural disasters has become more and more frequent over time. Natural disasters can be caused by endogenous causes i.e., they are caused by nature itself with no human involvement and also by exogenous causes such as wildfires which are mainly caused by human negligence. The management of natural disasters is considered particularly important, and this process includes tactical and management decisions as well as operational activities for the different stages of a disaster in order to improve the resilience of society. It is a fact that the protection of cultural heritage from the consequences of natural disasters due to climate change is gaining more and more ground on the international agenda. Furthermore, the G20 summit and the European Commission are constantly paying more attention to the importance of the past for the changes of the future. However, many areas affected by natural disasters are tourist destinations where the architectural cultural heritage and the natural environment are touristic attractions. The aim of this paper is to investigate the socio-economic consequences of natural disasters on tourism in areas of architectural cultural heritage. Floods are the second most frequent disaster in Greece after wildfires. The most recent example is the flood in the broader area of Thessaly, in October 2023, which will also be the main case study of this research. Many traditional settlements of Pelion, which were famous tourist destinations for their architecture and natural environment, as well as some of the reconstructed and reused industrial buildings of the 19th century in Volos, suffered severe damage from the flood. In this research we will discuss about the measures to be taken for this situation such as the mapping of flooded areas using new technological means, which will demonstrate the necessity of managing a disaster through records that will provide usable data, so that prevention and mitigation measures can be designed and implemented with the use of advanced technical tools.

Tourist Potential of the Municipality of Mêda (NE Portugal, SW Europe) from its Thermal Poles

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ABSTRACT

The municipality of Meda is a territory in the interior-central region of Portugal, in SW Europe. It has archaeological evidence of human occupation since ancient times of the Chipped Stone Age and more evident since the Roman occupation around 2000 years ago. The distribution and organization by main urban aggregates, which have survived to the present day, began with the actions that took place after the constitution of an independent territory that led to what is now Portugal, in 1143. The region has had its ups and downs over time, depending on the different eras, but it is currently going through a major crisis with the depopulation of the municipality, which, if solutions are not found to reverse this trend, could consequently lead to the desertification of the territory. There is therefore the objective of presenting a solution based on local endogenous resources, which are thermal waters with potential applications in thermalism, health tourism and well-being, which could lead to the settlement of senior populations from other countries and with all social, economic and other activities that result from it. Thus, this article begins with an introduction, where a brief note is given on the importance of the endogenous resources under study, thermal waters; then a brief characterization of the municipality is given, geographically, population, historical-cultural, patrimonial, economic-social, infrastructure and equipment, climatic and geophysical, followed by a presentation of the three Thermal poles: Termas de Longroiva, Termas da Areola and Águas do Graben. The main characteristics of the groundwater in those Poles are presented, with the potential in terms of exploitable flows, water temperatures in the current abstractions, and temperatures in the reservoir, which according to the studies carried out indicate 78°C for Águas do Graben, 84°C for Areola and 115°C for Longroiva, boosting new abstractions with water at temperatures that will favor the consolidation of those Poles and cascade uses, that is, geothermal uses in the first phase, in heating buildings and their domestic hot water, then in the direct use of water in thermal spa, well-being, recreational purposes, among others. As the main innovation in this article, in the next phase, for the different poles, plans/proposals for occupying the territory are presented, with areas of green parks and infrastructures to be recovered/built from scratch, and areas to be urbanized, among others. Those situations, as a whole, will make it possible for the municipality to attract tourists, and create conditions for many associated services, leading to the retention of people in those activities and even people in senior age groups, who can choose a place of residence where there are conditions for health, safety, good climate, good gastronomy, historical and natural heritage, whose main anchor is the continued thermal, well-being, aqua-ludic, and other services, centralized in thermal water exploration centers in the different poles.

Carbon Footprint Estimation at The National University of Rosario, Argentina: Evaluation and Perspective

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ABSTRACT

The National University of Rosario (UNR) is located in the city of Rosario, Argentina. Its current structure consists of 12 faculties, 3 secondary schools and 1 centre for interdisciplinary studies. It has a built-up area of more than 80,000 square meters. In 2019, its overall average population (students, professors, technical and administrative staff) was around 107,000 people. The campus policies include sustainability as one of its main objectives. To assess and eventually reduce the campus' environmental impact, its greenhouse gas (GHG) inventory was analysed and carbon footprint calculated, using the GHG Protocol (GHGP) and the ISO 14064 standard and series. In 2019, the campus produced around 3610 tonnes of CO₂ equivalent; corresponding to Category 2 (Indirect GHG emissions caused by imported energy) generating electricity, 2937 tonCO₂eq and natural gas, 673 tonCO₂eq. As this is a preliminary report corresponding to 2019 (several years prior to the present) and because the information necessary to calculate GHG emissions has not been systematised, the final results are more indeterminate than expected, estimated at between 10% and 20%. Neither were minor contributions estimated (with respect to the sources with the highest contribution: Stationary Energy and Mobility), due to sources such as Waste, Fugitive Emissions, etc. Furthermore, it was not possible to obtain information for this First Report on the number of trees that are planted on the entire land area of the UNR (mainly in the Faculties of Agricultural Sciences and Veterinary Science), in order to estimate the removals of the main greenhouse gas, Carbon Dioxide (CO₂). Given that in the Mobility Sector it was not possible to obtain direct information on GHG emitting sources (as only indirect data is available through the purchase of fuel in 2019 by the UNR), no data is presented for this sector. Consequently, the results presented in this Preliminary Report should be considered as minimum values for UNR emissions. However, taking into account the extensive experience from other reports and preliminary estimates, it is considered that the results of the UNR GHG emissions incorporate most of the emissions. The inventory will assist in the establishment of policies for GHG reduction and mitigation, resulting in potential environmental and economic benefits. Having completed the preliminary UNR Carbon Footprint Report, it is now time to move forward on a Greenhouse Gas (GHG) Emission Reduction Target and a Climate Action Plan to take this target forward. Consequently, and as part of the strategy to promote the development of sustainable campuses, the UNR decided to set a reduction horizon of 10% of the value calculated in the First Report until 2023, compared to the 2019 level.

Investigating the Influence of Roadway Materials on Ground and Atmospheric Temperatures in

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ABSTRACT

The paper investigates the impact of retrofitting pavements in a neighborhood setting, with a specific focus on mitigating the urban heat island (UHI) effect during the summer. The study aims to predict improvements to surface and air temperature at pedestrians' level using urban modelling, utilizing ENVI-met software. The research observes key environmental parameters such as ambient air temperature and mean radiant temperature for validation. By comparing different scenarios to a base case, the study evaluates the overall efficiency of proposed interventions, such as white topping and permeable interlocking. The results indicate that both the white topping and permeable sidewalk showed surface temperatures close to the ambient air temperature, with the permeable interlocking sidewalk having the lowest average surface temperature throughout the day. Additionally, the permeable interlocking sidewalk exhibited lower air temperatures compared to the base case during the daytime, and after 19:00, it slightly outperformed the white topping in reducing air temperature. This research contributes to our understanding of how pavement retrofit technologies can be evaluated on a neighborhood scale, providing valuable insights for making strategic decisions regarding the implementation of sustainable pavement technologies in cities.

The Influence of Urban Form on Streets' Walkability Conditions Selected Case Studies from Muscat-Oman

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ABSTRACT

Urban form is the physical characteristic of the built-up area, where the urban areas are performing as climate modifiers. A hot and humid city like Muscat, Sultanate of Oman, is an example of a fast urbanized city. It is facing the challenge of livable and walkable urban development, especially in the newly planned residential areas. Cars are dominating newly planned residential areas, severely compromising pedestrian mobility from the side of safety, connectivity, and comfort. On the other hand, peoples' outdoor activities and the usage of urban areas, especially streets, are directly affected by the microclimate and thus impact walkability. This research investigates the influence of urban form on streets' walkability conditions. It focuses on studying the street fabric of two different residential developments in Muscat (Al Khoudh6 and Al Mouj). The study started with a theoretical review to understand the relation between the urban form, microclimate aspects, and walkability conditions and identify their matrices. The literature concluded by preparing an evaluation list that helps compare and evaluate the research's main factors. All the required data for the study at both sites are collected, analyzed, and evaluated to find the relation between urban form, microclimate aspects, and walkability conditions. The study concluded that microclimate and walkability conditions are better in the carefully designed settlement (Al Mouj) due to the proper urban form planning that implements the critical urban form indicators positively. In addition, results prove that microclimate and walkability conditions significantly influence pedestrian comfort.

Contribution to the Efficient Land Use Study

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ABSTRACT

Human settlements, in all the diversity of their forms, appropriate land in different ways. In the same way as living organisms, cities grow, transport, adapt, innovate and change according to emerging trends (Hernandez, 2014). Cities expand, contract, densify, intensify, age and sometimes their functions even migrate to areas more conducive to their survival. All these city trends are closely linked to factors such as demographic changes, productivity and economic potential, existing physical and social conditions, the presence of policies favorable to actions, among others. A country that maximizes the many benefits of urbanization is one that is able to understand, measure and predict the growth trends of these urban centers; and which, in turn, puts in place actions / interventions with a view to reaping the benefits of this growth while minimizing the equally diverse challenges linked to unplanned urbanization. Proactive planning – a major prerequisite for sustainable urbanization – requires urban authorities and other relevant stakeholders to predict the direction the city's growth will take and/or to shape that growth by implementing infrastructure.

Human settlements, in all the diversity of their forms, appropriate land in different ways. In the same way as living organisms, cities grow, transport, adapt, innovate and change according to emerging trends. Cities expand, contract, densify, intensify, age and sometimes their functions even migrate to areas more conducive to their survival. All these city trends are closely linked to factors such as demographic changes, productivity and economic potential, existing physical and social conditions, the presence of policies favorable to actions, among others. Based on studies conducted by UN-Habitat in 2018, it was observed that in many countries there is a lot of variation between what is statistically identified as urban (the separation of enumeration areas into rural and urban areas in accordance with the procedures applied by the national statistical institutes for population and housing censuses) and what is officially identified as urban (if we consider the existing municipal or urban boundaries in the country).

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".

Variables with Incidence in the Generation of Microdumps in Chile: The Case of the Municipalities of Las Condes and El Bosque

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ABSTRACT

The existence of microdumps is an important problem worldwide and Chile is not an exception to this reality. There is a total of approximately 3,492 illegal final disposal sites for waste at the national level, classified as microdumps (sites under 1 Ha.). In Chile illegal dumps are on the rise and the Metropolitan Region (RM) is the city with the highest percentage. This study analyses the most important variables that explain this phenomenon comparing two municipalities of the RM, Las Condes and El Bosque, that differ, especially in socioeconomic status. The IPS (Indice de Prioridad Social/Social Priority Index) evaluates municipalities every year using three indicators: income, education and health. Las Condes is one of the municipalities with the best socioeconomic situation in the RM, at position N°51 of 52, in the category of “no social priority”, unlike the municipality of El Bosque, at position N°8 of the ranking, in the category of “mid to high social priority” according to IPS 2022 and in 2021 the same municipality reached position N°7 entering the category of “high social priority”. The Municipality of Las Condes has 10 microdumps with a density of 0.227/Km² and has 6.66 m\$/inhabitant for solid waste management, while the municipality of El Bosque has 48 microdumps with a density of 3.71/Km², with most of these located in areas of greater social vulnerability and it only has 2.80 m\$/inhabitant (42%) to perform the same function. The study concludes that the factors with the highest incidence in the generation of microdumps include social vulnerability of inhabitants, municipal resources for solid waste management, and the level of employment and education of the municipality’s inhabitants.

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, we internal migration data of people from 10 rural areas to a city from 2017-2022. Using this data, using regression, we find out the migration rate of the last five years, the number of people expected to arrive in the city from the ten rural areas by 2023, and determine what kind of accommodation they choose using agent-based modelling. The result from the study can be used for the city authorities to plan buildings in such a way that there is an assurance for the well-being of people and buildings are designed in such a sustainable way to promote climate resilience.

HSR Link and Evaluation Impact on Social Equity and Cities

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ABSTRACT

The consideration of social equity issues in transport appraisal is key to moving towards a more inclusive transport. However, the international literature on the impacts of long-distance rail transport, including high-speed railways (HSR), reveals that social equity impacts have been rarely fully examined or taken into consideration in appraisal. Indeed, the HSR potential to act as a transport and land use development policy tool to reduce accessibility inequalities and promote social inclusion remains unexplored. Several contextual policy factors and various methodological issues around the cost-benefit analysis (CBA) practice may have contributed to this fact. Transport equity analysis is often ad hoc, based on the concerns and values of the stakeholders involved in a planning process; other, significant impacts may be overlooked or undervalued. Therefore, this research paper contributes to individuating key variables that affect transportation equity analysis by assessing the validity of transport HSR projects with a CBA. The paper shows how equity is defined, impacts considered and measured, and people categorized can significantly affect economic and social results.



Managing Surface Runoff: Evaluating Infrastructure Development in Gedongsongo Temple Complex, Central Java, Indonesia

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ABSTRACT

The Gedongsongo Temple Complex, situated amidst the slopes of Mount Ungaran in Central Java, Indonesia, stands as a significant testament to Hindu architectural heritage on the island of Java, dating back to the 8th and 9th centuries CE. This complex, renowned among historians and archaeologists, has long been a favored destination for tourists. In efforts to bolster its appeal to visitors, infrastructural enhancements have been introduced within the temple precincts. This research endeavors to examine the repercussions of such infrastructure development on surface runoff patterns within the Gedongsongo Temple Complex and the ensuing impact on various environmental parameters within the area under scrutiny. The study adopts a comprehensive approach, employing EPA SWMM software for modeling and analysis. The methodology encompasses six distinct phases. Initially, data collection and preparation are undertaken, followed by the configuration of the EPA SWMM model. Subsequently, simulations are conducted to replicate existing conditions, facilitating a thorough understanding of the prevailing runoff dynamics. The model is then adjusted to accommodate proposed infrastructural modifications, paving the way for simulations of prospective layout scenarios. Finally, the resultant data is subjected to meticulous analysis and interpretation. Modeling outcomes reveal a discernible surge in surface runoff rates attributable to deficiencies in the existing drainage infrastructure. Consequently, instances of inundation have been observed within the Gedongsongo Temple Complex. Mitigating such inundation risks necessitates strategic interventions, including constructing robust drainage networks and adopting Low Impact Development techniques. By incorporating these measures, the adverse effects of heightened runoff can be effectively managed, ensuring the sustainable preservation of the temple complex's historical and cultural significance amidst its burgeoning tourist appeal.

Architectural Design Combined with Topology Optimization Addressed to Massive Periodic Structures

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ABSTRACT

Nowadays, the demand of sustainable, durable and eco-friendly engineering structures is a fundamental requirement for modern design processes. The efficient design tools need to be implemented to achieve this goal, so the innovative computational methods are extremely helpful already at the conceptual stage of the project. One of the most powerful tools in modern design, including civil engineering and architecture applications, is topology optimization. Topology optimization idea is to find, according to the established criteria, the optimal distribution of the material within a defined domain. The new layout of the material should minimize a defined cost function and fulfill previously imposed constraints. The most common formulation of the topology optimization is to minimize the compliance value of the structure subject to a total volume of the exploited material. Meanwhile, less common, but still important issues like manufacturing constraints and/or symmetry and pattern repetition can have a significant influence on the usefulness and aesthetic features of the final design. Following this trend, this paper investigates a simple method of topology optimization of structures under periodicity constraints with particular emphasis on civil engineering implementations. The possibilities and advantages of modern heuristic method called Cellular Automata are investigated. The Cellular Automaton is a mathematical idealization of the physical system in which the design domain is divided into a lattice of cells. The state of each cell is described by design variable, which is updated according to a simple local rule. By applying these design rules repetitively to all cells the material distribution within a design domain tends to a layout defined by the minimal compliance with respect to a predefined volume fraction. Additional challenges for the algorithm are the constraints imposed on a repetitiveness of the resultant material layout. This repetitiveness is defined by the periodic constraints executed by averaging of the compliance within the basic macrocells. Moreover, the rarely discussed and challenging application of self-weight loading makes obtained solutions more practical and realistic. The optimization of topology is addressed to massive periodic structures arranged to architectural design. The idea is illustrated in the paper by numerous examples, which, as far as a self-weight loading is taken into account, are unique in the literature.

Prediction of Californian Bearing Ratio of Wood Ash-Based composite Soil by using ensemble machine learning methods

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ABSTRACT

California Bearing Capacity (CBR) is vital soil strength metric, informing construction decisions and ensuring stability. Traditionally, CBR assessment relied on meticulous laboratory testing, a time-consuming and sometimes costly endeavor. The main objective of this study is to predict Californian Bearing Ratio of Wood Ash-Based composite Soil using ensemble machine learning methods. The database used to develop the ensemble machine learning models (XGBoost and Random Forest) is an experimental database. In the developed model, the laboratory-determined CBR represents the output variable, whereas the compaction characteristics (optimum moisture content (OMC) and maximum dry density, Atterberg limits (liquid limit (LL), plastic limit (PL), and percent of wood ash were used as inputs. To validate the model's predictions various performance indices such as root mean square error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE), and coefficient of variation (COV) were used. The obtained results indicate excellent performance and prediction accuracy of the XGBoost and Random Forest models.



Analogue Learning for Digital Study Courses: A Critical Report of Teaching Methodology Experiences in Higher Education

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ABSTRACT

Although we have mostly returned to purely classroom-based teaching, many teaching methods and tools remain digitalized. This particularly applies to courses such as Information Technology in Construction or Business Informatics for Construction in which the author lectures. However, many digital tools have proven unsuitable for developing the necessary spatial imagination that students require in the construction industry. As a result, various methods were tested as part of practical university teaching. These were partly based on the methods used to train architects. The five methods were deceleration, learning by doing, manual drawing, process orientation / iterations and the ability to work in a team. Some proved to be successful, others less so. So, after the first trial some adjustments were necessary. The lessons learned during the terms improved the module. This best practice report is designed to provide suggestions and simplify teaching methodology for other lecturers in the overlapping fields of information technology and construction.



Role of the Professional Profile Map (PPM) in Modern Education of Civil Engineers

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ABSTRACT

Modern civil engineering education places a strong emphasis on practical skills as well as theoretical knowledge. Practical experiments, laboratory work and actual projects are integrated into the curriculum. This approach ensures that graduates not only understand theoretical principles, but are also able to apply them to practical situations. Industry collaborations and internships further enhance this practical exposure, bridging the gap between academia and the professional sphere. The Professional Profile Map (PPM) assumes a pivotal role in shaping the education of civil engineers, offering a comprehensive framework that steers their academic and professional growth. A primary function of PPM is to assist civil engineering students in identifying the fundamental competencies and knowledge domains crucial for excelling in their profession. It provides a lucid overview of technical skills, which form the bedrock of a civil engineer's expertise. Moreover, the PPM underscores the significance of non-technical skills within a civil engineering education. Competencies like communication, teamwork, problem-solving, and project management are deemed indispensable for civil engineers, given their frequent involvement in interdisciplinary teams and interactions with clients and stakeholders. The map serves as a guiding compass, enlightening students about the pivotal role of these skills and motivating them to cultivate both technical knowledge and these vital interpersonal competencies. The paper examines the role of PPM in Erasmus+ education projects, highlighting the ease of adaptation of this tool according to educational needs. Such an approach is in line with the objectives of the Erasmus+ program encouraging interdisciplinary collaboration, practical experience and employability. A case study from the GREEN ROOFS project illustrates how PPM was used to identify knowledge, skills and competencies related to the implementation of green roofs engineering in construction. The role of PPM in harmonizing educational programs in different countries and promoting international cooperation was emphasized.



Urban and Maritime Transport at Mediterranean

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ABSTRACT

In Urban and Maritime transport at Mediterranean region gives the Conflict of systematic approaches to the diffusion of various flows (information, people, goods) and especially, innovations across urban networks (or systems of cities) have emerged in geography and regional science. In our reseaech the transportation aim with new approaches will be investigated by using neural network to have most efficient way of people and goods transportation. The results will be given with a sensitivity analysis using the comparisonal methods for different approaches and as an example will take place a case study between Istanbul and North Cyprus (Turkish District).



A Proposed Balanced Approach for Operational Energy Reduction and Cost Effectiveness in Thermal Retrofitting of Emirati Public Housing

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ABSTRACT

Efforts to enhance the sustainability and energy efficiency of existing Emirati public housing units are essential for achieving local Sustainable Development Goals (SDGs) in the United Arab Emirates (UAE). This study addresses the challenge of high energy consumption in older houses, particularly among elderly residents who are strongly attached to their homes and prefer not to move. Many of these homes were not constructed in accordance with Estidama regulations, resulting in poor thermal performance, high heat gain, and excessive reliance on air conditioning, leading to exorbitant electricity bills. To address this issue without demolishing homes or displacing residents, the research proposes a deep thermal retrofitting approach involving the addition of a sandwich panel self-insulated metal cladding layer to the external walls of existing housing units. The study employs a qualitative methods approach, including a literature review and market survey to identify suitable techniques and materials for retrofitting, as well as to gather capital cost data directly from the market. Detailed 3D Building Information Models (BIM) are then developed to visualize and analyze the proposed retrofitting scenario. Through simulation and analysis, the effectiveness of the added external cladding in terms of energy efficiency and cost-effectiveness is evaluated. The findings demonstrate that implementing this retrofitting scenario could lead to a significant reduction of 27% in operational energy consumption and corresponding monthly electricity bills. The payback period of the selected deep thermal retrofitting approach is estimated to be within 8 years, which will balance initial investment of the retrofitting cost with the operational energy reduction cost. These results offer valuable insights into the feasibility and potential impact of retrofitting techniques in Emirati public housing, contributing to broader efforts towards achieving SDGs in the UAE.



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