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2016
Prague, Czech Republic

WMCAUS 2016

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WORLD
MULTIDISCIPLINARY
CIVIL ENGINEERING - ARCHITECTURE -
URBAN PLANNING SYMPOSIUM

Eco-friendly Symposium - WMCAUS



ABSTRACT
COLLECTION BOOK

*the more you save the Earth
the more you get wealth*

World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium - WMCAUS

WMCAUS 2016

13-17 June, 2016 - Prague (Czech Republic)

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Preface

This Abstract Collection consists of the abstracts of papers presented in the “World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium” in the city of romance Prague (Czech Republic) during 13-17 June 2016. The World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium (WMCAUS) aims to provide a forum for discussion of the latest findings and technologies in different fields of Civil Engineering, Architecture and Urban Planning, to give opportunities for future collaborations, to be a platform for sharing knowledge and experiences in the fields of Civil Engineering, Architecture and Urban Planning, to lead for providing 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 City and Urban Planning such as; Construction Management and Engineering, Construction Materials, Geotechnics, Hydromechanics, Structural Engineering, Building Performance Simulations, Transportation, Architectural Space, Social Sciences and Architecture, Architectural Culture, Theories of Vision and Visuality, Architectural Design and Methods, Architectural Historiography, Architectural Heritage and Conservation of Historical structures, Sustainability in the Built Environment, Urban Planning, Public Space, Urban Design, Theories and Methods, Regional Planning, Archaeological Method and Theories, Sustainable Urban Development, Urban Sociology, Economics and Politics, Risk Management and Mitigation Planning, GIS-Based Modelling for Mitigation Planning, Computer Aided Design, Mathematical and Statistical Methods, Integrated Coastal Zone Planning and, Management, Accreditation of Civil Engineering, City and Regional Planning Education.

However the idea of organization of WMCAUS is quite old, the 1st WMCAUS was organized this year. WMCAUS 2016 will be one of the Annual series. However, nowadays there had been many local or international meetings related to Civil Engineering, Architecture, Urban Planning Sciences, we decided to organize a traditional style of symposium, friendlier and very fruitful alternative world symposium which is not a festival-like super-large convention, too chaotic and busy to have a chance to discuss something in deeper with other participants.

The main mission of the "World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium - WMCAUS" is to lead to contribute in multidisciplinary studies related with Civil Engineering, Architecture, City and Urban Planning and to improve interactions between people within these fields. As another mission it will provide a forum for this diverse range of studies which report very latest results and document emerging understanding of the related systems and our place in it.

We would like to express our sincere gratitude to all 500+ participants of WMCAUS 2016 from 50+ different countries all over the world for their interests and contributions in WMCAUS 2016. We wish you enjoy the World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium – WMCAUS 2016 and have a pleasant stay in the city of romance Prague. We hope to see you again during next event WMCAUS 2017 which will be held in Prague (Czech Republic) approximately in the similar period.

Prof.Dr. Işık YILMAZ
 Assoc.Prof.Dr. Marian DRUSA
 Prof.Dr. Marian MARSCHALKO

Chairmen of WMCAUS 2016

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Session Title:
Construction Management and Engineering

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Construction team downtime minimization model including efficiency coefficients

Michał Krzemiński *

Warsaw University of Technology, Civil Engineering Department, Al. Armii Ludowej 16, 00-637 Warsaw, Poland

ABSTRACT

The article presents a newly developed model for minimizing construction team downtime. The model is designed specifically for flow shop construction scheduling, where schedules are created with the assumption that the work will be organized in accordance with the Linear Scheduling Method (LSM). Such schedules are utilized in the construction industry in cases of structures that can or should be subdivided and it is expected that the subsequent work processes carried out on the subdivisions will be organized in accordance with the technological assumptions. The algorithm has been developed basing on the presupposition that the teams whose task will be to assist the ones generating the most significant downtime will differ in their efficiency. It is an important assumption, as otherwise an optimization process would be required for equal efficiency. To enter into the algorithm the information that a given team is not able to perform a certain process, 0 is to be entered into the efficiency matrix. Efficiency must be within the 0 to 1 range. The article presents a precise description of the mathematical algorithm. The model is based on an iterative algorithm. The functioning of the algorithm is also presented on an example of 5 consecutive teams working on 5 subdivisions. The results yielded by the utilization of the algorithm proved satisfactory. There was a slight, about 16%, reduction in the duration, while worker downtime has been reduced significantly, by 42%. Work is planned to continue on creating specialized software to accelerate the operations carried out within the framework of the next iteration of the algorithm. The author also plans to develop a method of evaluation of output algorithms. It should be noted that both shortening the duration, and reduction of construction team downtime resulted from selected teams working longer (the selection was performed by the algorithm in process of optimization of the output schedule). This extension of working time can affect the cost, and it is therefore necessary to determine whether the minimization of the cost of worker downtime is worth more than raising the cost of labour of the selected teams.

Key words: Flowshop model; minimum slack; scheduling; construction scheduling.

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An analytical survey of construction change systems: gaps and opportunities

Ehsan Eshtehardian ^{1*}, Saeed Khodaverdi ²

¹ Tarbiat Modares University, Department of Architecture & Art, Jalal HW, IR 14115-335, Tehran, Iran

² Iran University of Science & Technology, Department of Civil Engineering, Narmak, IR 16846-13114, Tehran, Iran

ABSTRACT

This paper surveys the studies on construction change and reveals some of the potential future works. A full-scale investigation of change literature, including change definitions, types, causes and effects, and change management systems, is accomplished to explore some of the coming change trends. It is tried to pick up the critical works in each section to deduct a true timeline of construction changes. The findings show that leaping from best practice guides in late 1990s and generic process models in early 2000s to very advanced modelling environments in mid 2000s and early 2010s have made gaps along with opportunities for change researchers in order to develop some more easy and applicable models. Another finding is that there is a compelling similarity between the change and risk prediction models. So, integrating these two concepts, specifically from proactive management point of view, may lead to a synergy and help project teams avoid rework. Also, the findings show that exploitation of cause- effect relationship models, in order to facilitate the dispute resolutions, seems to be an interesting field for future works.

Key words: Construction change; change management systems; dispute resolutions; change literature.

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Current methods for the utilization of the fresh concrete waste returned to batching plants

Aynur Kazaz ^{*1}, Serdar Ulubeyli ²

¹ Akdeniz University, Department of Civil Engineering, Division of Construction Management, 07058, Antalya, Turkey

² Bulent Ecevit University, Faculty of Engineering, Department of Civil Engineering, 67100, Zonguldak, Turkey

ABSTRACT

Among various types of materials, the concrete waste forms the major ingredient of the construction solid waste flow. Although the hardened or demolished concrete is not dangerous, the fresh concrete waste has a high potential to damage the natural environment. Therefore, it is necessary to minimize or fully eliminate the disposal of the fresh concrete waste. Considering the environmental significance of such wastes, this study aims to report current methods for the utilization of the fresh ready-mixed concrete returned to batching plants. This is because, in the related literature, these techniques have not been presented together up to date and each one of them has been investigated separately without citing the others. In this regard, the present study is the first attempt to give a full picture of utilization opportunities of this kind of wastes. Toward this aim, an in-depth literature review was performed as a methodological approach. Thus, types of the returned concrete were first explained and the existing methods were then discussed one by one in a detailed manner. As a result, the current methods were determined as (i) matching with suitable customers, (ii) blending with next matches, (iii) discharging onto the ground, (iv) producing pre-cast concrete components, (v) using with superabsorbent polymer, (vi) using with hydration stabilizer admixtures, (vii) recycling mechanically, (viii) discharging into the settling basin, (ix) using the hardened slurry cake in concrete, and (x) using the hardened slurry cake in partition wall blocks. Consequently, this study can fill the gap in the literature, may help researchers who will investigate the returned concrete from different viewpoints, may attract attention of industrial practitioners to benefit from such wastes, and may help saving the overall environment through suitable methods of processing the returned concrete.

Key words: Batching plant; concrete waste; fresh concrete; leftover concrete; over-ordered concrete; returned concrete.

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Building information model (BIM) use in Turkish construction industry

Hande Aladag *, Gokhan Demirdogen and Zeynep Isik

Yildiz Technical University, Department of Civil Engineering, Construction Management Division, Davutpasa Campus,
Istanbul, Turkey

ABSTRACT

Changing business conditions due to globalization, improved technology, transformed demands, needs of customers and etc. give rise to an increase in competition in construction industry. In this context, in order to survive and sustain in the long term, construction companies should progress in the field of technology and innovation. Thus, innovative approaches such as information technology (IT) use in construction is of the essence in terms of competitiveness for the construction industry's success. Among IT tools such as designing and structural analyses programs (CAD, SAP2000), enterprise resource planning (ERP) and data management programs; BIM technologies became a major shift for the construction industry in order to organize the reciprocal interdependencies between different stakeholders considering the increasing complexity of construction projects in design, bidding, construction and maintenance processes also with additional benefits on change control, decrease in repetition, energy efficiency, health and safety, risk and quality management. Taken into consideration of worldwide rising importance of BIM technologies, Turkish construction companies should tend towards BIM use in order to increase their global competitiveness and to provide the sustainability of Turkish construction industry's performance. In this context, the main aim of this study is to diagnose Turkish construction industry to develop a clear understanding about BIM adoption, to investigate challenges and benefits of BIM applications in Turkish construction companies and to provide strategies and recommendations for the Turkish construction industry for BIM implementation. Thus, focus group discussions were carried out with experts from construction companies and universities in order to reveal the importance, challenges and the use level of BIM in Turkish construction industry. The findings of the study can be used as a BIM implementation guidance at strategic and operational levels by Turkish construction companies that will face possible challenges in implementation of BIM and this constitutes the value of the study.

Key words: Information technology (IT) use; building information model (BIM); construction industry; focus group discussion.

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The cost risk in water and sewerage systems construction projects

Iwona Rybka ^{*1}, Elżbieta Bondar-Nowakowska ¹, Mieczysław Połoński ²

¹ Wrocław University of Environmental and Life Sciences, Faculty of Environmental Engineering and Geodesy, C.K. Norwida 25, 50-375 Wrocław, Poland

² Warsaw University of Life Sciences, Faculty of Civil and Environmental Engineering, Nowoursynowska 166, 02-787 Warsaw, Poland

ABSTRACT

Due to their complexity and uniqueness, all construction projects are exposed to the high risk. The condition for this risk reduction is an identification of risk events and an evaluation of their occurrence probability and effect. The subject of this study was the risk of an increase in planned costs of water and sewerage systems construction projects. The data obtained from expert survey constitute the basis of the analyses. The questionnaire, which was prepared specially for this purpose, contains the list of 25 factors that generate cost risk events which can occur during construction works execution. The list of these factors is the result of literature studies, interviews, direct field observations, as well as the inspection of investment documents. These factors included specific features of construction works such as: a large number of people involved, investment process formalization, and long duration of the investment, capital intensity, considerable material resources use, and interference with natural environment, dependence on weather and ground conditions as well as topography. The expert pointed out in the survey whether they observed particular factor in their practice, and whether the factor affected the cost of the investment. The questionnaire was filled by 51 carefully selected respondents. Each of the experts had a long-standing professional experience at the managerial position in water supply and sewerage systems realization. The results were analysed using statistical methods. Examination of the data set concerning the frequency of risk events, and the set of data determining these factors effect on investment cost increase, demonstrated the similarity in these sets structure. The similarity index was over 0.9. The method of correspondence analysis revealed that the most common source of cost risk on the construction sites of water supply and sewage systems include: faulty design documentation, unforeseen physical conditions, adverse weather and ground conditions, need to update the design solutions as a result of technological progress, inadequate design supervision, corrective action as a result of lack of required work quality. The factor related to the quality of project documentation was the most distinctive among all concerned in the study. This indicates that particular attention should be paid to the design phase as part of cost risk management plan. Faulty design documentation to the highest degree affects the high level of cost risk in water and sewerage systems construction projects.

Key words: Cost risk; construction of water supply and sewage systems.

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Survey of construction management documentation usage in planning and construction of building project

Maria Kozlovská, Daniela Macková *, Marcela Spisáková

Technical university of Kosice, Faculty of Civil Engineering, Vysokoskolska 4, Kosice, Slovakia

ABSTRACT

Project management presents the management and coordination of human and material resources throughout the life of project by using the modern techniques of management for achievement of predetermined objectives in particular scope, costs, time, quality and satisfaction of projects stakeholders. The construction project is unique summary of activities which resulted in product meeting the required quality parameters limited by time and costs. These parameters can be managed only through the carefully planning. The wide range of plans is result of construction planning. The plans allow the effectively manage the achievement of planned construction parameters. Not only the time, costs and quality are important for construction project management, but also the plans in the field of safety, construction equipment and measures for eliminating the impact of the winter season for construction. For effective planning and management of construction process by the plans, it is currently necessary to use more sophisticated ICT tools. The paper presents the results of longitudinal research focused on the opinion of constructors in Slovakia related to their approaches to processing these important plans for management of their construction projects. The survey was repeated in 1996, 2003, 2008 and 2013, therefore it is possible to examine the trends in the field of plans processing and then their using for construction management. The dependence of construction management documentation processing on time has been confirmed by statistical method (chi squared test) for investigation of quantitative characters. The findings of research indicate that trend in the processing of construction management documentation is improving. On the other hand, the survey also confirmed the insufficient software support in processing of these plans. Considering the current trends of using the building information modelling (BIM) technologies at the design stage, it is necessary to adapt the documentation for construction management to this trends.

Key words: Construction management documentation; planning phase; construction phase; questionnaire survey; software tools; Building Information Modelling (BIM).

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Improving construction processes using Lean Management methodologies

Piotr Nowotarski *, Jerzy Paślawski, Jakub Matyja

Poznan University of Technology, Instytut Konstrukcji Budowlanych, ul. Piotrowo 5, 60-965 Poznań, Poland

ABSTRACT

Construction sector is in general characterized by frequent deadlines delays, budget overruns and problems in maintaining proper quality. To prevent such problems, a common practice is to transfer the management methods used successfully in production industry. Article presents the idea of introducing Lean Management methodologies in chosen construction processes and the purpose of the study is to show how Lean Management can influence the total cost of selected process on the construction site.

Article is based on the study conducted by authors on the construction of office building in Poznan (Poland) city centre, where proposed new approach to management was introduced and tested. Authors focused their attention to economic aspects of introduced changes showing how proposed different style of management can influence on the cost of analysed processes. Lean methodologies are used to assess the risk problems and find suitable solution which will influence on reduction of the total time and cost of analysed works. Proposed idea of Lean Management in this paper as construction management solution can be remedy for many different problems in the construction industry not limited to analysed examples. Analysis of presented study led to the conclusions, that Lean Management can be interesting approach that can be implemented in construction process. Result of changing management of chosen process showed that visible cost and time savings are possible, depending on how deep the implementation of new approach is and what tools are used. Also the implementation of new management methodologies are possible only with the full acceptance of people involved in the process at any stage. Without active participation of those people, the results of introduction Lean Management can quickly vanish, and in such situation process will be conducted in old, ineffective way.

Key words: Lean Management; construction process management; cost reduction; 5s; construction site.

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Environmental cost-saving activities on construction site - cost-efficiency of waste management: case study

Anna Sobotka *, Joanna Sagan

AGH University of Science and Technology, Al. Mickiewicza 30, Cracow 30-059, Poland

ABSTRACT

Realization of Millennium Development Goals should be also reflected in construction industry. Sustainable consumption and production patterns can be associated with implementing and developing reverse logistics system on construction site to close the supply chain of construction materials. Initiating activities are undertaken already at the construction site, conditioning thereby further possibilities of resource recovery, stages of the recovery process, and total costs. Hence, the type, quantity and the quality of waste affect the cost of its collection – which can be a significant item in a project's budget. The paper provides an overview of the existing national recovery systems and waste policies to provide background for the case study. A crucial part of the research is an analysis of three waste management scenarios for a particular construction project. "Anthropocentric", "Actual" and "Eco-centric" approaches were studied in terms of waste collection costs. Two extreme approaches were created as an alternative to usual waste management policy applied on construction site. The "anthropocentric" approach is a reflection of ill-conceived waste management - assuming no segregation, which leads to high costs of waste processing. The "Eco-centric" approach, in turn, assumes direct sales of sorted waste at lower prices, and also by reverse logistics within the project, thereby providing cost savings. The results show that policy of waste disposal encourages and even forces entrepreneurs to implement reverse logistics despite the additional duties and requirements. General conclusions of research confirm that currently operating systems of waste management on site are sustainable, but nevertheless, it is still possible to make them more eco-efficient and, at the same time, more profitable. This was proved in the analysis of the "Eco-centric" scenario, which could be also called as "Eco-nomic" scenario.

Key words: Waste management; construction site; sustainable development.

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Monitoring of indoor environmental quality

Silvia Vilcekova, Ludmila Meciarova *

Technical University of Kosice, Faculty of Civil Engineering, Vysokoskolska 4, 042 00 Kosice, Slovakia

ABSTRACT

Since medieval times, people found that indoor environment should not be polluted, otherwise they might become ill. Studies focusing on the quality of indoor environment either in homes, schools or workplaces are performed all over the world. All these studies are different in location but also in methodology. Therefore, it is not possible or very difficult to use the results obtained in one location for other. It is necessary to know the true state of indoor environmental quality if we want to protect the health of citizens and suggest appropriate action for that purpose. The first measurement of indoor environmental quality in the printing company was conducted in spring season 2015. Another measurement was carried out several months after this given the disappointing results, however in the winter season 2015. The aim of this study was to compare the results of these measurements, and find out whether there are changes in the levels of total volatile organic compounds and in the presence of individual volatile organic compounds in this type of workplace. Questionnaire survey focused not only on the subjective perception of the indoor environmental quality as well as an assessment of whether the employees are not suffering from SBS (Sick Building Syndrome) symptoms was repeated for a better assessment of the situation. The electronic nose was used for sampling and analysis of individual volatile organic compounds. The photoionization detector with UV lamp was used for determination of total volatile organic compounds concentrations. The air temperature and relative humidity were set with data logger. The operative temperature was determined by globe Vernon-Jokl thermometer. PM concentrations were measured with airborne particle counter.

Key words: Indoor environment; monitoring; VOCs; particulate matter; health.

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**Supporting partnering relations management in construction projects' implementation
 using AHP and Fuzzy AHP**

Elżbieta Radziszewska-Zielina *, Bartłomiej Szewczyk

Cracow University of Technology, Faculty of Civil Engineering, Ul. Warszawska 24, 31-155 Cracow, Poland

ABSTRACT

Maintaining good relations between construction projects participants and focusing on the common goal, which is projects' success, allow improving projects' performance. The article presents the use of analytic hierarchy process (AHP) to support partnering relations management in construction projects' implementation. 18 partnering relation parameters have been presented. These parameters have been assigned to cooperation between the general contractor or management company and four other project participants, namely subcontractors, the designer, material and equipment suppliers and the investor. Four criteria have been used to determine the order of the parameters which should be improved firstly. These criteria are: time, cost, quality and safety of construction projects' implementation. In the AHP algorithm pairwise comparisons have been limited to the criteria. Pairwise comparisons of parameters have not been performed, due to a large number of them. Instead priority vectors in relation to criteria have been specified taking into account current assessments of particular partnering relation parameters and the weights of these parameters' impact on the considered criterion. The results of the analysis can be treated as recommendations for the project manager. The higher the global priority for the parameter is the sooner it should be improved, because this improvement is likely to bring great benefits in relation to time, cost, quality and safety of construction projects' implementation. In the article application of AHP method has been illustrated in both the basic presentation and in its more elaborate variant: the Fuzzy AHP – FAHP. The presented example shows that AHP method can be successfully adapted to supporting partnering relations management.

Key words: AHP; fuzzy AHP; construction projects; partnering relations.

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The impact of field data capturing technologies on automated construction project progress monitoring

Sepehr Alizadehsalehi, Ibrahim Yitmen *

Eastern Mediterranean University, Civil Engineering Department, 99628, Famagusta, North Cyprus

ABSTRACT

Accurate and timely information of construction project progress in a regular repeated basis is one of the critical stages of construction management. Current manual monitoring methods are time consuming and error prone. According to previous researches, automated this process with help of new technologies is the most economical and easiest way to solve the traditional methods. The advance field data capturing technologies are being investigated in the construction industry and have shown potential for supporting progress tracking. However, their full potential has not yet been achieved. The purpose of this study is to investigate the impact of field data capturing technologies, in combination with building information modelling (BIM) on automated project progress monitoring. The research is based on a survey of contracting and engineering consulting firms operating in the Middle East, Mid-Asia, Europe, North America, and Far East. The useable survey comprised 326 individual responses from 500 distributed, giving a response rate of 65.2 percent. Based on an evaluation of the findings, 3D Laser Scanning, Image-based, and Wireless Sensor Networks technologies in combination of BIM were found as the most effective technologies for automated progress monitoring. At the end a conceptual framework is illustrated and managerial implications are highlighted with a sample statement focusing on requirements, processes and benefits. The study confirms the importance of using BIM-based field data capturing technologies in enhancing automated project progress monitoring factors performance. It also highlights the need for further exploration of the role of the BIM-based field data capturing technologies in improving automated construction project progress monitoring.

Key words: Data capturing technologies; automated progress monitoring; BIM, construction projects.

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How the residents are affected from construction projects conducted in residential areas

Cenk Budayan ¹, Tolga Celik ^{*2}

¹ Yildiz Technical University, Civil Engineering Department, Istanbul, Turkey

² Eastern Mediterranean University, Civil Engineering Department, Famagusta, Northern Cyprus

ABSTRACT

The construction projects have adverse impacts on the residents who live at a neighbourhood of a construction project. In the literature, these adverse impacts are identified and the social cost of these adverse impacts are formalized. However, in all these studies, all adverse impacts are assumed to create nuisance at the same level, whereas the residents are more sensitive to some of these nuisances, on the other hand some of the nuisances which are considered in the social cost studies can be overlooked by the residents, and therefore this can cause misleading calculations of social cost. In order to overcome shortcoming of social cost studies, a study, which aims to identify the level of effects of each nuisance on the residents, is conducted by performing a questionnaire survey. 266 respondents are obtained at the end of the study, and the data obtained by questionnaire survey is analysed by using descriptive analysis. According to this analysis, loss of peace and quietude of the neighbourhood, cleanliness of the house, and degradation of ambient conditions are identified as the most disturbing nuisances. In addition, the country conditions and culture of the region is considered as important factors that play an important role in the intensity of adverse impact.

Key words: Adverse impacts; Stakeholder Management; Criticality Index.

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Computational analysis of the resistance to mining influences the small sports hall built on the stiff foundation case

Piotr Bętkowski *

Silesian University of Technology, Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

In the paper the influences of mining area deformations are analysed, mainly curves of the area, for deformations of the steel construction of the sports hall. There is described the small sports hall which is built some year ago in one of Silesian cities on areas on which the active coal mining is being conducted. In the paper are given short information about made in past and designed in future mining exploitation and the disadvantageous arrangement of layers of the soil-ground in the region of hall, made light of by designers. In the original hall project documentation is information about mining influences and protection applied by designers of the structure to these influences. The new sports hall wasn't correctly protected to mining influences, in spite of applying the huge and expensive spatial foundation case and solutions adapting steel structures to forecast deformations of the area. Typical solution for mining protection applied straight out for redoubling damage. In this object appeared large displacements of steel construction elements, irregular cracks of walls in highest zones and in the area of windows, as well as deformations of the floor making it difficult for the hall the normal use. In the paper is described the effect of application "theoretically correct" technical solutions, but not-correlated behind oneself in the mining prevention. They special attention is paid to applied structural solutions of the reinforced concrete foundation case, the spatial stiffness of the steel construction and improper materials used in construction of walls. This article contains results of extensive analyses of FEM, theoretical deliberations and photographic documentation of damage for a real municipal sports hall. Conducted analyses much exceed the scope of typical design calculations; however conclusions can be valuable for designers, but also essential for researchers dealing with hall contractions located on mining areas. The possibility of the comparison of the results of calculations with geodetic measurements of deformations of the steel construction and other damages of the hall was important for the quality of analyses. In the paper are given the method of repair of the hall and protecting to further mining influences. It is pointed out that the adapted repair procedure could not interfere in functional and architectural advantages of the hall.

Key words: Mining influence; mining damage; structure analysis; sport hall; maintenance.

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Conclusions from observation the small crisp arch bridges located on mining areas

Piotr Bętkowski *

Silesian University of Technology, Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

In the paper remarks, observations and conclusions from long-term observation of a few small crisp arch bridges located on mining areas are described. Small arch bridges often aren't taken out above the surface the area - these are mainly objects with the ride above the arch, surrounded with soil-ground centre in embankments. These crisp bridges were made with bricks, concrete not-reinforced or reinforced below the minimal percent determined for the reinforced concrete. Such objects are sensitive to mining deformations of the soil-ground centre, but attractive architectural what is particularly important on areas of cities. An influence of mining deformations of the area on crisp arch bridge objects is discussed. The attention is paid to important aspect of bridge maintenance, participating of Mines in costs of removing mining damages - the Mines perform building assessments of the impact of the mining exploitation for bridge, bridge expert opinions, and assesses the safety of damaged structures, projects of repairs and plans of protection for mining influences. To the order of Mines such documents often are performed by companies/persons without any professional know-how bridge. The problem is especially important in the case of small crisp arch bridges where the cooperation of arch with the ground is decided for the resistance to mining influences - in literature such cooperation is described only for flexible objects, such as corrugated sheet, e.g. SuperCor. In the paper is shown that the most of damages are not made by mining deformations but damages are made by incorrectly protection to mining influences, lack of small and often cheap mining preventive action taken in the title of mining damages or as a result of simply atmospheric factors. Arch structures are able to carry in a lot of greater deformations of the area than frame bridges with the similar span and what's more practically almost without any damages. Probably the cooperation of the soil-ground with the arch is important; so that the protections to mining influences should aspire for providing such cooperation. The lightening of the arch conducts to destruction of construction, what is described in the paper in one of examples. In the paper on the examples of a few real arch bridge objects are described well and bad realized protections to the influence of mining deformations of the area. The special attention is given for good transfer additional loads associated with mining deformations of area by crisp arches as a result of the interaction of the structure of the arch with the soil-ground centre. In the paper are discussed the examples of such cooperation and interaction, these examples are illustrated with photographic documentation.

Key words: Arch bridges; mining protection; maintenance; crisp structure.

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Impact of delays during concreting reinforced high-performance concrete beams

Daniel Wałach *

AGH University of Science and Technology, Al. Mickiewicza 30, Cracow 30-059, Poland

ABSTRACT

Increasing application of HPC commit to analysis its concreting process - the article raises the issue of impact of delays during concreting of reinforced high-performance concrete beams. It is difficult to cast the whole structure monolithically if the concrete elements are large size; there are some limitations to the availability of formwork, concrete workers or supply of the fresh concrete. In such cases, it becomes necessary to perform structure elements in two or more stages, which leads to formation of cold joints - plane of weakness or discontinuity formed when a batch of concrete hardens before the next batch is placed. A cold joint is usually characterized by poor bond unless remedial measures are taken. Correctly located and properly executed construction joints provide limits for successive concrete placements, without adversely affecting on structure. There are many available guidance as to the location and performance of joints in case of ordinary concretes – some special requirements for HPC have not been found. The main purpose of the research was detailed analysis of the Ultimate Limit State as well as Serviceability Limit State (deflection and cracks) on full-size HPC beams, with different positioning of cold joints. Both the network of cracks as well as deflection, shaped differently for beams made of HPC in relation to pattern made of ordinary concrete. The obtained results allowed to determine best technology of shaping joints in the beam elements made of HPC, providing obtain an element comparable to the beams which was cast the whole.

Key words: Cold joints; high-performance concrete.

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Building site organization with 3D technology in use

Anna Sobotka *, Katarzyna Pacewicz

AGH Akademia Górniczo – Hutnicza w Krakowie, Wydział Górnictwa i Geoinżynierii, Polska

ABSTRACT

Nowadays growth of three-dimensional printing technology is observable in different branches of economy. 3D printing is a technology, which uses Information Technology with numerical model to create physical objects. Now that technology is used in construction industry. Printer in that approach is used to create shell building. 3D printing technology is a challenge in terms of manufacturing products and buildings. It is possible that, this technology might extend available technologies and methods at building construction site. This might be a root cause of elimination manual work throw complex mechanisation, partial mechanisation and automatization of building site. That process brings information about expected use of man power. In this evolutionary process printing technology match ranks of automation and robotics in one processes. Technology implementation is connected with current information revolution and brings possibility to change organization and management of construction site. In this paper an analysis of the impact of the use of 3D printing technology, characterized by automation and robotics, on the organization of work at the construction site, particularly realized in difficult conditions like dense urban development, in the renovation and others. Point of start that analyses which is base to distinguish work organization efficiency conditions is a thorough analysis and characterization of 3D printing technology in use in the construction industry, using SWOT analysis. Received results are base to score that technology in terms of implementation it in construction industry and results and conditions which are realizing related with resources management including human resources management, time management, cost management and construction logistic.

Key words: Printing; technology; construction; organization; automatization.

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Critical success factors for public private partnership in Jordan: effect of project type

Abdallah Qudah ^{*1}, Rami Haddad ², and Maymoon M. Al-Hami ²

¹ American University of Madaba, Civil Engineering Department, Amman, Jordan

² Jordan University of Science and Technology, Civil Engineering Department, Irbid, Jordan

ABSTRACT

Critical success factors (CSF) concerning public-private partnership (PPP) projects in Jordan were determined and examined in the present survey study. The ongoing questionnaire study aimed at determining the importance of different CSFs for different types of projects carried out in Jordan. The two project categories studied were transportation and water & environment. The questionnaire was designed upon the current state of knowledge and after intensive direct interview of employees from both private and public sectors having different rankings and responsibilities. This paper aims at establishing whether these CSFs are indeed affected by the project type or not. For that, the data collected from 41 useable responses, out of 50 distributed questionnaires (23 from transportation and 18 from environment sectors) were statistically analysed to achieve the aims of the study. The results showed that the means of the eighteen CSFs were found to range from 4 to 4.85, which indicated that the respondents considered all the 18 factors to be very important to a successful implementation of PPP projects in Jordan. An independent t-test results showed that there are significant differences between the two sectors in eight factors, namely good governance, definite and split authority between the public and private sector, thorough and realistic cost/benefit assessment, commitment and responsibility of public and private sectors, favourable legal framework, government involvement by providing guarantees, multi-benefit objectives and sound economic policy.

Key words: Public-private partnership; success factors, survey study, statistical analysis.

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Development of eco-VE function for construction

Byung-Soo Kim *¹, Dong-Eun Lee ²

¹ KyungPook National University, Department of Civil Engineering, 1370 Sangyegk-Dong, DaeGu, Korea

² KyungPook National University, School of Architecture and Civil Engineering, 1370 Sangyegk-Dong, DaeGu, Korea

ABSTRACT

Recently accepted "Paris Agreement" has restricted the Earth temperature increase to be below 1.5 degrees Celsius contrast to previous industrialization. To follow this agreement, there should be efforts such as carbon emission reduction and eco design etc. One of these efforts is development of eco-VE(Value Engineering) function that applied eco-friendly concept on VE which is commonly used at design phase. Concept of this model includes carbon productivity concept and potential environment pollution index that reflects eco-VE function on original VE. The carbon productivity concept is a cause of production increase that offset production decrease factor depending on green-house gas reduction. The potential environment pollution index presents the possibility of environment pollution through construction phase. The carbon productivity is 'Construction cost/Carbon emission'. The construction costs are consisted of material, equipment, labour cost and indirect expenses. Carbon emissions are calculated by emission for material production and equipment fuel consumption. The potential environment pollution index is composed of environmental pollution and conservation cost. The environmental pollution cost includes environmental damage and destruction cost. The environmental conservation cost includes environmental pollution prevention cost, waste treatment cost, environmental pollution compensation, environmental pollution test research funds and law cost. These costs can't be calculated directly because it is not occurred yet. While designing it is calculated by comparing original plan to alternative about possibility of environment pollution. The value of VE increases when the cost is low and the performance is high. The value of eco-VE is 'Carbon productivity/Potential environment pollution index'. If the eco-VE function is applied to VE for alternative development at design phase, there will be big impacts on greenhouse gas reduction.

Key words: Eco-VE function; carbon emissions; carbon productivity; potential environment pollution.

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Model for assessing the social utility properties of a building

Aleksandra Radziejowska *, Zygmunt Orłowski

AGH University of Science and Technology in Cracow, Department of Geomechanics, Civil Engineering and Geotechnics, Al. Mickiewicza 30, 30-059 Cracow, Poland

ABSTRACT

In this article authors propose a mathematical model for the evaluation one of the fundamental dimension of building's sustainability: the social performance of the building. Among the social aspect, according to PN-EN 16309+A1:2014-12 - Sustainability of construction works – Assessment of social performance of buildings – Calculation methodology, were distinguished the following utility properties: accessibility, adaptability, health and comfort, impacts on the neighbourhood, maintenance and safety and security. In order to evaluate the considered aspect, the authors apply reference points (classes) for the examined social utility properties. The levels of study classes of properties are determined under the national standards, as well as the results of surveys conducted among experts. Authors present the proposal of methods of quantify measurable and immeasurable characteristics and the rules of computing of aggregating indicators of social performance of the building. The article contains a calculation example.

Key words: Sustainable development; social utility properties; evaluation; mathematical model; building's sustainability.

* Corresponding Author

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Identifying the factors affecting collaborative design for building performance

Gozde Basak Ozturk ^{*1}, David Arditi ², Ibrahim Yitmen ³, Mehmet Yalcinkaya ⁴

¹ Adnan Menderes University, Department of Civil Engineering, 09100, Aydin, Turkey

² Illinois Institute of Technology, Department of Civil and Architectural Engineering, 60616, Chicago, Illinois, USA ³
Eastern Mediterranean University, Department of Civil Engineering, Mersin 10 Turkey, Gazimagusa, Northern Cyprus

⁴ Aalto University, Department of Civil and Structural Engineering, 02150, Espoo, Finland

ABSTRACT

Collaboration is an important requisite in the multi-participant building design environment. The performance of a building as an end product is enabled via the collaborative efforts of project participants. The main purpose is to identify the factors that affect the collaboration between the stakeholders in the building design process. This research aims to identify the effect of the different levels of collaboration between the stakeholders on building performance. The related data is collected from the growing literature on collaborative design and building performance metrics. Recent technological developments that serve a higher level of collaboration and the construction industry's efforts to improve building performance are also considered. A conceptual model is proposed to address the collaborative relationship between stakeholders in the building design process, and to assess the effects of this relationship on building performance. The challenge is to enable collaboration through integrating the work performed by project by stakeholders with diverse backgrounds, varying levels of expertise, and different perspectives. Collaboration between design stakeholders is to be acknowledged as parameter that improves building performance. The outcome of this research is expected to enhance building performance and consequently improve the competitiveness of building design firms.

Key words: Collaborative design; construction industry; building performance.

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The experience with the assessment of the value of five competitive building enterprise of a regional significance in the period of a financial crisis

Martina Beránková *, Eliška Křížovská, Bohumil Puchýř

Brno University of Technology, Brno, Czech Republic

ABSTRACT

This contribution is intent on the problems of the evaluation of the five competitive building enterprises of a regional significance in the period of a financial crisis and it is a part of the forming dissertation thesis on the topic „Modelling of The Development of the Value of the Middle – Size Enterprise in the Real Competition of The Czech Republic”. It goes out from the matter of fact that choice of a suitable method is one of the most important and very essential steps in the process of an evaluation of an enterprise and therefore it is necessary to pay him a considerable attention. It is possible to divide the contribution into two main parts namely into a theoretical part and a practical part. While the theoretical part acquaints with the survey of the method used for an evaluation of an enterprise and the terminology connected with the solving problems in its introductory chapters, the practical part contains the basic data about five examined building enterprises and their evaluation by the method of return DCF entity. The aims of the contribution are to figure on the created model of five building enterprises with the similar production and the size of the economic turn-over the external negative influence of a critical character and to prove on the basis of the own experience that if an enterprise is in debt the method of return DCF entity becomes inaccurate. In order to reach these aims the evaluation of the examined building enterprises is set in the year 2010 in which the most outstanding negative effect of the financial crisis on their economic results was noticed.

Key words: Enterprise; method DCF entity; prognosis β ; perilous premium of a country; secure interest rate; two –phase calculation of an enterprise value.

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Formulation of parabolic resources profile of manpower requirement using various empirical formulae of resources levelling

Swapnil Wanjari *¹, Abhay Tawalare ¹, M. Marimuttu ²

¹ Visvesvarya National Institute of Technology, South Ambazari Road, Nagpur, India

² Indian Institute of Technology, Madras, India

ABSTRACT

Manpower planning of the Construction Project is highly complicated because large numbers of activities were executed either parallel or in staggered. So far, heuristic method is being used for resources levelling. In this method, resources were kept constant throughout the project duration. However, practically it is infeasible to mobilize people at the start of project if the drawings are not ready, or retain the people at the end if there is no work. The general requirement of manpower is minimum at the start, maximum during the peak period and again minimum manpower at the end of project. Hence the general trend of manpower requirement curve is parabolic shape. It consists of minimum manpower for critical activities at start of project, constant manpower at mid of project and again minimum manpower for critical activities at the end of the project. The objective of study is to fit the manpower resources in the parabolic profile with mathematical expression. This study is focused on development of methodology for preparation of parabolic resources levelling for the manpower in the projects. Also various empirical formulae were used such as Release and rehire, Resource idle days, Entropy maximization for development of parabolic resources levelling.

Key words: Resource levelling; parabolic resources profile; manpower requirement; resource idle days.

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Pricing in construction project management performed by the self-employed

Martin Nový *, Jana Nováková, Miroslav Bartoš

Brno University of Technology, Faculty of Civil Engineering, Institute of Structural Economics and Management, Veveří
331/95, 602 00 Brno, Czech Republic

ABSTRACT

The price is the decisive parameter in evaluating the competition for the implementation of construction works. Clear and correct determination is an important principle of project management and the basis for success of construction projects. The method of determining the price of the construction work with the aid of so-called 'calculation formula' has been for many decades commonly used in Czech construction industry as a basic tool for pricing. It is based on the situation when the person performing the construction work is an employee of the contractor (within the meaning of the Labour Code). All the items of the calculation formula of particular construction work can be derived from the standards used by a company, costs known in advance (contractual wages, statutory deductions from wages, machinery work, overhead costs) and the intended profit. The situation is different in case of a natural person who works on his/her own, within the meaning of The Trade Licensing Act. Apart from overall costs, part of his/her "wage" (remuneration) must cover the cost of living. In this article, the authors use the principle of retrograde calculation and propose a method whereby a self-employed person is also able to accurately calculate the cost of a construction work. Part of the calculation is also the determination of net income after subtracting all statutory deductions. In the future, the use of the suggested calculation with provability of sub-items can become a tool for increasing competitiveness of the self-employed.

Key words: Price of construction works; self-employed; retrograde calculation.

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Stakeholder engagement in mega transport infrastructure projects

Mehmet Erkul ¹, Ibrahim Yitmen ^{*1}, Tahir Celik ²

¹ Eastern Mediterranean University, Civil Engineering Department, 99628, Famagusta, North Cyprus

² Cyprus International University, Civil Engineering Department, 99258, Nicosia, North Cyprus

ABSTRACT

Mega transport infrastructure projects (MTIP) which inherent uncertainty and complexity, are in practice all over the world. These projects concerning their nature show political sensitivity and involve diverse group of stakeholders with conflicting interests. In such situations, decision-making becomes extremely difficult, as the necessary knowledge base for making adequate decisions is lacking due to both uncertainty and conflict of interests. It should be stated that project success on large scale transport projects totally rely on practicing effective stakeholder engagement (SE) techniques. SE practices in MTIP have crucial interrelations with national culture and their unique working environment. It should be noted that excluding key stakeholders in decision making procedures throughout the project lifecycle would be a losing strategy resulting with cost overruns, time delays, chaos with declining prestige and losing public support. This study aims to identify the stakeholders and their interests, analysing stakeholders' relationships and assessing stakeholders' influences in MTIP. In SE there are diverse approaches like operational, practical, and conceptual which will be reviewed in the literature. A model of framework will be proposed to provide new perspectives for identifying the precise interrelationships between the SEs, facilitate the complex processes and guide senior management in meeting project objectives. The proposed framework will also provide an effective SE approach to accommodate stakeholder analysis in MTIP for the planning, decision making and implementation of the project, so as to establish clear project priorities.

Key words: Stakeholder engagement; mega transport infrastructure projects; model of framework.

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Safety and health site inspections for a new training mode

Marco L. Trani ^{*1}, Luca Beretta ², Giada Nicolini ³

¹ Politecnico di Milano, A.B.C. Department, Via Ponzio 31, Milan 20133, Italy

² Research Consultant, via Silvio Pellico 14, Lesmo 20855, Italy

³ Research Consultant, via Bazzana Inferiore 1, Assago 20090, Italy

ABSTRACT

Nowadays in Italy the field of construction appears to be the sector with the largest number of accidents at work. Therefore it is of utmost importance to focus on this issue, in order to reduce all those risk factors that can undermine individuals' safety on building sites. To do this a partnership between bilateral bodies (CPT Milano) and INAIL (The National Insurance Institute Against Accidents at Work) of the Lombardy region started a training project mostly based on almost 70 building sites at the Universal Exhibition of Milan – Expo 2015 –. The aims of the research are the improvement of the worker's training offer and the creation of a rational methodology to allow a smart organization of the planning and the rollout of safety training courses. To do this, the first step of the research consisted in a deep analysis of the main problems on building sites, identified during inspections through all the Expo area. These inspections were made from a technical point of view, as well as monitoring workers' behaviour during their activities. In cases where the problems were more dangerous and due to workers behaviours we proceed with training activities 'on the job'. All critical issues (over 4.800) were registered in monitoring cards and a large amount of data was collected. In order to improve the training courses we also created standard models for each topic to be discussed during individual lessons. This need also arises from the finding of an inconsistency between the problems identified and the analysed topics in the current training. The analysis for the development of these models concerns not only the basic courses for safety, but also specific courses for tasks not yet regulated. Finally, the task group of Politecnico di Milano developed a methodology to identify the cause of problems encountered on a building site developed through two complementary analytical tools. The first, applied directly on site, used the timing of resolution of the problem encountered as an evaluation tool. The second is based on a back office analysis and used flow charts as a feedback. We developed a first proposal for a basic training course for workers (16 hours) in the field of health and safety, able to optimize the timing and subject matter. This study also allowed us to confirm that the training provided in the National Regulation should be developed according to the task and integrated with the introduction of greater specificity to the classes of risk level and type of processing. This applied model, obtained in a high-risk environment that however not particular accidents had, can be used in any other building sites and at a national level, since it is based on National Regulations. It may also be applied in any type of environment as independent from the boundary conditions of the place, ensuring that it can be seen as an expendable standard course for all companies in the construction sector.

Key words: Health & safety; safety training; construction site critical issues.

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Analysis of the urban space perception, transformed under the influence of complementary architecture

Natalia Wojciuk *¹, Roman Milwicz ²

¹ Suwalska 12, 87-100 Toruń, Poland

² Poznan University of Technology, Division of Construction Technology and Management, Poland

ABSTRACT

The character of urban space is being recreated by changes, which are taking place very fast. Especially, the buildings that are a part of the complementary development have an important influence on its composition. As we penetrate into the historical, compact urban fabric, the complementary buildings are transforming the face of a well-known place that often has a rich history, permanently inscribed in the memory of the inhabitants of many generations. These changes are extensively discussed and analysed among many architecture critics, conservators, historians, urban planners and inhabitants. We have selected a few examples of public spaces in Poznan and Wroclaw, metamorphosed in the last 10 years and we have analysed the way they engage dialogue with the modernity and revive the squares and places to be more accessible to inhabitants and much more willingly attended. The urban agglomerations, in which we have conducted the study, were chosen because of the high rate of historical buildings. The review of the metamorphosed spaces was made in the light of architectural, conservation and psychological aspects.

Key words: Architecture; complementary architecture; space; transformations; conservation.

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Influence of EU funds on education of managers and managerial competence in construction sector

Jerzy Pasławski, Piotr Nowotarski *, Sebastian Dubas, Roman Milwicz

Poznan University of Technology, Instytut Konstrukcji Budowlanych, ul. Piotrowo 5, 60-965 Poznań, Poland

ABSTRACT

The need for modernization of curricula is growing with the development of new technologies and changing construction market in all over the world. European Commission has put much effort and funds to European projects connected with education of future managers. Those funds enabled to alter competence of working managers to changing construction industry. Article presents how EU funds influenced curriculum of construction studies and managerial competence at one of the biggest Universities in Poland – Poznan University of Technology. It shows results of two finished EU Programs, one connected with launching Construction Technology Management, a new course on 2nd cycle studies, and second related to creation of postgraduate MBA studies in construction- project was focused on the joint creation of study an later its implementation within project consortium. Article describes how those projects influenced faculty, university and involved workers, as well as situation of graduates- students who have participated in new course which was conducted in foreign language - English. After presented discussion authors came to the conclusions that programs implemented at Poznan University of Technology funded by the European Union helped to increase opportunities that the university can offer for current and future students. In addition, these projects, aimed at strengthening cooperation with the industry and helped graduates finding jobs. This provided unique benefits for people who had opportunity to participate in those projects. As another benefit was expanding teaching offer with an MBA studies in the field of construction, in consequence the potential of the didactic units increased significantly. In addition, employees of the institute and the faculty involved in preparation and implementation of those projects, had the opportunity to make new contacts in Europe and worldwide, which positively affected potential of research and teaching, creating new opportunities for development and joint projects.

Key words: MBA for construction managers; modernization of the curriculum; construction technology management; the new approach in the education of engineers; managerial competences.

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Application of new flexible rubber packing materials for precast concrete pipeline

Sungnam Hong ^{*1}, Sun-Kyu Park ²

¹ College of Engineering, Sungkyunkwan University, Suwon 440-746, South Korea

² School of Civil and Architectural Engineering, Sungkyunkwan University, Suwon 440-746, South Korea

ABSTRACT

Buried pipeline is an indispensable factor of leading smoothly a society as a primary role. Recently, as a matter of convenience of construction and the economical purpose, the use of Precast Concrete products quickly increased. But there was various damage forms in a part of joint of Precast Concrete buried pipeline. The purpose of this study is to propose the new type of the flexible rubber packing material (EF) which could resist a permanent deformation of the ground or an earthquake and to investigate its safety together with effectiveness as conducting experiment and analysis.

Key words: Buried pipeline; precast concrete; joint; rubber packing material (EF); safety.

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Impact of multi-scale asphalt thin beams in the bending beam rheometer on the prediction of relaxation modulus of bituminous material

Chun-Hsing Ho *, Cristina Pilar Martin Linares, Maria Francisca Martinez Gonzalez

Northern Arizona University, Department of Civil Engineering, Construction Management, and Environmental Engineering, PO Box 15600, Flagstaff, Arizona 86011, USA

ABSTRACT

Asphalt thin beams (112 mm x 12.7 mm x 6.35 mm, length x width x thickness) in a Bending Beam Rheometer (BBR) have been used in the asphalt industry as one of methods to predict low temperature cracking properties of asphalt mixtures. Given the research work dedicated to the asphalt industry, the potential benefits of testing smaller specimens (cheaper equipment, less material, faster conditioning, easier availability for quality control, etc.) are well recognized. However, the two main criticisms of using the BBR to test mixtures are raised: (a) the thickness of the beam is smaller than the maximum aggregate size; thus a single aggregate particle can affect the results of the test, and (b) such small specimens cannot represent the overall property of the mix. This paper is conducted to address the above issues by using a combination of imaging techniques, statistical analysis, and viscoelastic modelling. Three nominal maximum aggregate sizes (NMAS), 12.5 mm (1/2"), 9.5 mm (3/8") and 6.25 mm (1/4"), were prepared in a laboratory. Each one of three NMAS specimens was cut into a six-faced block that was then scanned and analysed its pixels using imaging techniques. Subsequently, asphalt blocks were trimmed into thin beams and tested in a BBR to obtain their stiffness and creep compliance values. Analysis of variance (ANOVA) associated with viscoelastic modelling were performed to evaluate whether multi-scale asphalt thin beams could impact the prediction of thermal cracking properties of bituminous material. Based on results, the paper concludes that the difference between the three NMAS thin beams is not significant and their relaxation modulus curves show closer agreement. Thus, using asphalt thin beams in a BBR to determine thermal cracking properties of bituminous material is valid.

Key words: Bending beam rheometer; multi-scale thin beams; thermal cracking.

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A finite element model to evaluate the effect of vegetation on temperature variations of pavements and influence of motion on ambient temperatures

Chun-Hsing Ho *¹, Hengming Dai ²

¹ Northern Arizona University, Department of Civil Engineering, Construction Management, and Environmental Engineering, PO Box 15600, Flagstaff, Arizona 86011, USA

² Northern Arizona University, Department of Mechanical Engineering, PO Box 15600, Flagstaff, Arizona 86011, USA

ABSTRACT

This paper presents a computational mechanism/model using finite element method (FEM) to predict temperature variations between shadowed and unshadowed pavement surfaces and assesses how the effect of motion of runners and bicyclists can influence ambient surface temperatures. Natural environment and tree canopies have been found to have had influence on the heat energy absorption of pavement surfaces. The use of vegetation reduces the impact of solar radiation filtration on the thermal stress development of pavements. Based on the angle of the sun in the sky, the heat energy received on pavement surfaces can be described as a function of time. The heat on the surfaces is then penetrated into the pavement layers where the heat is stored and remitted back to the surface and the sky at night known as urban heat islands. The entire process of heat conduction, convection, and remittance significantly impacts the properties of asphalt pavements as the temperature raises and drops within the pavement layers. In addition, the effect of motion of objects (human bodies and bicyclists) on ambient surface temperatures is still not clear. Thus, the objectives of the paper are (1) to build a FEM model to analyse the shading effect of vegetation on the performance of asphalt pavements, and (2) to determine the relationship between the motion of objects and ambient temperature changes. Based on a series of field measurements, the FEM model can accurately predict temperature changes on shadowed and unshadowed pavements. The findings indicated thermal stresses decreased dramatically when pavement surfaces were shadowed by vegetation. Furthermore, ambient temperatures dropped 1-2.2 Celsius degrees by adjacent runners and bicyclists with a speed ranging from 5.7 MPH (9 KM/HR) to 15.3 MPH (24 KM/HR). This research provides (1) better understanding of the effect of vegetation/landscaping on the performance of pavements and (2) knowledge of the motion of objects on ambient temperature variations. The results can be used by pavement engineers in the stage of planning and design of pavements.

Key words: Finite element; vegetation effect; motion effect; temperature variations.

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Application of smartphone accelerometers to identify pavement failure modes using signal processing technology

Chun-Hsing Ho *, Data Zhang

Northern Arizona University, Department of Civil Engineering, Construction Management, and Environmental Engineering, PO Box 15600, Flagstaff, Arizona 86011, USA

ABSTRACT

Highway researchers have used a number of mechanical vibration models to predict dynamic vibration responses between the tires of a vehicle and pavements. The vibration data were likely measured by sensors attained on a trailer which is attached to a vehicle. More recently, smartphones equipped with accelerometers on-board have been widely used by highway researchers as a cost-effective way to collect vibration acceleration for determination of pavement roughness detection. However, there is a concern regarding how to interpret vibration data into readable and useful information in which highway engineers would take advantage of vibration analysis results to identify potential areas of pavement deterioration, and therefore prioritize the maintenance plan. This project used mobile accelerometer apps embedded in modern smartphones to predict dynamic vibration responses while traveling on pavements. The project presents an evaluation mechanism using to a fast Fourier transform (FFT) to review vibration data collected in roadways of Flagstaff, Arizona, USA. The goal of the research is to provide an analysis model that can help highway engineers better perform pavement condition assessment and identify different types of pavement distress modes. A number of road tests were implemented on three streets using mobile apps (accelerometers) attached in three types of vehicle (sedan, large size, and truck). Vibration data were analysed using a series of FFT analyses to change data from a time domain to a frequency domain in support of the interpretation of vertical acceleration values of gravity. Based on magnitude values shown on FFT charts, potential pavement issue points can be identified and the locations of pavement failure points can be found from their corresponding GPS coordinates. This approach significantly reduces the manpower and can save the time used for pavement condition assessments as compared with traditional pavement survey.

Key words: Signal processing; smartphones; accelerometers; pavement condition assessment.

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Outrigger systems to mitigate collapse of building structures due to loss of perimeter vertical elements

Osama Mohamed *, Magdy Ibrahim, Omar F. Najm

Abu Dhabi University, College of Engineering, Khalifa City B, Abu Dhabi, PO Box 59911, United Arab Emirates

ABSTRACT

Outrigger systems are often used to transfer lateral forces to the foundation. They are particularly designed to control drift in tall buildings due to wind and seismic forces. Progressive collapse resistant design focusses on reducing the risk of disproportionate collapse associated with the loss of primary load-carrying elements. This paper advocates the use of outrigger systems to control lateral drift in a wider class of structures to benefit from the additional advantage of reducing the potential for collapse associated with the loss of one or more perimeter columns. Properly designed outrigger systems are capable of transferring loads associated with the collapse of one or more perimeter columns to other parts of the structural system, even when the loss is not due to natural phenomenon such as wind or earthquakes. Toppling of buildings, caused in some instances by the existence of a soft-story, is an example of disproportionate collapse caused by failure of perimeter columns. The paper discusses how outrigger systems may mitigate toppling of building structures. The loss of any vertical element may result in reversal of internal axial forces in stories above the notionally removed column from compression to tension. When outrigger systems are utilized to resist lateral forces, vertical elements on the perimeter are naturally designed to resist tension under lateral forces, as well as compression. It is therefore intuitive to consider their design to resist loss of perimeter vertical elements. However, from the point of view of architectural functionality, outrigger systems may pose challenges in terms of space utilization, in addition to the need to repeat the outrigger-belt system.

Key words: Disproportionate collapse; outrigger system; seismic forces; wind forces.

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Comparison of the effectiveness of superficial strengthening of masonry with two types of GFRP reinforcement

Iwona Galman *

Silesian University of Technology, Department of Structural Engineering, Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

The autoclaved aerated concrete (AAC) has become one of the most popular materials used in construction of small dwelling houses (load-bearing walls) and large structures of frame (as a filling). Masonry walls with ACC blocks are made with thin bed joints and head (vertical) joints not filled with mortar. Unfortunately, such type of masonry walls is characterised by low crack resistance. One of the solutions to this problem may be application of superficial strengthening with FRP laminates. Strengthening materials tested so far (glass and carbon fibre mesh used in FRP system solutions) gave very promising results, but a relatively high cost of the material itself was the main drawback. This prompted a further search for new and relatively inexpensive materials that would allow to improve the serviceability of the existing structures made of AAC blocks. The paper presents laboratory test results of the wall surface strengthening made of inexpensive GFRP mesh, which is normally used as reinforcement of thin external plastering in thermal insulation systems and GFRP strips dedicated to strengthening of structural elements. The goal was to investigate its influence on the behaviour and mechanical properties of small masonry wallets made of AAC blocks with thin joints. Three series of masonry specimens were tested: unstrengthened wallets (as reference elements), walls with superficial strengthening with both sides strengthened with GFRP mesh (for thin external plastering) and wallets with expensive strengthening on both sides with strips mounted on the surface of the head joint. A total of 18 specimens subjected to diagonal compressive loading were tested (6 in each series). All specimens were subjected to diagonal compressive test according to RILEM LUMB 6 recommendations. The results turned out to be highly promising. An increase of shear capacity of all types of superficially strengthened masonry in comparison to the reference elements was observed. The tests also showed a positive effect of external reinforcement on the type of cracking and failure mode of such walls.

Key words: Diagonal tensile strength; AAC blocks masonry; superficial strengthening; GFRP laminates.

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Fracture mechanics parameters of fine grained concrete with polypropylene fibres

Marta Kosior-Kazberuk ^{*1}, Piotr Berkowski ²

¹ Bialystok University of Technology, Wiejska 45A, 15-351 Bialystok, Poland

² Wroclaw University of Technology, Wyb. Wyspianskiego 27, 50-370 Wroclaw, Poland

ABSTRACT

Addition of different materials to improve concrete properties is one of the solutions applied to prolong service life of structures made of it. Over the past years, fibre reinforced concrete has been widely used in different structural and non-structural applications. Moreover, important efforts have been devoted to develop new types of synthetic fibres. The fracture mechanics, as one of the most significant field of science, is widely used to analyse the material behaviour in structure. The paper reports the results of experimental programme focused on the effect of various synthetic fibres on fracture properties and ductility of concrete investigated in Mode I conditions. The synthetic fibres of different surface finish were used. Two of them were smooth surface, straight fibres, made of the mix of polypropylene and polyethylene. They were characterized by the same mechanical properties but different length: type A (50 mm) and type B (25 mm). The third type (C) of dispersed reinforcement was structural, extruded fibre with the length of 50 mm, made of modified polypropylene. The fibres were added at three volume fractions 0.3%, 0.6% and 0.9%. The fracture parameters were assessed on beams with initial notches in three-point bend test. The analysis of load-CMOD and load-deflection curves obtained made it possible to determine the fracture parameters of concrete. The changes in concrete properties due to incorporation of different polypropylene fibres were analysed on the basis of critical stress intensity factor K_{Ic} , critical value of crack tip opening displacement $CTOD_c$ and fracture energy G_f . The addition of the synthetic fibres had a slight effect on strength properties of concrete but, at the same time, it had a significant influence on the fracture parameters by the modification of pre-cracking and particularly post-cracking behaviour of concrete. Results of measuring toughness and energy-absorption characteristics showed that the specimens reinforced with the modern synthetic fibres acquire a great ductile behaviour and energy absorption capacity, compared to ordinary concrete specimens. However, the beneficial effect of fibres depends on their length and flexibility. Stiff fibres (type C) were less effective than flexible ones (types A and B).

Key words: Concrete; polypropylene fibre; fracture mechanics; ductility.

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Performance evaluation of asphalt concrete modified by polyolefins through dry and wet process

Fabrizio Cardone *, Francesca Frigio, Maurizio Bocci

Polytechnic University of Marche, Department of Civil and Building Engineering, and Architecture , via Breccie Bianche, 60131, Ancona, Italy

ABSTRACT

Polymer modification in road paving applications enables significant improvement in road service life since it enhances the mechanical response of asphalt concretes (AC) such as rutting, fatigue and low temperature cracking. The most common polymers, currently used in the asphalt industry for modification, can be divided into two main categories: elastomers and plastomers. Polymers may be added either directly to the bitumen prior mixing with the aggregate (wet process) or to the mixture, at the same time the bitumen is blended with the aggregate (dry process). The two processes may lead to mixtures with different properties. In this context, this paper presents a laboratory investigation concerning the effect of a polyolefinic additive (PO) on the mechanical performance of AC. In particular, two polymer modified ACs including PO were produced by means of wet and dry modification processes. An unmodified and a styrene-butadiene-styrene (SBS) polymer-modified AC were considered as control mixtures for comparison purpose. Mechanical characterization consisted in analysing the rutting and cracking behaviour of the ACs selected. The rutting resistance was determined by means of wheel tracking (WT) tests at 40 and 60°C, whereas fracture properties were investigated by means of semi-circular bending (SCB) tests at 10°C. WT test results at lower temperature highlighted that PO polymer-modified ACs show higher resistance to rutting with respect to the control mixtures. However, the PO polymer-modified ACs were found to be more temperature sensitive denoting a penalized rutting resistance at higher temperature compared with SBS polymer-modified AC. As far as SCB tests are concerned, PO polymer-modified AC showed higher fracture toughness and reduced fracture energy with respect to the control ACs. Nevertheless, the dry process seems to guarantee an ability of deformation such as to better endure cracking propagation with respect to the mixture produced by wet process.

Key words: Polymer modification processes; plastomer; polymer-modified asphalt mixture; mechanical characterization; rutting; fracture behaviour.

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Utilisation of waste wood particles in a common construction material

Niyazi Ugur Kockal *

Akdeniz University, Department of Civil Engineering, 07058, Antalya, Turkey

ABSTRACT

There are many types of waste materials can be pronounced which are used as aggregates or cement replacing mineral additives. Aggregates occupy 70-80% of the concrete and/or mortar volume. In this perspective, utilisation of waste materials as aggregates will reduce the cost of the concrete and/or mortar production much more than using them in replacing with cement. Besides, waste aggregates can decrease environmental problems related to aggregate mining and waste disposal. Aggregates can mainly influence the properties of concrete and/or mortar due to having the most occupation in latter materials among other constituents. Therefore, in this study, mixtures were prepared with wood particles as aggregates in different ratios to lower the thermal conductivity keeping the workability in a certain level. The results showed that higher amount of wood aggregate decreased the thermal conductivity constant and correlatively bulk density values of mortar mixtures.

Key words: Waste aggregate; wood particles; thermal conductivity coefficient; bulk density.

* **Corresponding Author**

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Heavy-weight cement-based materials

Niyazi Ugur Kockal *

Akdeniz University, Department of Civil Engineering, 07058, Antalya, Turkey

ABSTRACT

Having a density greater than 2600 kg/m³ results cement-based materials in classifying as high density or heavy weight. Heavy-weight cement-based materials can be produced by using natural high density aggregates such as barites, magnetite, etc. In this study, waste aggregates were collected from iron industry and used in cement-based material preparation. The findings revealed that incorporation of waste aggregates increased the density but reduced the compressive strength.

Key words: Waste aggregate; heavy-weight cement-based materials; density; compressive strength.

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Testing of water flow glazing in shallow geothermal systems

Fernando del Ama Gonzalo ^{*1}, J. Antonio Hernández Ramos ²

¹ Alfaisal University, College of Engineering, P.O. Box 50927, 11533 Riyadh, Kingdom of Saudi Arabia

² Polytechnic University of Madrid, School of Aeronautics and Space Engineering, Spain

ABSTRACT

The glazed façade of a building is the part that produces the greatest energy losses and gains. The need to reduce energy consumption and CO₂ emissions was one of the reasons that gave rise to dynamic windows. The ideal window would be one with optical properties that could readily adapt in response to changing climatic conditions or occupant preferences. The emerging concept of “dynamic window” is more as a multifunctional envelope that produces and manages energy rather than simply a static piece of coated glass. These facade systems include switchable windows and shading systems such as motorized shades, switchable electrochromic or gasochromic window coatings, Suspended Particle Device (SPD) Windows and double-envelope window-wall systems that have variable optical and thermal properties that can be changed in response to climate and building system requirements. Water flow glazing is a different concept of “dynamic window”. Water flow glazing provides control over the thermal load striking the surface, without compromising on transparency. The circulating water through the chamber both absorbs infrared radiation and reduces the temperature of the interior glass pane. Alongside, it provides thermal inertia to the window and a great potential to absorb and transport energy. The aim of this paper is to study the behaviour of water flow glazing in regards to the solar heat gain coefficient. Heat absorption can be controlled in water flow glazing to adapt the envelope to different climate conditions and façade orientations. To this end, real data have been obtained from a prototype throughout a year. The prototype combined water flow glazing in the roof, south, west and east façades with shallow geothermal wells without any need for additional energy source. Not only has the energy consumption for heating and cooling been analysed but also the contribution in the production of hot water in the building. The results of this study show that the solution of double glazing with a circulating water chamber is a less polluting and more efficient option than the systems currently used.

Key words: Water flow glazing; geothermal.

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The microstructure of selected mortars undergoing long-term influence of external environment

Anna Kaczmarek *, Maria Wesolowska

University of Science and Technology in Bydgoszcz, Department of Building and Building Physics, Kaliskiego 7, 85-796 Bydgoszcz, Poland

ABSTRACT

A facial wall is defined as an element used outside or inside which should have an attractive look. It is built from attractive wall elements using standard way of execution and joints filled with mortar appropriate for this type of wall element. From the point of view of durability the mortar is a wall element which not only binds bricks but also take part in humidity transport. It is associated with mortar microstructure which in comparison to clinker is characterized with high percentage of pores causing capillary flow and wall drying abilities. Mortars belong to the group of chemically active materials for which both internal as external factors are essential. The reason for internal corrosion are mortar components (binder, sand, water, additions). External corrosion includes all cases where mortar is threatened with external factors (CO₂ gas, acid rain, temperature changes exceeding zero point, solution of soluble mineral salts originating from surrounding elements). The factors mentioned essentially influence mortar microstructure changes. This process is distributed in time. This work concerns the analysis of changes in quantity and distribution of pore distributions resulting from many years of functioning of mortar in facial wall threatened with external factors. The researches were performed on a field test station localized in area of the University of Science and Technology in Bydgoszcz (Poland). Three facial walls with different mortars were chosen: Portland cement based mortar CEM I, Portland cement based mortar CEM I with plasticizer and cement-lime mortar. During construction of walls standard beams were formed from mortars in order to perform basic tests and microstructure tests after 28 days of hardening. During the subsequent years of wall functioning there were noticed appearances of efflorescence of various range and intensity. The information gathered allowed to state the area of highest efflorescence intensity. After ten years, for each wall, from selected place mortar samples were taken to examine microstructure with mercury porosimetry method. The results served to evaluate changes of meso and macro pores in mortars resulted due to external environment influence.

Key words: Mortar; mercury porosimetry; facing walls; impact of climate.

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Relationship between density and compressive strength of cement-based materials

Niyazi Ugur Kockal *

Akdeniz University, Department of Civil Engineering, 07058, Antalya, Turkey

ABSTRACT

The aim of this study was to evaluate the influence of density of cement-based materials on strength. Therefore, density, compressive strength and some other properties of materials with different combinations were determined by following relevant standards. Compressive strength of hardened specimens were determined in accordance with EN 1015-11. $\varnothing 50 \times 100$ mm cylindrical specimens were tested to obtain compressive strength and modulus of elasticity. The bulk density and porosity values were obtained by testing both 100 mm cube specimens according to ASTM C 642. Significant and good correlations were obtained between these two pronounced parameters. However, some additional related characteristics of cement-based materials could be considered in order to predict compressive strength more accurately. Pore size distribution and modulus of elasticity are also effective in estimation of compressive strength. Generally, compressive strength reduces with a decrease in density. However, there can be some exceptional cases depending on the properties of ingredients of cement-based materials.

Key words: Density; compressive strength; cement-based materials, correlation.

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Changes of clinker microstructure after long-term influence of external environment

Maria Wesołowska *, Anna Kaczmarek

University of Science and Technology in Bydgoszcz, Department of Building and Building Physics, Kaliskiego 7, 85-796
Bydgoszcz, Poland

ABSTRACT

Contemporary clinker elements because of numerous colours and shapes give uncountable opportunities for architectural compositions. Apart from undeniable aesthetic values they characterize with high resistance to environment influence. It is associated both with clinker microstructure as with adopted mortar types. By definition a facial wall has an attractive look which should be maintained during the whole period of the construction usage. However, it often occurs that the intended effect has not been reached. On majority of buildings during the first years of using there are efflorescence appearing, covering mainly clinker surface. They are primary efflorescence which should disappear during the first year of exploitation. The multi-year work led by the authors on real objects indicate that this period is definitely longer and efflorescence change according to seasons. The cyclic influence of salts change the clinker microstructure. This work concerns the clinker microstructure and its changes resulting from ten years of exposition on external climate conditions. The researches were led on field station localized on area of the University of Science and Technology Bydgoszcz (Poland). For analysis three clinker brick walls were selected, each built with different mortar: Portland cement based CEM I, Portland cement based CEM I with plasticizer and cement-lime mortar. From bricks designed for building there were taken 6 random samples which was initial material for microstructure evaluation. The researches were led on facial layer of bricks 5 mm thick. Basing on long-term observation a wall area was indicated with the highest efflorescence intensity. For each wall from the selected area 6 samples of clinker were taken of 5mm thickness. For microstructure evaluation the mercury porosimetry method was used. The results obtained were used to comparative analysis of changes in meso and macro pores in clinker after ten years of functioning in external environment.

Key words: Clinker brick; mercury porosimetry; facing walls; impact of climate.

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The investigation on flexural properties of hybrid fibre reinforced self-compacting concrete

Małgorzata Pająk *¹, Tomasz Ponikiewski ²

¹ Silesian University of Technology, Faculty of Civil Engineering, Department of Structural Engineering, Akademicka 5, 44-100 Gliwice, Poland

² Silesian University of Technology, Faculty of Civil Engineering, Department of Building Materials and Processes Engineering, Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

The paper considers the compressive and flexural parameters of the self-compacting concrete reinforced with combination of steel and polypropylene fibres. Three volume ratios of steel fibres (0.5%, 1.0%, 1.5%) were mixed with two amounts (0.3%, 0.9%) of two types of polypropylene fibres. The influence of hybrid fibres on compressive strength of SCC was negligible and comprised in the range of -5 to 11% of the strength of the matrix. Based on the flexural tensile tests on hybrid fibres reinforced mixes it was noted that steel fibres played the most important role in enhancing the mechanical parameters. Meanwhile, in the hybrid mix polypropylene fibres only slightly improved the toughness irrespectively of the length of PP fibres. The highest applied amount of the longest polypropylene fibres indeed improved the flexural parameters of the SCC matrix reinforced with steel fibres but on the other hand it did not satisfy the requirements for SCC in the fresh state.

Key words: Self-compacting concrete; hybrid fibres; steel fibres; polypropylene fibres; flexural tensile strength.

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Mechanical properties of masonry walls made of calcium silicate materials made in Poland

Radosław Jasiński *, Łukasz Drobiec, Adam Piekarczyk

Silesian University of Technology, Department of Building Structures, Gliwice, Poland

ABSTRACT

The article presents the results of the compressive, shear and flexural strength of wall with thin joints made of 15 types of silicate masonry produced by 12 Polish manufacturers. Europe. According to the requirements of EN 772-1 set a normalized compressive strength f_b (90 specimens) of masonry units. Investigations of the compressive strength of the wall in made with accordance the requirements of EN 1052-1 (44 specimens) specifying both the characteristic compressive strength f_k and the value of K factor as well as. In accordance with the requirements of EN 1052-3 were performed the initial shear strength of the masonry f_{vko} (117 specimens). Recognized failure mechanism and changes the strength of the walls depending on the percentage of vertical holes. Given the optimum range percentage of vertical holes. Describes the results (48 specimens) of a flexural strength at failure in a plane parallel to the bed joint f_{x1} and in a plane perpendicular to the bed joint f_{x2} . The study was conducted in accordance with EN 1052-2. Determined the basis strength characteristics of the wall under compression, shear and flexural compared to the characteristic proposed in the Polish National Annex to PN EN 1996-1-1 and national annexes for standards of other European countries.

Key words: Calcium silicate units; compressive strength; K factor; initial shear strength; flexural strength.

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Frost resistance of a recycled cold mix with foamed bitumen and with a different type of road binder

Przemysław Buczyński *

Kielce University of Technology, Faculty of Civil Engineering and Architecture, Department of Transportation Engineering, al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

ABSTRACT

The use of alternative binding agents to replace part of Portland cement in the composition of recycled cold mix bases (RCM) made with foamed bitumen and bitumen emulsion have become a common practice. Individual design of the binder composition allows utilization of fine grained waste materials such as fly ash or cement dust. The use of these materials is allowable on condition that the required parameters of the recycled base are maintained. Additional advantages from the individual design of road binder compositions include an opportunity to control the characteristics of the binder (compressive strength, resistance to the action of frost), which may affect physical and mechanical properties of the recycled mix. The analysis of frost resistance results from the tests of hot bituminous mixtures reported by Iwański (1999) and Judycki and Jaskuła (2014) reveals the importance of the issue. Adverse weather conditions occurring during the winter season in Poland Judycki et al. (2014) and in the neighbouring countries Trojanowa et al. (2015) make researchers look for the answers to the problem of the resistance of recycled bases with foamed bitumen and other road binders to the action of water and frost. The resistance to the action of water and frost has to be determined as a factor that has a deleterious effect on the quality of the recycled base layers. To evaluate the influence of the binder with respect to the weather factors, a modified AASHTO T283 procedure was used. The modification comprised increasing the number of freeze-thaw cycles to 2, 6 and 18 cycles. Based on the results obtained, the decline in the indirect tensile strength was determined, together with the values of WRW+M. The binder design included the combination of three primary constituents, that is, Portland cement (CEM I 32,5R), hydrated lime (Ca(OH)₂) and cement dust (CKD). Compositions of these binders were determined using the simplex centroid design (mix design). The design of the recycled base simulated the process of deep cold recycling with the use of materials derived from the existing structure. Foamed bitumen in the amount of 2.5% was used. The foam was produced from pen 50/70 bitumen. The binder content amounted to 3.0%. The evaluation of frost resistance was preceded by determining basic physical and mechanical properties of the recycled base, that is, void space content, absorption, indirect tensile strength ITSDRY, and stiffness modulus at indirect tension after 28 days of storing the specimens. The regression models obtained were used to optimize the composition of the binder. This indicates a possibility of adding those materials to replace 30% of the Portland cement amount.

Key words: Foamed bitumen; recycled cold mix; road binders; cement; water and frost resistance; reclaimed asphalt.

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Biological corrosion in the sewage system and the sewage treatment plant

Elżbieta Stanaszek-Tomal *, Maria Fiertak

PK Cracow University of Technology, 24 Warszawska St., 31-155 Cracow, Poland

ABSTRACT

Biological corrosion of sewers and sewage treatment plants constitutes a serious problem and its effects result in the loss of billions of dollars a year. It is generally acknowledged that corrosion of concrete caused by microorganisms is associated with the production of sulphuric acid by them as the main metabolic product. The activity of the bacteria leads to the formation of the sulphur cycle in the system, and consequently to the formation of sulphuric acid, whose presence causes corrosion of concrete. Moreover, the presence of other organisms, such as nitrifying bacteria, fungi and organic acids also contributes to the degradation of the concrete. This article discusses the mechanism caused by biogenic inorganic acids. In many cases, microbiological corrosion damaged concrete structures to the point at which necessary repair should take place after four years, which was followed by total destruction after six years. In order to protect concrete against microbiological attacks it is necessary to apply coatings that will make a barrier and will be resistant to the effect of biogenic inorganic acids (sulphuric, nitrate) and organic ones. The most relevant features that such coatings should be characterised by include resistance to acids, good adhesion to steel and concrete, lack of permeability as well as resistance to the effect of salts. This paper will only describe the mechanism induced by an attack by biogenic acids.

Key words: Sulphur bacteria; nitrifying bacteria; wastewater treatment plant; corrosion of concrete.

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Aggressive environmental effect on polypropylene fibre reinforced hot mix asphalt

Niyazi Ugur Kockal *, Sevil Köfteci

Akdeniz University, Department of Civil Engineering, 07058, Antalya, Turkey

ABSTRACT

Highway transportation is the most preferred transportation system as compared to other modes due to its high accessibility. Flexible highway pavement consists of mainly aggregate and bitumen, besides, in order to improve performance, some organic and/or inorganic additives are also utilized as additional constituents in the hot mix asphalt (HMA). By improving performance, positive characteristics can be gained to the HMA such as high strength, durability, toughness, suitable flexibility and resistance to impact. In this study, an attempt has been made to minimize deterioration due to the damage given by different aggressive environmental conditions. For that purpose, polypropylene fibres were added in varying ratios (0, 5, 7.5 and 10 % by weight of binder) into the HMA, then these mixtures were maintained in the freeze-thaw cycling cabinet, CaCl₂, NaCl and Na₂SO₄ solutions for a certain period. The results showed that stability increased continuously by mixtures with a content of up to 7.5 % of polypropylene fibre, and then a drop was observed by 10 % fibre reinforced mixtures. In addition, exposure to freeze-thaw cycles and Na₂SO₄ solution was found as the most harmless and harmful conditions, respectively among other environments in the investigation.

Key words: Hot mix asphalt; polypropylene fibre; aggressive environmental condition; stability.

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The influence of binder composition on the cement paste structure, physical and mechanical properties of concrete and its freeze/thaw resistance

Tomasz Juszcak, Jerzy Wawrzeńczyk, Agnieszka Molendowska *

Kielce University of Technology, Al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

ABSTRACT

The primary objective of this study was to determine how differences in the composition of the binder made with Portland cement, slag and/or fly ash affect the modification of the cement paste structure and the properties of concrete with respect to its freeze/thaw resistance. The testing programme comprised two stages. The effect of the binder composition on the cement paste microstructure was studied in the first stage using mercury intrusion porosimetry (MIP) and scanning electron microscopy (SEM). Concretes were studied in the second stage, during which their physical properties (absorption, permeability), compressive strength and surface scaling resistance (slab test) were determined. The testing programme was developed based on the mixture design. The binder was assumed to consist of Portland cement (CEM I 42,5 N), ground granulated blast furnace slag (GGBS) 0-60% by mass of the cement and fly ash (FA) 0-30% by mass of the cement. One constant composition of the concrete mix, water/binder=0.45, was established for all concretes. Only proportions of binder constituents were subject to changes in particular series, whereas the sum of these constituents $B=(\text{CEM I}+\text{GGBS}+\text{FA})$ was constant. The tests conducted on the hardened cement pastes indicate that an increase in the amount of mineral admixtures results in an increase in the pore surface area and porosity. Varying the binder composition by adding slag or fly ash results in minor changes in the pore size distribution within the cement paste. The predominant pore diameter for Portland cement is 19.0 nm, with 15.5 nm for 30% FA and 14.5 nm for 60% GGBS. Changes in the composition of the binder do not affect the test results for concrete absorption substantially, but absorption values tend to decrease with increasing amount of slag and increase with increasing amount of fly ash. Increased amount of slag leads to a marked reduction in concrete permeability. Permeability for concretes with fly ash is quite high. Increasing amount of fly ash reduces freeze/thaw resistance. Concrete behaves properly up to 20% slag content by mass of the cement. When this value is exceeded, the amount of the scaling material increases. The findings of this study show that the use of mineral admixtures does not guarantee an impermeability and frost resistant structure of concrete. It seems that application of fly ash or a mixture of fly ash and slag as concrete admixtures is impractical. An addition of slag is a better solution provided little amount is used. The freeze/thaw tests results presented in the paper for non-air entrained concretes with water to binder ratio of 0.45 show that if mineral admixtures are to be used, concrete mixes should be air entrained.

Key words: Structure; mineral admixtures; paste; concrete; permeability; freeze/thaw resistance.

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Correlation between the zero shear viscosity and rutting resistance parameters of the asphalt concrete

Grzegorz Mazurek *, Marek Iwański

Kielce University of Technology, Al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

ABSTRACT

The article presents the test results of the correlation of zero shear viscosity (η_0) and the rutting parameter $G^*/\sin\delta$ with rutting parameters such as: WTSAIR and PRDAIR. In the study was used the asphalt concrete coded as AC11S containing the synthetic wax in the amount from 1.5% to 4.0% with steps 0.5% compacted at a temperature range from 115°C to 145°C with steps 10°C. Zero shear viscosity was determined using Cross/Sybilski rheological model. The results of the parameter WTSAIR and PRDAIR showed a good correlation with the parameter η_0 ($R^2 > 95\%$) than with the parameter $G^*/\sin\delta$ which convergence was $R^2 = 73\%$. Parameter ZVE exhibited a higher sensitivity in discriminatory in terms of test results of rutting resistance of the asphalt concrete and bitumen stiffness. Moreover, the increase in the amount of synthetic wax F-T gave a favourable increase in the rutting resistance of the asphalt mixture. ZSV and parameter $G^*/\sin\delta$ had no absolute correlation. The higher sensitivity and correlation with the results of asphalt concrete rutting parameter showed parameter ZSV. In this connection, parameter $G^*/\sin\delta$ should be used more carefully in the prediction of resistance to rutting process of asphalt mixtures with the addition of synthetic wax F-T. ZSV parameter should be used as a major indicator characterizing the susceptibility of asphalt mixtures in terms of the rutting resistance test. This is particularly justified in the case of the new bitumen modifier usage.

Key words: Zero shear viscosity; synthetic wax F-T; rutting resistance; correlation.

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Analysis of the pressed brick characteristics in the beginning of the XX century in Valladolid, Spain

Soledad Camino *, Alfredo Llorente *, Javier León, José M^a Olivar

Universidad de Valladolid, E.T.S. de Arquitectura, avda de Salamanca 18, 47014 Valladolid, Spain

ABSTRACT

In the second half of the XIX century, pressed brick facades started to be built, which showed facades with pressed face brick, header bond and weathered joints. This sunken joints system facilitates the entrance of rain water in the masonry, therefore, its deterioration is found mainly in rainy and low temperature climate zones. In Valladolid, Spain, some brick masonries that made this kind of brick were established due to its location, characterized for having good clays. Many buildings with this kind of facade were built and are well preserved, versus other facades built with other materials such as stone, which present various injuries. The pressed brick characteristics have been the cause of the good state of the facades. Because of this reason, documents that contain the results of the tests that were done to the bricks of one of the most important brick masonries in the area have been analysed. These documents have been compared to the tests done to bricks made in these masonries that come from demolitions or old building reforms. These demolitions or old buildings reforms were done according to the procedures, in force, of the testing standards of the ceramic bricks CE. The test results are similar in compressive strength and water absorption. The compressive strength is higher than what is necessary for the load that had to withstand these facades and the water absorption is low. As for the procedures for testing, it can be pointed out that they are also similar except for one major difference. The difference is that in the early XX century, test tubes (specimen) that were broken due to compression had been subjected to the test of frost resistance, which provided more accurately information of the brick behaviour in facades and assumes that the demand for quality brick before placing it in work was superior to the quality in the present. This has undoubtedly contributed to keep in good condition the facades built with this brick.

Key words: Brick; conservation; heritage; tests; durability.

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Influence of hardening accelerating admixtures on properties of cement with ground granulated blast furnace slag addition

Jan Pizoń *, Patrycja Miera, Beata Łązniewska-Piekarczyk

Silesian University of Technology, Akademicka 5 st., 44-100 Gliwice, Poland

ABSTRACT

Ground granulated blast furnace slag (GGBFS) is a by-product of steel manufacturing process. As such it is commonly used in concrete technology as component of blended cements or addition for concrete. Utilization of GGBFS conforms to idea of sustainability. Unfortunately slag may lead to delay of setting and hardening of concrete. It is undesirable effect for manufacturing of precast elements or executing of concrete works during lower temperature period. Attempt to acceleration of hydration process of such cements by hardening accelerating admixtures was made. Paper shows results of compressive strength, hydration heat and initial setting time examinations. Portland cement (CEM I 52,5R) and cement with addition of 35% of GGBFS (which corresponds to normative range of CEM II/B-S) were tested. Tests have involved four accelerating admixtures with different chemical base (calcium format, C-S-H crystal seeds, calcium nitrate and trietanolamine). Initial setting time was measured by Vicat apparatus. Compressive strength of mortars was measured after 12, 24, 48 hours and 7 and 28 days of curing in climatic chamber. Hydration heat tests were conducted using isothermal calorimeter TAM AIR III during 72 hours after cement contact with water. Tests were conducted in 20°C. Water-binder ratio of mortars for compressive strength tests and cement pastes for hydration heat examinations was equal 0,5. Research had shown that all accelerators cause shortening of initial setting time by 40-50% depending on admixtures chemical base. The most efficient was accelerator based on C-S-H crystal seeds. Increase of hydration heat exhalation rate was observed. Summary hydration heat after 72 hours was greater in presence of hardening accelerating admixtures. Those admixtures caused also the increase of early compressive strength of standard mortars. Higher percentage growth of compressive strength was observed for cement with GGBFS addition. Calcium nitrate, calcium format and C-S-H crystal seeds based admixtures were the most efficient for Portland cement mortars and the latter for cement with GGBFS addition.

Key words: Hardening accelerating admixtures; slag; hydration heat; compressive strength; initial setting time.

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Performance concrete SCC supplemented with meal chalcedonite

Anna Kotwa *

Politechnic University of Kielce, Kielce, Poland

ABSTRACT

The article presents the results of the compressive strength, water absorption, capillary concrete SCC modified flour chalcedonite generated in the production process broken aggregates chalcedonite. Chalcedonite meal substitute for a percentage of the amount of aggregate in the concrete mix and the amount of cement is left unchanged. The study used cement CEM I 42.5. The study indicates that the use of 10% of the additive in powdered form chalcedonite will increase the compression strength, lower water absorption and capillary action.

Key words: Meal chalcedonite; compressive strength; mineral supplements; concrete; concrete mix; water absorption.

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Shear stiffness of solid clay brick wallets sheared perpendicularly to the masonry bed joints

Adam Piekarczyk *

Silesian University of Technology, Faculty of Civil Engineering, Department of Building Structures, Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

The article presents some results of experimental tests on solid clay brick masonry wallets ca. 130 × 140 cm subjected to simultaneously shearing perpendicular to the bed joints and vertical compression. On the basis of measured strains and shear forces the values of angular distortion and shear stiffness were calculated. The way of cracking at the masonry failure was observed, as well. The purpose of the study was to examine how the angular distortion depends on the shear stress and the how the masonry shear stiffness changes with load increasing. The impact of the value of compressive stress perpendicular to the bed joints on shear stiffness was also investigated. The results of investigations showed that relationship between the shear stresses and the angles of distortion were quite linear for shear stresses from 0 to τ_{cr} (τ_{cr} – shear stress accompanying first diagonal cracking). After diagonal cracking this dependence was nonlinear with characteristic hardening evident for the specimens simultaneously sheared and compressed. The hardening was stronger when the specimens were strongly compressed. The compressive stresses accompanying vertical shearing (in the analysed range of compression) have positive influence on the cracking resistance and capacity of vertically sheared masonry. The bigger values of the shear stress τ_{cr} accompanying the first cracking, the distortional angle θ_{cr} in common with the ultimate shear stress τ_u were reached when the compression was stronger. The strongly masonry were compressed the bigger values of the shear stiffness were calculated in nearly whole range of the shear stresses from 0 to τ_{cr} .

Key words: Masonry shear stiffness; masonry angular distortion; sheared masonry.

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Strengthening the cracked walls and installation parameters used connectors

Daniel Dudek *, Marta Kadela

Building Research Institute, Department of Building Construction Elements and Building Mining Areas, 40-153 Katowice, Poland

ABSTRACT

At the moment, observed more and more damage to buildings, it is associated with both the operation of the load, the time factor (fatigue), and the operation of additional burden, e.g. from the traffic, effects of mining, etc. Such injuries affect directly on the condition building. Evaluation of technical condition should primarily contain a request, specifying the degree of risk the failure or structural damage. In addition, the assessment should identify the causes of damage and ways to remove or secure the structure before further interaction. Only then formulated conclusions on the possibilities and how to repair, strengthen and secure the structure for further use. One possibility is the use of strengthening the walls of bonded anchors into account with resins. In line with existing European and global interpretations, capacity pull-out connectors depends on the embedment depth for a single switch, the state of the ground, the parameters of assembly and expertise work during fastening or connections. In fact, these switches work in a variety of mounting systems provided by systemic donor (manufacturers), which translates into a final bearing capacity of bonded anchors. The article presents the results of the work of the bonded anchors with selected resins commonly used in the European market for a variety of substrates - concrete walls made of ordinary non-cracked concrete, ordinary concrete cracked where the initiation of cracks was 0.00 and 0.30 mm, and walls made of brick full ceramic grade of not less than 20 MPa and full brick silicate class of not less than 20 MPa. All tests performed for the purposes of this article were conducted at ambient temperature of 23°C. Article therefore does not include testing at other than 23°C and humidity, or moisture substrate.

Key words: Fixings in concrete; fixings in wall; bonded anchors; resistance of fasteners; cracked concrete; crack.

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The effect of sewage sludge ash on properties cement composites

Monika Łukawska *

University of Technology in Kielce, Al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

ABSTRACT

Apart from typical waste materials such as: fly ash, blast furnace slag, silica fume, which are accepted for concretes all over the world, one should pay attention to the use of ash coming from the combustion of sewage sludge ash (SSA). In the article, the results of research on sewage sludge ash (SSA) and fly ash (FA) and the effect of these ashes on properties of fresh pastes and hardened mortars have been presented. The tests of ashes grading were carried out as well as their specific surface area was determined. The chemical composition of SSA was also identified. In order to examine the ashes in detail, structural analyses were conducted. By means of XRD analysis, the occurrence of crystalline materials was detected and by means of the morphology of ashes was investigated. Testing properties of fresh pastes and hardened mortars, 10% and 20% of cement mass was replaced with SSA or FA. Control paste and mortar were also made of ordinary Portland cement (OPC). By means of Vicat's softening point the initial and final times of setting were defined for standard consistency pastes containing ashes. Standard and long-term compressive strength of hardened mortars were carried out. The grading and the specific surface area are similar to the ones of FA. Chemical composition along with XRD and SEM analyses suggest that their use may be possible in the same way as the use of fly ashes. However, some low content of heavy metals and phosphorus in SSA was also found. The replacement of cement with 10 or 20% SSA resulted in setting times extension. It is important in the use of binder, though longer setting times of FA cement were observed as well. The chemical composition may suggest that setting time extension was caused by the occurrence of the phosphorus in SSA. The standard compressive strength of 10% and 20% SSA mortars were lower. The partial replacement of cements with SSA ash makes the kinetics of strength development slow down. It confirms that the process of hardening is retarded. However, the long-term increase in compressive strength of mortar was higher compared to OPC mortar. It means that it was partially similar to the influence of the fly ash.

Key words: Sewage sludge ash; cement composites; fly ash.

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Effect of biomass waste materials as unconventional aggregates in multifunctional mortars for indoor application

Chiara Giosuè ^{*1}, Alessandra Mobili ¹, Giuseppe Toscano ², Maria Letizia Ruello ¹, Francesca Tittarelli ¹

¹ Università Politecnica delle Marche, Department of Materials, Environmental Sciences and Urban Planning – SIMAU, 60131 Ancona, Italy

² Università Politecnica delle Marche, Department of Agricultural, Food and Environmental, 60131 Ancona, Italy

ABSTRACT

In order to decrease energy consumption in buildings, a new way to recycle waste materials coming from biomasses by-product in mortars was studied. In this way a better management of biomass waste, reducing materials in landfill, can also be reached. To this aim, mortars with water/cement equal to 0.5 by weight and aggregate/cement equal to 3.5 by volume were considered. Then, cement was replaced by hydraulic lime and sand was substituted with two different types of spruce sawdust shavings (as it is and roasted), biomass bottom ash and biomass fly ash. The results show that mortar prepared with cement has obviously better mechanical compressive strength and 60% lower capillary water absorption. All unconventional aggregates increase the total porosity of lime mortars from 41%, in the case of biomass bottom ash, to 52% in the case of spruce sawdust shavings and fly ash. Moreover, biomass fly ash and both spruce sawdust shavings, decrease density of mortars to permit the classification as lightweight mortar (with ρ less than 1300 kg/m³). Regardless porosity and lightness, biomass bottom ash improves up to 150% the mechanical performance of lime-based mortars. As regards durability, in general bio-based lime mortars show nearly twice higher capillary water absorption with respect to sand lime mortars. Roasted spruce sawdust shavings and biomass bottom ash decreases the capillary water absorption of lime mortars of about 5% and 50%, respectively regardless of porosity and lightness. All mortars can be classified as permeable to water vapour, since the vapour transmission resistance factors are very close or less than 15. Moreover, spruce sawdust shavings as it is and roasted are able to increase three and two times the capacity of mortar to be a hygroscopic buffer in terms of MBV values. All biomass waste unconventional aggregates improve the depollution capacity in terms of percentage of adsorbed Volatic Organic Compound as Methyl Ethyl Keton (MEK) inside a sealed box of lime-based mortars. In particular, both biomass ashes (bottom and fly) show the best performances with a reduction of MEK concentration 75% higher than reference lime mortars adsorbing up to 95% of MEK after two hours test.

Key words: Indoor air quality; lightweight mortar; biomass waste; durability; humidity control; depollution.

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Durability properties of concrete produced by marble waste as aggregate or mineral admixture

Gulden Cagin Ulubeyli ^{*1}, Turhan Bilir ¹, Recep Artir ²

¹ Bulent Ecevit University, Department of Civil Engineering, Zonguldak, 67100, Turkey

² Marmara University, Department of Metallurgical and Materials Engineering, Istanbul, 34722, Turkey

ABSTRACT

In recent years, the growth in the industrial production and the consequent increase in the corresponding consumption have led to a fast decline in available natural resources. However, a high volume of the industrial production has generated a considerable amount of waste materials which have a number of adverse impacts on the environment. In this regard, the marble industry produces a huge amount of waste in the last decades and grows significantly in time. The marble waste is generally a highly polluting type of industrial wastes due to its highly alkaline nature and its manufacturing and processing techniques, all of which impose serious health threats to the surroundings. As a solution to these negative effects, the literature suggests that the marble waste can be used in the construction industry as partial percent substitutes for aggregate, binder, and admixture in concrete. However, previous studies investigated this issue from different technical viewpoints and it seems necessary to examine the current positive, negative, and contradicting points in the use of marble waste in concrete. By doing so, this study can have a potential to fill the above-mentioned gap in the literature. Therefore, in the present study, the effect of different usage areas of the marble waste on durability properties of concrete was investigated based on past studies. In this context, durability properties of concrete, such as (i) water permeability, (ii) sulphate attack, (iii) abrasion resistance, (iv) chloride penetration, and lastly (v) performance at high temperature and freezing and thawing cycles, were examined. Consequently, contributions of the marble waste to durability properties of concrete were presented as a whole in a detailed manner.

Key words: Aggregate; concrete; durability properties; marble waste; mineral admixture.

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The effect of using rice husk ash as filler on moisture susceptibility of asphalt mix

Raja Mistry *, Tapas Kumar Roy

Indian Institute of Engineering Science and Technology, Department of Civil Engineering, Shibpur, Howrah-711103,
West Bengal, India

ABSTRACT

Moisture damage - one of the major cause of severe pavement distress - can be defined as the loss of strength and durability of asphalt mixture due to adhesive failure at binder-aggregate interface and/or cohesive failure within binder-filler mastic in the presence of water. Nowadays, the use of different wastes in asphalt mix has considerably extended due to environmental and economic concern. So the effect of these wastes on performance response of asphalt mix, especially moisture susceptibility should lookup carefully. This study is aimed at determining the effect of using rice husk ash (RHA), an agricultural by-product from rice mill industry as filler on moisture susceptibility of asphalt mixture. For that, optimum bitumen content (OBC) of the conventional mix (i.e. the mix containing 2% hydrated lime as filler) and mixes containing 2%, 4%, 6% and 8% RHA as filler were determined by Marshall mix design. The moisture susceptibility of the samples, prepared at OBC were then evaluated by tensile strength ratio, retained Marshall Stability and Cantabro Test. The test results indicated that, the addition of RHA up to 4% filler ratio not only reduces the OBC but also increased the moisture resistance of the resulting mix compared to the conventional mix. Moreover, it can be concluded that particularly in the area where RHA is generally dumped, can be used as anti- stripping filler in asphalt mix.

Key words: Moisture susceptibility; asphalt mix; filler; rice husk ash.

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Preliminary analysis of the effect of selected physical properties features on moisture resistance of asphalt concrete mixtures produced in half warm mix asphalt technology with foamed bitumen

Anna Chomicz-Kowalska ^{*1}, Władysław Gardziejczyk ², Mateusz M. Iwański ¹

¹ Kielce University of Technology, Al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

² Białystok University of Technology, ul. Wiejska 45A, 15-351 Białystok, Poland

ABSTRACT

The needs of environmental preservation and for decreasing the energy intensity of the construction industry are now among the main driving forces of development of new techniques and materials in road construction. Much attention is now given to efforts in decreasing the production temperatures of asphalt concrete, which typically are as high as 160°C -180°C. The introduction of these techniques began with the spreading of the Warm Mix Asphalt family of methods, allowing for the temperature reduction of 30-40°C. However, it is the use of Half-Warm Mix Asphalt with foamed bitumen, which permits significant economic and environmental benefits with the decrease in production temperatures that exceed 60°C. Although, this technique has some significant advantages, there is a possibility that the produced half-warm mix asphalt may be less resistant to severe climatic conditions (e.g. water and frost damage) and it may perform worse under cyclic loading. The paper presents the results of investigations of moisture damage resistance of asphalt concrete mixes (AC 8) produced in low temperature process with foamed bitumen (compacted at 95°C). Two of those mixes were investigated: one produced using standard 50/70 pen bitumen, and the other with a Fischer-Tropsch wax modified 50/70 pen bitumen. The performance of the studied mixes was compared with a control mix produced in typical hot mix asphalt process without additives. The obtained results have shown that the 2.5% Fischer-Tropsch wax modification had a positive impact on the measured properties of the investigated mixes. The investigated relationships included also the impact of the physical properties (volumetric density ρ_{bssd} and voids filled with bitumen VFB) on the resistance to moisture damage (ITSR) and its coefficients, i.e. ITS_d i ITS_w (dry indirect tensile strength and indirect tensile strength after one freeze-thaw cycle). The findings were that the asphalt concrete compacted at 95°C produced with foamed bitumen that was previously modified by 2.5% addition of Fischer-Tropsch wax had properties comparable to the control mix that was compacted at 45°C higher temperature. The analysis of the results has also shown significant relationships between the measured physical properties of the mixes and the coefficients of the ITSR ratio.

Key words: HWMA; WMA; half-warm foam mix asphalt; moisture and frost resistance; Fischer-Tropsch wax.

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Influence of the production process on the selected properties of asphalt concrete

Marek Iwański, Justyna Mrugała *

Kielce University of Technology, Al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

ABSTRACT

The paper investigates the influence of the concentration of synthetic wax modification of bitumen on the properties of asphalt concrete produced and compacted at 95°C at 115°C. In both types of mixes the bitumen was modified with 1,0% to 2,5% concentrations of synthetic wax in 0,5% steps. Nowadays, the most widely adopted classification of asphalt production techniques is the one based on production temperatures. According to this classification, the investigated production methods are regarded as Warm Mix Asphalt, where the production temperatures range from 110°C to 135°C and as Half-Warm Mix Asphalt with production temperatures ranging from 60°C to 100°C. Both methods are subjects of increasing attention due to their significant economic and environmental benefits. In the production of Warm Mix Asphalt mixes, a 35/50 bitumen modified with F-T wax was used as a binder. To achieve production temperatures below 100°C, additionally the binder was foamed prior to mixing – using the method most commonly used in production of CMA foamed bitumen mixes. The experimental work was separated into two stages: the first included assessment of the properties of the 35/50 F-T synthetic wax modified binder and the properties of foamed bitumen. In the second stage, the properties of AC 22W asphalt concrete were investigated, which included: air void content (Vm), resistance to moisture and frost damage (ITSR), wheel tracking slope (WTSAIR) and proportional rut depth (PRDAIR). The investigated asphalt concrete was designed as for binder course for moderately trafficked roads (KR 3-4). The conducted research allowed to assess the minimum amount of synthetic wax which results in the mix fulfilling the binding requirements (for both WMA and HWMA mixes).

Key words: Synthetic wax F-T; foamed bitumen; WAM technology; HWMA technology.

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Design of novel ceramic composite for complex geometry façades

Salvatore Viscuso *¹, Sergio Tarantino ²

¹ Politecnico di Milano, Architecture, Built Environment and Construction Engineering Department, Milan, Italy

² Stanford University, Center for Integrated Facility Engineering (CIFE), Civil & Environmental Engineering Department, The Jerry Yang & Akiko Yamazaki Environment & Energy Building (Y2E2), 473 Via Ortega, Room 292, Stanford, CA – 94305, USA

ABSTRACT

The paper deals with an innovative composite panel for optimizing anchoring to the rear structure of façade claddings. The new composite, called ELASKIN, is made of a ceramic thin slab and a reinforced rubber foil, combined together through a simple technological update in glued laminating machinery that are already used in ceramic industry. The research has started from the analysis of current methods for the production, transportation and usability of ceramic façade materials. Specifically, dry construction systems need a high-finishing level of panels; in hidden anchoring systems, slabs must be connected with metal structures - steel or aluminium - by manufacturers before arriving in yard, due the fragility of thin ceramics that doesn't permit to cut or modify them directly on-site. Through a performative design test modelled in Dynamo, a parametric plug-in for Autodesk Revit, it has been tested that the rubber-embedded ceramic panel is adaptable to several geometries of curtain walls by cutting only the ceramic slab in a customizable way by means of CNC laser plotter. The simulation has verified that it is possible to fix the tensioned elastic foil directly to the rear structure: in that way, clamps are hidden from the front of the curtain wall, because no structural clamp is directly added to ceramic part. The parametric digital model has also been object of a thermo-energetic analysis to assess its performance. A prototype building energy model has been designed with the novel composite panel applied to a traditional ventilated façade system. Using EnergyPlus, simulations have been carried out in this research to evaluate the energy performance of ELASKIN and to compare it with the performance of an open joint ceramic ventilated façade. First handcrafted mock-ups have verified the functional reliability of this new technological solution. Moreover, one of them has reproduced a little portion of ceramic cladding of Vanke Pavilion, designed by Daniel Libeskind for Expo 2015, verifying the substantial reduction of auxiliary structural materials compared to the erected anchoring solution. Finally, the paper demonstrates how the packaging waste associated to the adoption of this new building component is reduced by the integration of elastic foil that protects the ceramic slab during the delivery. Presently, the packaging is still deemed as a secondary element to the ceramic material itself, while the spread of dry construction procedures increases the supply of finished industrial components, thus generating a growth of packaging volumes and types that require to be disposed off on-site. The presented product allows reducing waste by means of innovative functional design strategies to be directly applied to industrial manufacturing. In the following steps, other mock-ups will investigate the industrial workflow for fabricating the composite ELASKIN with the laminating machinery produced by System Group Spa, while new tests should validate the panel to structural regulations.

Key words: Performative design; composite panel; laminated ceramic; reinforced rubber product; advanced manufacturing.

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The influence of binder composition on the cement paste structure, physical and mechanical properties of concrete and its freeze/thaw resistance

Tomasz Juszcak, Jerzy Wawrzeńczyk, Agnieszka Molendowska *

Kielce University of Technology, Al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

ABSTRACT

The primary objective of this study was to determine how differences in the composition of the binder made with Portland cement, slag and/or fly ash affect the modification of the cement paste structure and the properties of concrete with respect to its freeze/thaw resistance. The testing programme comprised two stages. The effect of the binder composition on the cement paste microstructure was studied in the first stage using mercury intrusion porosimetry (MIP) and scanning electron microscopy (SEM). Concretes were studied in the second stage, during which their physical properties (absorption, permeability), compressive strength and surface scaling resistance (slab test) were determined. The testing programme was developed based on the mixture design. The binder was assumed to consist of Portland cement (CEM I 42,5 N), ground granulated blast furnace slag (GGBS) 0-60% by mass of the cement and fly ash (FA) 0-30% by mass of the cement. One constant composition of the concrete mix, water/binder=0.45, was established for all concretes. Only proportions of binder constituents were subject to changes in particular series, whereas the sum of these constituents $B=(\text{CEM I}+\text{GGBS}+\text{FA})$ was constant. The tests conducted on the hardened cement pastes indicate that an increase in the amount of mineral admixtures results in an increase in the pore surface area and porosity. Varying the binder composition by adding slag or fly ash results in minor changes in the pore size distribution within the cement paste. The predominant pore diameter for Portland cement is 19.0 nm, with 15.5 nm for 30% FA and 14.5 nm for 60% GGBS. Changes in the composition of the binder do not affect the test results for concrete absorption substantially, but absorption values tend to decrease with increasing amount of slag and increase with increasing amount of fly ash. Increased amount of slag leads to a marked reduction in concrete permeability. Permeability for concretes with fly ash is quite high. Increasing amount of fly ash reduces freeze/thaw resistance. Concrete behaves properly up to 20% slag content by mass of the cement. When this value is exceeded, the amount of the scaling material increases. The findings of this study show that the use of mineral admixtures does not guarantee an impermeability and frost resistant structure of concrete. It seems that application of fly ash or a mixture of fly ash and slag as concrete admixtures is impractical. An addition of slag is a better solution provided little amount is used. The freeze/thaw tests results presented in the paper for non-air entrained concretes with water to binder ratio of 0.45 show that if mineral admixtures are to be used, concrete mixes should be air entrained.

Key words: Structure; mineral admixtures; paste; concrete; permeability; freeze/thaw resistance.

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A low shrinkage cement concrete intended for airfield pavements

Małgorzata Linek *

Kielce University of Technology, al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

ABSTRACT

The work concerns the issue of hardened concrete parameters improvement intended for airfield pavements. Factors which have direct or indirect influence on rheological deformation size were of particular interest. The aim of lab testing was to select concrete mixture ratio which would make hardened concrete less susceptible to influence of basic operating factors. Analyses included two research groups. External and internal factors were selected. They influence parameters of hardened cement concrete by increasing rheological deformations. Research referred to innovative cement concrete intended for airfield pavements. Due to construction operation, the research considered the influence of weather conditions and forced thermal loads intensifying concrete stress. Forced thermal loads are generated on airfield pavements in the form of hot combustion gases coming from nozzles of taking off aircrafts. Fresh concrete mixture parameters were tested and basic parameters of hardened concrete were defined (density, absorbability, compression strength, tensile strength, splitting strength). Influence of the following factors (length of curing period, ambient temperature, humidity) on rheological deformation value was also analysed. Based on obtained test results, it has been discovered that innovative concrete, made on the basis of modifier, which changes internal structure of concrete composite, has definitely lower values of rheological deformation. Both, in case of environmental conditions during concrete curing and in case of forced thermal loads. Observed changes of microstructure, in connection with reduced deformation values allowed to reach the conclusion regarding advantageous characteristic features of the newly designed cement concrete. Applying such concrete for airfield construction may contribute to extension of its operation without malfunction and the increase of its general service life.

Key words: Airfield concrete; thermal stress; cement concrete.

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Filler of ground clay brick in self-compacting concrete

Sandra Juradin *, Lidia Karla Vranješ, Katarina Grbeša

University of Split, Faculty of Civil Engineering, Architecture and Geodesy, Matice hrvatske 15, 21000 Split, Croatia

ABSTRACT

Filler has a significant influence on the workability and compressive strength of self-compacting concrete. Abib, Gaher-Abib and Kharchi (2013) have found that “the addition of filler from fired clay in the composition of a self-compacting concrete promotes improvement of the rheological performance (workability and stability of the mixture) and the mechanical (strength)”. The purpose of the experimental investigation is to determine the influence of ground clay brick as filler on the workability and compressive strength of self-compacting lightweight concrete. Red brick was ground in the mill and separated into two fractions: <0.04 mm and <0.125 mm. For this purpose, nine mixtures of self-compacting concrete were prepared and tested. Concrete mixes contained one of two fractions ground red brick and it was combined with other additives like: silica fume and stone powder. The composition of the each mixture was determined according to the CBI method. Properties of fresh mixture were determined by slump flow method, visual assessment of stability, T50 time, V-funnel method, L-box method and J-ring method. Also, in hardened state, compressive strengths and dynamic modulus of elasticity after 7 and after 28 days were determined. The use of ground clay brick as filler (<0.125 mm), in combination with other fillers, gives better results of compressive strength than mixture with only addition of same ground clay brick. Mixtures with ground clay brick (< 0.04 mm) had better results of compressive strength than the first mixtures, but in fresh state the mixtures were sticky. Obtained results are shown in the paper.

Key words: SCC; ground red brick; workability; dynamic modulus of elasticity; compressive strength.

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Effects of concrete deterioration on bonding performance between the steel bar and concrete

Yuan-Zhou Wu^{1,2}, Heng-Lin Lv^{1,2*}, Juan Gao¹, Hai-Yan Wen¹

¹ China University of Mining and Technology, School of Mechanics and Civil Engineering, Xuzhou, 221116, China

² JiangSu Collaborative Innovation Center for Building Energy Saving and Construction Technology, Xuzhou, 221116, China

ABSTRACT

Experimental investigation was conducted to explore the effect of deteriorated concrete on the bond strength between steel bar and the concrete. Three types of concrete were included, that are C20, C25 and C30. The deteriorated specimens were pull-out loaded after different time. The factors of tensile strength of concrete, water cement ratio w/c , relative thickness of protective concrete and carbonation depth were focused on. The results indicated that the failure mode of specimens changed from splitting failure to concrete crushing as the deterioration of concrete increased. The ultimate bond strength between the steel bar and concrete increased firstly and then decreased as the carbonization depth of concrete increased, meanwhile decreased with the reduction of relative thickness of protective concrete. As the compressive strength of three different type of concrete was similar, the specimen with smaller w/c has the larger ultimate bond strength. The bond strength decreased vividly as the expansive cracks appeared. An estimation model of bond strength was established, and the usability was confirmed as the results of calculation and test compared.

Key words: Deterioration; concrete; steel bar; bond performance; effect.

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Performance of a new non-clinker aluminium dross cement curing agent

Sun Jia-ying, Yang Yi-fan *

Zhejiang University, Ningbo Institute of Technology, Ningbo, Zhejiang 315100, China

ABSTRACT

The properties of a new aluminium dross cement-curing agent based on industrial solid wastes combined with an activator are evaluated through orthogonal testing using standard testing methods for compressive strength, bending strength, setting time, soundness, and the water needed to achieve a standard consistency. The influence of the curing conditions and the water to cement ratio on the strength obtained with the aluminium dross curing agent was also studied along with the durability to water erosion, resistance to sulphate attack and stability when subjected to dry/wet cycles or high temperature. The results obtained demonstrate that this new clinker-free aluminium ash curing agent provides good mechanical properties and a high resistance to water and sulphate attack. This material was also found to be suitable for use as a curing agent in soil solidification.

Key words: Industrial waste; curing agent; aluminum dross; strength.

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Research on the quality of ceramic tiles with regard to the estimation of the productive state of technological process

Bohdan Stawiski *, Tomasz Kania

Wroclaw University of Technology, Faculty of Civil Engineering, 50-370 Wroclaw, Poland

ABSTRACT

Problem of the research on quality of ceramic floor tiles remains still open. Their strength, and as a consequence possible applications, depend both on the constitution of ceramic composite, and on their degree of homogeneity. The method of controlling tile strength should be based on evaluating this feature in various cross-sections. Such measurements are very important because their mechanical properties are often not uniform across the whole surface. Standard control tests are not compliant with this requirement because they anticipate only destructive strength tests in their middle cross section. Application of the ultrasound method allows for the easy homogeneity estimation of ceramic composite in the tile. Transformation of the direct results for the resistance of material requires scaling of the measuring device what considerably expands the scope of research, however resistance parameters are not always necessary. Paper presents the research on the probe composed of 23 floor tiles with dimensions 600 x 600 and 600 x 300 mm. Tiles has been sampled from the lot of material that had been built in the floor and shown excessive defectiveness (broken edges, pop-offs and breaks). The main purpose of experimental tests was to determine the homogeneity of ceramic material in various cross-sections of each tile. Big variation of ultrasound wave velocity within the range of many tiles shown the cause of quick loss of expected serviceable properties. In addition has been carried out the measurements of the length, width and deformation of the surface of tiles. Dimensional deviations and deformations didn't exceed the admissible values.

Key words: Ultrasounds; ceramic tiles; homogeneity; deformations.

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A graphic version of Cholesky's method for improving the manual analysis of spatial porticoes almost exactly

Agustin Lacort *

University of the Bask Country, Paseo de Colón, 8, 2º D, San Sebastián, Guipúzcoa, Spain

ABSTRACT

This study proposes a new version of the classical Cholesky's procedure to solve the lineal equation systems derived from the analysis of building structures in terms of first order theory. With this modification this numerical method becomes a graphic one more suitable to be used manually. The new graphic method seeks to carry out the Cholesky's operations by tracing dotted lines sequentially on regular surfaces formed by squares with unit-length sides. When drafting instruments are used the results obtained are exact. The paper begins by describing the graphic method in detail and suggests some modifications that may enable it to be applied easily when the initial values are hard to deal with. It is observed that if the method is applied without using drafting instruments the results are still highly accurate, since the perimeter of the surface on which they lines are drawn reduces the possibility of error. Thus, drawing freehand calculation speed is increased at the expense of only a minimal error that does not depend on the procedure but rather on the tool used. This facilitates the use of the method in the initial stages of design. Besides, the graphic method is applied to analyse an ordinary spatial hyperstatic portico that is hard to calculate manually with classical methods. The analysis takes into account the hypotheses of manual deformation and doesn't consider the torsional stiffness of the beams. Finally, the results are compared with the exact ones. Based on this research, the possibility emerges of calculating certain hyperstatic structures commonly found in building graphically and almost exactly. Possible lines of research are also pointed to in the developing of further graphic methods that can analyze other types of structure directly and with the same precision.

Key words: Manual methods; graphic methods; structural analysis; lineal analysis; building structures.

* **Corresponding Author**

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Effect of using recycled instead of virgin EPS in lightweight mortars

Francesca Tittarelli ¹, Chiara Giosuè ^{*1}, Alessandra Mobili ¹, Costanzo di Perna ², Saveria Monosi ¹

¹ Università Politecnica delle Marche, Environmental Sciences and Urban Planning (SIMAU), Department of Materials, Via Brezze Bianche 12, 60131 Ancona, Italy

² Università Politecnica delle Marche, Department of Industrial Engineering and Mathematical Sciences (DIISM), Via Brezze Bianche 12, 60131 Ancona, Italy

ABSTRACT

The exponential growth of EPS waste from packaging incited a search for alternative means of recycling and a possible solution is the substitution of commercial virgin EPS with recycled one in mortars and concretes. Moreover, the use of industrial by-products to reduce the thermal conductivity of cement-based materials improves resource efficiency in buildings. In this work, therefore, the effect of using recycled EPS instead of commercial virgin one on the properties of lightweight mortars is investigated. Lightweight mortars are manufactured by replacing the 33-66-100% of sand volume with virgin or recycled EPS in order to obtain lightweight structural mortars with $R_c \geq 18$ MPa, moderate strength lightweight mortars with $R_c = 7 \div 18$ MPa, and thermo-insulation mortars with $R_c = 0.5 \div 7$ MPa, respectively. The addition of a hydrophobic agent is also considered in the presence of recycled EPS.

Results show that, at the same dosage, replacing of virgin EPS with recycled one improves the mechanical performance of mortars without affecting workability. It increases the capillary water absorption in thermo-insulation mortars (100% EPS by sand volume) that can be obviously decreased with a hydrophobic admixture. Does not change significantly the permeance of water vapour, that is actually increased with an hydrophobic admixture. Recycled EPS mortars have lower thermal insulation properties than those manufactured with virgin one, but this can be counteracted by increasing the percentage of EPS. To obtain mortars with a certain thermal insulating capacity, an economical save over than 25% can be reached by using recycled EPS.

Key words: EPS; recycling, lightweight mortar; cement.

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High-performance and low carbon construction materials database for built environments

Barbara Gherri *, Valentina Battilocchi, Marialena Busani, Fabio Scola

University of Parma, Department of Civil and Environmental Engineering and Architecture, Parma, Italy

ABSTRACT

Considering that buildings represent 40% of greenhouse gases and approximately 10% of global gross domestic product, the target the building industry has to accomplish is to get to a High Quality and Low Carbon Living, by reducing carbon emission by 2050, as recommended by Energy Performance of Buildings Directive EPBD. Considering these needs, designers, manufacturer and the construction companies should be able to make use of web and design tools for collecting and inventorying a large variety of environmentally friendly materials, through a specific database that enclose low carbon certified products and eco-labelled ones. Considering the actual state of unparalleled material innovations and the strict demand to address the built environment towards a more conscious use of low carbon, sustainable and certified materials construction, the accelerated pace of these innovations and the extensiveness of their applications have enhanced our awareness, without the support of a research and catalogue instrument where to consult and search for these new products. The innovative, new and unusual materials that each days pop up in the marketplace require firstly a rethinking of traditional application and process, though the concepts of sustainability and life-cycle/ are a comfortable fit, passing through an inventory database, especially tailor made on these needs, and exclusively design for the building sector. The creation of a new searching and learning resource challenges traditional concepts, roles, and functions as library, collection, and inventory database merge into one space with a multiple mission. With the redefinition of the role of building materials for ensuring a low carbon future for the built environment and to guarantee a comfortable and healthy living conditions for people, as well as the acceleration of the pace in which new high performance materials appear, the classification and description of materials is innately challenging, and so far there is no a proper instrument to be used. The project here proposed aims at creating a High-Performance and Low Carbon Construction Materials Database for Built Environments is called LoCaMat -Low Carbon Material Database- is now part of the European Climate KIC program -Knowledge Innovation Community, dedicated to climate change, established and promoted by EIT. LoCaMat will acts as the first Italian and European database that encompasses multiple data on certified green materials to be used for the construction sector, making buildings climate change resilient, ensuring an efficient use of energy and resources, getting to a complete life cycle assessment for buildings materials and components. LoCaMat aims, for first time, at collecting in a friendly tool certified products and low carbon items according to criteria and ecological standards, identifying sustainable performance and low environmental impact of building materials into a convenient reference database. LoCaMat is an online a building product information source for Architects and Designers, encompassing for first time, Green Data and every kind of Environmental Specs for your Sustainable Design and Green Practice, offering a complete materials ID cards, that you can browse by application, trade mark, country, LEED credits, green specs and Eco-labels index.

Key words: Low carbon; eco-labelling; construction materials; environmental specs; sustainable materials.

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Experimental investigation of torsional restraint provided to thin-walled purlins by sandwich panels under uplift load

Ivan Balázs ^{*1}, Jindřich Melcher ¹, Andrej Belica ²

¹ Brno University of Technology, Faculty of Civil Engineering, Institute of Metal and Timber Structures, Veveří 331/95, 602 00 Brno, Czech Republic

² Lindab S.A., Route d'Ettelbruck 34, 9230 Diekirch, Luxembourg

ABSTRACT

Sandwich panels, usually used as members of wall or roof cladding, can provide lateral and torsional restraint to metal members of the substructure along their spans. They can positively influence the buckling resistance of the metal members. Lateral restraint given by sandwich panels can be considered for downward as well as uplift load applied on the surface of the panels. Torsional restraint can normally be utilized in case of downward load only. The uplift load causes the reduction of the contact area between the panels and metal members which is assumed to result in small (or conservatively zero) values of rotational stiffness which corresponds to the torsional restraint. There is a lack of data regarding torsional restraint under uplift load. Certain values of rotational stiffness can be considered when metal members of cold-formed cross-sections are utilized. The determination of the values of rotational stiffness should be assisted by testing. The paper focuses on experimental verification of torsional restraint given to steel purlins of thin-walled cold-formed cross-sections by sandwich panels under uplift load. As the test setup for verification of torsional restraint provided to metal members by planar members according to the actual standard for design of steel structures does not cover the influence of external load applied on the surface of the panels, a special test setup taking the external load into account had to be used. The paper describes the specimens, the test setup and the procedure of testing and summarizes selected relevant results of the series of performed tests.

Key words: Buckling; experiment; sandwich panel; stabilization; thin-walled beam.

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Influence of the chalcedony on the properties of autoclaved aerated concrete

Sylwia Kapala *, Ryszard Dachowski

Kielce University of Technology, al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland

ABSTRACT

Autoclaved aerated concrete (ACC) is one of the commonly used materials in Europe due to utility value and the high economic efficiency of preparation being. In spite of the undeniable advantages of autoclaved aerated concrete new improvements are being searched for due to the controversy over its properties. One of the measures to improve the ACC fundamental properties (increased compressive strength and reduced water absorption) is to modify its composition. The paper presents the effect of chalcedony on the microstructure and physical and mechanical properties of the autoclaved aerated concrete products. The modified product was subjected to microstructural analysis and to the tests for bulk density, water absorption and compressive strength. The results presented here are from evaluative experiments which will be continued in the next stage due to observed improvement, albeit a slight one, of the AAC primary parameters.

Key words: Autoclaved aerated concrete; chalcedony; microstructure; modification.

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Experimental investigation of the effects of four anti-slide particles on the operational performance of coated coloured pavement

Feng Liu ^{1,2}, Dechao Qu ², Zhicheng Tan ², Changxi Yang ², Yang Liu ^{*2}

¹ JiNan Urban Construction Group, Shandong, China

² Harbin Institute of Technology, School of Transportation Science and Engineering, Harbin, China

ABSTRACT

Four anti-slide particles, quartz sand, coloured sand, ceramic particle, and bauxite particle were investigated aiming at their effects on the operational performance of coated coloured pavement. First, the basic physical and mechanical properties of the four particles were compared and analysed. Second, the effects of the particle kind, specific surface area, and angularity on the operational performance of coated coloured pavement were assessed by simulating pavement with rutting specimens. Finally, the effects of the four anti-slide particles on the slip resistance and wear resistance of coated coloured pavement were analysed. Moreover, based on the results of testing investigation, practical engineering application of anti-slide particles in coated coloured pavement has been realized and promoted.

Key words: Coated coloured pavement; anti-slide particle; friction coefficient; texture depth.

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Experimental investigation of the variation of concrete pores under the action of freeze-thaw cycles by using X-ray CT

Jie Yuan ¹, Yang Liu ^{*1}, Hangxia Li ², Changxi Yang ¹

¹ Harbin Institute of Technology, Harbin, School of Transportation Science and Engineering, China, 150090

² Shandong Medical College, Department of Medical Imaging, Jinan, China

ABSTRACT

The variation of concrete pores under the action of freeze-thaw cycles was investigated experimentally by using the X-ray CT. Firstly, the statistical characteristics of concrete pores of testing specimens were obtained by the X-ray image analysis. Secondly, the variation of porosity and pore volume of concrete were analysed and discussed through the comparison with the above characteristics. Thirdly, the failure process of the concrete specimens under the freeze-thaw cycles was investigated by scanning the interior structure of concrete specimens. The results showed that there was no big variation of both the amounts and volume of concrete pores that were located at the interval [0.5mm³, 20mm³], while huge change was found out during the process of experiment for pores in other intervals. The severity of damages caused by the repeated freezing and thawing actions gradually ranged from surface spalling to completed disintegration of the interior concrete specimens after 30 freeze-thaw cycles.

Key words: Concrete; pore; freeze-thaw cycles; X-ray CT.

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Technical solutions for the modernization of low traffic roads

Paul Marc *, Ciprian Costescu, Alin Buzuriu, Anda Belc

University of Politehnic Timișoara, Faculty of Civil Engineering, Timișoara, Romania

ABSTRACT

Romania witnesses fully the modernization of low traffic public roads which include not only most of the rural streets and rural roads, but also some urban streets and county roads. To this purpose, specialists are asked to take into account the present road dowry (from completely non-arranged dirt roads, to roads on which road layers in different granular materials are up to 40...50 cm thick), the type of the foundation ground (generally cohesive soils whose real bearing capacity requires a capping layer), the low road traffic (the calculation traffic generally bellow 0.3 million 115 kN standard axles, but heterogeneous and sometimes including busses, lorries, etc.), the weather and hydrological regime (the presence of underground waters and frost susceptible soils in the road bed implies checking for freezing-thawing, which usually leads to the requirement of having the frost susceptible ground at depths lower than 50...60 cm from the road surface), the technical-economic and environmental conditions of the area, etc. Based on the authors' designing experience and the research they performed, the paper proposes technical solutions to treat the road bed and realize the resistance structures for low traffic roads, taking into consideration the road dowry. The proposed road structures, calculated according to the Romanian standard method aim at obtaining a good adaptation to the heterogeneous traffic to be supported, the full use of local materials and a constant and uniform bearing capacity at the level of the road bed.

Key words: Road pavement; capping layer; foundation ground; low traffic; bearing capacity.

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Industry and community in Anina (Romania)

Dinu Dan Razvan *

Politechnic University of Timisoara, Faculty of Architecture and City Planning, Str. Traian Lalescu Nr. 2/A, Timisoara, Romania

ABSTRACT

After the industrial “Big-Bang”, we can see only the devastating effects of a post-industrial “Big-Crunch”. The problems of the post-industrial cities are (with some differences like the geographical region, local culture, and the typology of the industry), universal and fundamental. We shall try to analyse what were the variable and invariable factors in the industrial society and how the dual industry-community system did worked, taking the mining city of Anina, from Romania as a case study. The more complex a system is, the more vulnerable it gets. Anina formed as a result of man's desire to effectively exploit nature. Extraction of the precious coal from underground created in successive stages certain needs and also imposed a model for generating the mono-industrial city. The locations of the mineral deposits, the regional infrastructure and the topography of the terrain were the physical invariants which all future urban developments were based on. However, the development of technology, the needs of the global market, the available workforce and the new syndicates were strong influences in the way mining assemblies were built. Industry represented the generative force of the city, and was also the skeleton on which the community was founded on. People represented the living component of the mineral universe of what later became a city of continuous technological evolution. Anina, a small city at the middle of the 19th century (about 2000 inhabitants) was under the effects of a demographical explosion over a few decades. After people found out about the valuable coal deposits, they started coming to the city. By 1912 there were 15000 inhabitants. Such a big surplus of people gave birth to the workers colonies. They represented an adequate model for managing the complex problems that appeared as a result of the constant demographical increase. What are the characteristics of the building assemblies, the advantages and disadvantages that came with them, how did they adapt to the evolving community and what were the effects on the long term in Anina are just a few of the questions raised in this study. Although their apparition meant an increase in the industrial exploitation, the hard working conditions generated the emergence of professional organizations, the unions. The community was starting to come together and to search for methods of protecting their civil rights. Improving living conditions was necessary to ensure a workforce of a certain quality and to create a sustainable relationship within the whole. The system was evolving towards a hard to reach balance. One can notice a strong relationship of interdependence between the community and industry, however, industry always had the upper hand. Its disappearance was devastating to the industrial community, which in most cases failed to recover. The contrast between the industrial model and the human expectation is still being felt in the post-industrial age. The industrial heritage, now in ruins, closely reflects the image of a shattered community, disfigured by the exodus of inhabitants left without a choice. The issue still persists. It is universal and requires global, flexible solutions.

Key words: Industrial landscape; post-industrial age; Anina; community.

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Landfill leachate as an additive properties of lime-sand products

Ryszard Dachowski *, M. Nowek

Politechnika Świętokrzyska, Wydział Budownictwa, Al. 1000-lecia PP 7, 22-314 Kielce, Poland

ABSTRACT

Sand-lime commodities are ecological products. They are produced from natural raw materials: lime, sand and water. Sand-lime bricks meet ecological requirements both at the production stage and operation. In the process of autoclaving the lime is combined with the silica and produce insoluble calcium silicates. Through this process the bricks and silicate blocks are characterized by high strength and durability. In modern construction, great importance are the environmental aspects. Therefore, attention should be paid to the possibility of the production of silicate from waste materials. This article aims to explore the possibility of use as a modifier, leachate from environmental landfills, i.e. inert waste, which are not subject to specific physical, chemical or biological alternations. In order to carry out laboratory tests of modified sand-lime products, were prepared rectangular samples with dimensions of 40x40x160mm. Samples were manufactured in the Department of Silicate Production. The sand is mixed with burnt lime and water in appropriate proportions. Approximately 90% of the weight of the product of sand, limestone is about 7% and about 3% water. In the reactors, a process of slaking weight. When exposed to water the lime is converted to slaked lime, as a result of elevated temperature derived from the reaction of lime slaking an alkaline environment and the surface of sand grains loses its crystalline structure. Grains obtained in this way, the proper form for the further conversion of the silicate in the later stages of the production process. The essence of the research was to replace the water by leachate. Placed in trigeminal moulds, silicate mass was pressed under a pressure of 20 MPa and then moved to the autoclave. There, during the several hours of hydrothermal treatment at a temperature of 203 °C and a pressure of 1.6 MPa, there was a range of physico-chemical processes. Samples after moulds removal were stored for 21 days within appropriate conditions of temperature and humidity at the room. The article presents the effect of the addition in the form of leachate to environmental properties of modified sand-lime products and their microstructure. Samples were made with about 3% of the leachate, and a sample in which the composition was the leachate and admixture, and the admixture itself. In order to verify the effect of the various modifiers it was prepared as a sample of a conventional sand-lime brick. Test results obtained in bulk density of the materials, show that modifiers do not significantly affect the characteristic of the analysed material. Analysing the results of the compressive strength of modified sand-lime products can be seen a significant impact of used modifiers. Compressive strength of sample from environmental leachate has increased by about 7%. Environmental effluent in combination with an admixture showed a compressive strength of silicate similar to a conventional product. In contrast, the same admixture increase the compressive strength by about 20%. Microstructure analysis of test samples modified sand-lime products under scanning by electron microscope showed presence of phases C-S-H, tobermorite and ksonotlite, in samples with the addition of leachate and admixture. XRD study of traditional silicate sample, revealed the presence of quartz and tobermorite or other calcium silicate. Summing up studies can be concluded that addition of environmental leachate already in small quantities results in an improvement of performance of sand-lime products.

Key words: Sand-lime products; leachate; microstructure.

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Impact of the orientation of the test direction with respect to the annual growth rings of pine and fir wood on the results of non-destructive tests

Justyna Jaskowska-Lemańska *, Daniel Wałach

AGH University of Science and Technology, al.Mickiewicza 30, 30-059 Cracow, Poland

ABSTRACT

Wood maintains remarkable durability under optimum conditions. However, it erodes faster than other construction materials in the circumstances of average usage of civil structures. Therefore built features made of wood, especially historical features and structures, require repairs and reinforcements more frequently than those made of other materials. Non-destructive testing is usually carried out in structures that are currently in use and is aimed at early detection of failures and taking appropriate remedial measures. It can be generally assumed that diagnostic testing of wood is a difficult process due to its structure. However, the ability to identify the current strength parameters of wooden structural components makes it possible to properly assess their suitability for further use and design appropriate reinforcement and reconstruction methods. However, it should be borne in mind that non-destructive test results are influenced by factors such as: the type of wood, its defects, moisture content, age and the direction of test in relation to annual growth rings as well as microbial agents. This paper addresses the evaluation of the mechanical properties of pine wood and fir wood under testing perpendicular, vertical and diagonal to the annual growth rings. This paper presents problems related to direction of test content on the results of non-destructive testing (sclerometer, ultrasonic tests and cutting resistance measurements). Based on the survey found the orientation of the test direction with respect to the annual growth rings must be taken into account in the course of the analysis using non-destructive methods.

Key words: Pine wood; fir wood; non-destructive testing; relation to annual growth rings.

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Analysis of family structure influence on modal split for different trip purposes

Arash Rasaizadi ^{*1}, Moein Askari ², Seyedehsan Seyedabrishami ³

¹ Sharif University of Technology, Transportation Planning and Engineering, Tehran, Iran

² K. N. Toosi University of Technology, Tehran, Iran

³ Tarbiat Modares University, Faculty of Civil and Environmental Engineering, Tehran, Iran

ABSTRACT

The travel demand models are very influential on transportation future planning. Different variables including individual, family and zonal characteristics use to construct effective demand forecasting models. This paper focused on one of the four-step demand model, trip mode choice, to investigate how family structure variables such as household size, family members' jobs, ages and etc. Influence on trip mode choice. In previous studies researchers use household size, number of children and number of employees in their models. These variables can't discriminate between different families with different structure so we need to use another variable. This paper used life cycle concept to describe family structure better and more accurate. By using this concept, we can introduce some dummy variables that can be effective in model estimation process to depict family effects on mode choice model. For family structure, we consider 5 types of families that difference between them are based on age of their children. Based on literature, we use Multinomial Logit model that is a widespread in predicting this stage for each purposes. We use three different algorithms (Simulated Annealing algorithm, Nelder Mead algorithm and Broyden-Fletcher-Goldfarb-Shanno algorithm) for models calibration in R-Studio program. The appropriate mode choice model has been developed using trip dairy real data in one of the populated city in Iran for different trip purposes. Some of the most important results that achieved was more important role of family structure (life cycle) in mode choice than house hold size in work, educational, personal, and social- recreational trip purposes.

Key words: Life cycle; trip split stage; multinomial logit; family structure.

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Effect of electric boosting method on early age mechanical strength of shale-slag constructional binder

David Rieger *, Oldřich Kroupa, Tomáš Kovářik, Petr Franče

University of West Bohemia, New technologies - Research Centre, Univerzitni 8, 306 14 Pilsen, Czech Republic

ABSTRACT

This paper deals with a novel procedure for hardening of inorganic geopolymeric binders. This class of binders is intensively studied and methods how to control and increase of hardening rate are in aim of interest. The curing at elevated temperatures is accepted approach to fast hardening and is mainly applied in the range of temperatures 40-100 °C. This approach is mostly realized in dry ovens and also by applying of elevated pressure in autoclaves. However, it should be pointed out that this approach has significant disadvantage in presence of thermal inertia which consists in volumetric heat capacity and heat conductivity of used moulds. Certainly, these properties limit the heating rate of cured products. We are presenting approach where heat is released directly in bulk volume of binder by presence of alternating electric current as a result of charge carrier's transfer. As a model binder the mixture of shale dust and milled blast furnace slag was tested. This mixture exhibited good quality of binding properties for construction components in civil engineering and was alkali-activated by sodium silicate solution with silicate module of 1.71. This process was realized in moulds with dimensions of 20x20x125 mm and heating current at frequency of 50 Hz was applied via graphite electrodes. The regulation of heating power was realized by regulation of supply voltage. The heat treatments were carried out at temperature 80 °C for 1 hour. Subsequently, flexural and compression strength was determined in time interval from 6 to 672 hours. Prepared specimens were measuring and results were compared with specimens cured for the same time at ambient temperature. Findings indicate that specimens cured by electric heating are after 6 hours four times stronger but at the end of investigated time period are slightly outperformed by specimens cured at ambient temperature. The rheological measurement of hardening rates at ambient and elevated temperature were performed for completion by the strain controlled small amplitude oscillatory rheometry in plane-plate geometry with applied strain of 0.01 % to maintain binder structure uninterrupted.

Key words: Binder, hardening, electric heating, mechanical strength, alkali-activation, rheometry.

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Influence of metakaolin substitution by slag in alkali-activated inorganic binders for civil engineering

David Rieger *, Tomáš Kovářík, Oldřich Kropupa, Pavel Novotný

University of West Bohemia, New technologies - Research Centre, Univerzitni 8, 306 14 Pilsen, Czech Republic

ABSTRACT

In this study the effect of metakaolin replacement by milled blast furnace slag in alkali-activated geopolymeric binder was investigated in accordance to their rheological and mechanical properties. It was demonstrated that slag addition into the metakaolin binder can improve mechanical properties of final products. Our investigation was focused on broad interval of metakaolin substitution in the range from 100 to 40 volume per cents of metakaolin so that the volume content of solids in final binder was maintained constant. Prepared binders were activated by alkaline solution of potassium silicate with silicate module of 1.61. The particle size analyses were performed for determination of particle size effect on rheological properties. The rheological properties were determined in accordance to flow properties by measurements on Ford viscosity cup and by oscillatory measurements of hardening process. For the investigation of hardening process, the strain controlled small amplitude oscillatory rheometry was used in plane-plate geometry with applied strain of 0.01 %. This very low strain maintains binder inner structure uninterrupted in the course of measurements. The reproducibility and versatility of this method is demonstrated for determination of hardening process evolution by observation of changes in shear modulus and loss tangent. All measurements were performed by isothermal heating at 30 °C for comparability of results. For determination of applied mechanical properties were binders filled by ceramic grog in the granularity range 0-1 mm. The filling was maintained constant at 275 volume per cents in accordance to ratio of solids in dry binder. Subsequently, the mechanical properties were investigated after 1, 7 and 28 days and microstructure was documented by optical and scanning electron microscopy. The results indicate that slag addition have beneficial effect not only on mechanical properties of hardened binder but also on flow properties of fresh geopolymer paste and subsequent hardening kinetics of alkali-activated binders.

Key words: Geopolymer; metakaolin; slag; rheometry; mechanical properties.

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Comparison of final report of acceptance with actual level of defects in newly build flats

Sebastian Dubas *, Piotr Nowotarski

Poznan University of Technology, Instytut Konstrukcji Budowlanych, ul. Piotrowo 5, 60-965 Poznań, Poland

ABSTRACT

Every year in Eastern Europe, especially in Poland, thousands of flats and apartments are ready to move-in. Owners of properties are usually obliged by contract to perform a reception of an apartment from the developer. An execution of this acceptance is governed by contractual arrangements between a contractor and a user of the premises, so that the parties know the circumstances under which such a reception should be made. The article presents basic principles in reporting acceptance of flats, basing on existing legislation. Approach shown in the article is presented from a perspective of reception done with participation of external expert – construction professional, usually invited on behalf of the future owner. The authors for the purpose of this article analysed selected acceptances of flats. An amount of faults reported in protocols of final acceptance and their actual level revealed during reception were taken into the account. Thanks to an access to the records of experts, after comparing protocols and disclosed defects, authors were able to determine that during the execution of acceptance, significantly more defects are detected than finally put into the official protocol. The authors analysed those defects that most frequently were not entered in the protocols along with a brief summary of possible causes of the prevalence of such situations, using one of the methods of Lean Management connected with root cause analysis - 5 whys. In the course of the study it has been determined that, in general, the number of defects in the protocols may be much lower than in reality. This level decreases even more in special cases related to personal dependencies of developer, its representatives and future owners of flat. It is worth mentioning that situation in which no or little defects are shown in report is very favourable for developers who may take it as their advantages over competition, resulting in misleading potential future customers and owners.

Key words: Housing acceptances; housing report of acceptance; apartment defects; Lean Management; 5 Whys.

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Landfill leachate as an additive in sand-lime products

Ryszard Dachowski, Milena Nowek *

Kielce University of Technology, al. 1000-lecia PP 7, 25-314 Kielce, Poland

ABSTRACT

Sand-lime blocks are ecological products. They are produced from natural raw materials: lime, sand and water. Sand-lime elements (also known as silicates) meet ecological requirements both at the production and operation stage. In the process of autoclaving lime is combined with silica and produce insoluble calcium silicates. Thanks to this process silicate bricks and blocks are characterized by high strength and durability. Environmental aspects are of great importance in modern construction. Therefore, attention should be paid to the possibility of the production of silicates from waste materials. This article aims to investigate the possibility of use leachate from environmental landfills (inert waste, which are not subject to specific physical, chemical or biological alternations) as a modifier of sand-lime products properties. In order to carry out laboratory tests of modified sand-lime products, rectangular samples with dimensions of 40x40x160 mm were prepared. Samples were manufactured in the Silicates Production Plant. The sand is mixed with quick lime and water in appropriate proportions. Approximately 90% of the weight of the product is sand, limestone is about 7% and about 3% constitutes water. In the reactors, a process of lime slaking takes place. When exposed to water quick lime is converted to slaked lime, as a result of elevated temperature derived from the reaction of lime slaking an alkaline environment, the surface of sand grains loses its crystalline structure. Grains obtained in this way, have the proper form for the further conversion. The essence of the research was to replace the water by leachate. Placed in trigeminal molds, silicate mass was pressed under a pressure of 20 MPa and then moved to the autoclave and cured at a temperature of 203°C and under a pressure of 1.6 MPa. The article presents the effect of the addition of leachate and water resisting admixture on the properties of modified sand-lime products and their microstructure. In order to verify the effect of the various modifiers a sample of traditional sand-lime product was also prepared. Analysing the results of the compressive strength of modified sand-lime products certain impact of used modifiers was observed. The compressive strength of the sample with environmental leachate was slightly increased. Leachate in combination with an admixture showed a compressive strength of silicate similar to a conventional product. In contrast, using only admixture increased the compressive strength of the product. Microstructure analysis of modified sand-lime products under a scanning electron microscope showed the presence of C-S-H phase, tobermorite and xonotlite, in samples with the addition of leachate and admixture. XRD study of traditional silicate sample revealed the presence of quartz and tobermorite or other calcium silicate. Summing up studies it can be concluded that the addition of the environmental leachate already in small quantities results in an improvement of the performance of sand-lime products.

Key words: Sand-lime products; leachate; microstructure.

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Determination of microstructure and phase composition of sand-lime brick after autoclaving process

Katarzyna Komisarczyk *

Kielce University of Technology, Kielce, Poland

ABSTRACT

The mass on the sand-lime products consists of fully organic components: silica sand, quicklime and water. Depending on the proportions of ingredients used, admixtures and additives, the degree of fragmentation of the sand, and autoclaving temperatures can create different hydrated calcium silicates structured. In autoclaved sand-lime products mostly can be found: C-S-H (I), C-S-H (II), 11A tobermorite, xonotlite and C2SH (A). Often occurring in the materials that are the subject of this paper and the most perfect form of C-S-H phase is tobermorite. Tobermorite may have two forms. Observed under a scanning electron microscope shows a cross-section in the form of blades. It may also be similar to honeycomb or form well shaped spherical aggregations. Using a scanning electron microscope described the internal structure of "white brick". While the phase composition was examined by X-ray diffractometry. Pore size distribution using the most universal and most common method of analysis of the porosity of building materials – Mercury Intrusion Porosimetry. The study in addition to the standard components used in lithium water glass. Three series of samples in the parallelepipeds shape with dimensions 40 x 40 x 160 [mm]. The study standard sample, with the content of 0.5% and 5.0% additives was made in the lab Kielce University of Technology.

Key words: Sand-lime brick; autoclaving process; microstructure.

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Stabilization of expansive soft clay soil by using waste aluminium beverage cans

Hanifi Canakci, Media Omar Ali, Fatih Celik *

Gaziantep University, Department of Civil Engineering, Gaziantep, Turkey

ABSTRACT

This study presents the effectiveness of mixing the reuse aluminium (beverage cans) waste materials with lean clay soil on the soil's physical properties was discussed. The mixing material that is used improves the engineering characteristics of expansive soft clay soils. Different percentages of aluminium by dry weight of soil, ranging from 2% to 10% in increments of 2%, were used to improving the property of this expansive soil. Physical and mechanical testing was carried out according to applicable ASTM and AASHTO testing methods. The soils and the admixtures of aluminium were examined in the laboratory to find the enhancements in the swelling behaviour, optimum moisture content, and corresponding maximum dry density. The result showed that when the percentage of the admixture increases it is found that the bearing capacity and dry density increased, and decreases the swelling and the optimum moisture content.

Key words: Lean clay; swelling; beverage cans; waste materials; soil stabilisation.

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Clay soil stabilization with waste soda lime glass powder

Hanifi Canakci, Aram Kamal Al-Kaki, Fatih Celik *

Gaziantep University, Department of Civil Engineering, Gaziantep, Turkey

ABSTRACT

This study investigates the effects of soda-lime waste glass powder on: maximum dry density, liquid limit, plastic limit, plasticity index, unconfined compressive strength of clay soil. In this study, a clayey type soil has been selected because it has some problems. The principal problem with the chosen clayey type soil is that of swelling and strength. Glass dust was chosen to check the improvement because it is a cohesion less material. The soda-lime waste glass powder ratio used in the present study was a 3%, 6%, 9% and 12% dry weight of the clayey soil. To find the type of soil grain size, analysis and specific gravity tests were performed. The main results show that the increase of additives lead to apparent reductions in optimum moisture content, liquid limit, plastic limit, plasticity index as well as an increase in maximum dry density.

Key words: Clay; soda lime glass powder; waste materials; soil stabilisation.

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Improvement of the strength of Ankara clay with self-cementing high alkaline fly ash

Adil Binal *, Bertan Bas, Rustu Orkun Karamut

Hacettepe University, Department of Geological Engineering, 06800 Beytepe, Ankara, Turkey

ABSTRACT

Turkey's plants are fired by lignite, producing class C fly ash containing a high percentage of lime. Sulphate and alkali levels are also higher in class C fly ashes. Therefore, fly ash is, commonly, unsuitable as an additive in cement or concrete in Turkey. In this study, highly alkaline fly ash obtained from the Yeniköy thermal power plants is combined with soil samples in different proportions (5%, 15% and 25%) and changes in the geomechanical properties of Ankara clay were investigated. The effect of curing time on the physicommechanical properties of the fly ash mixed soil samples was also analysed. Free swelling index values showed a decrease of 92.6%. The California bearing ratio has seen a more drastic increase in value (68.7 times for 25% fly ash mix).

Key words: Fly ash; Ankara clay; cohesion; internal friction angle; California Bearing Ratio.

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Behaviour and geomechanical properties of residual soils in Karataş vicinity (Manisa, Turkey)

Adil Binal *, Ebru Paksu, Naz Cansu Çelik

Hacettepe University, Department of Geological Engineering, 06800 Beytepe, Ankara, Turkey

ABSTRACT

In this study, geomechanical properties of residual soil derived from basaltic lava were investigated for determining the bearing capacity of ground of new buildings that will be built in the Kula-Geopark area next year. In the region called Karatas locality, soil samplings from different locations were carried out. Natural moisture content, density, particle size distribution, Atterberg limits, direct shear and consolidation tests of soil samples were performed. The natural moisture content of soil samples was determined by an average value of 4.5% and an average natural density of 2.08. Overall, soil samples are defined as "Silty Sand" according to the unified soil classification. Consolidation Index value (Cc) and coefficient of volume compressibility (mv) were calculated as 0.30 and 0.987 m²/MN. Cohesion values of the residual soil (c) changes between 5 and 11 kPa, and internal friction angle values vary between 34° and 39°. These local variations in geomechanical properties are specific for residual soil.

Key words: Residual soil; geomechanical properties; consolidation test; cohesion; internal friction angle.

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**Evaluation of shear strength properties of Modified Expanded Polystyrene (MEPS)
comparing with sand**

Hanifi Canakci, Dilek Alak, Fatih Celik *

Gaziantep University, Department of Civil Engineering, Gaziantep, Turkey

ABSTRACT

The paper presents the results of the study which influence the use of recycled waste expanded polystyrene foams (EPS), as a lightweight material used with river sand. In this study, thermally modified waste EPS have been used. The waste EPS were put in an oven at 130 °C through 15 min to obtain modified expanded polystyrene (MEPS). The influences of MEPS on shear strength properties such as cohesion and internal friction angle were investigated. For this purpose, 12 series of Direct Shear tests were carried out. MEPS and sand were prepared at same gradation curve and were mixed with each other at substitution of 2, 4, 6, 8 and 10 % by weight for loose and dense cases. The test results showed that MEPS has a similar behaviour comparing with the shear strength of the sand at same gradation. MEPS can be an alternative light weight fill material for geotechnical applications.

Key words: Sand; modified EPS; shear strength; waste materials; soil stabilisation.

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Effects of fibre-reinforcement on liquefaction behaviour of poorly graded medium dense sands

Tugba Eskisar *¹, Eyyub Karakan ², Selim Altun ¹

¹ Ege University, Department of Civi Engineering, 35100, Bornova, Izmir, Turkey

² Kilis 7 Aralık University, Faculty of Engineering and Architecture, 79000, Kilis, Turkey

ABSTRACT

Cyclic dynamic effects, acting on saturated sands have been the cause of most geotechnical problems due to triggering of liquefaction. Development of excess pore water pressure in the soil medium results in a liquid-like behaviour and in the end hazards become unavoidable. If the site is not well improved against liquefaction economical loss may become a major concern. The behaviour of dense sand is important to evaluate the success of ground improvement. In recent years, using recycled materials such as polypropylene fibres as soil reinforcement has gained popularity as it provides low cost and environmentally friendly solutions. Reinforcing sand soils with fibres could be a good solution among other ground improvement techniques in a liquefaction susceptible area. The objective of this study is to evaluate the liquefaction behaviour of fibre reinforced sand concerning the lower and upper limits of medium relative densities of 50% and 70%, respectively. A systematic testing program of stress-controlled cyclic triaxial tests was performed on saturated sand samples with and without fibre reinforcements under undrained conditions. The confining pressure for all test cases were 100kPa reflecting the actual overburden pressure in field conditions. The effect of parameters such as fibre content (0.25%, 0.50%, and 1%) and fibre length (6mm and 12mm) on the liquefaction behaviour of unreinforced and reinforced specimens was studied. Upon increasing the fibre content and fibre length, the number of loading cycles leading to liquefaction increased. Pore water pressure and shear strain curves are obtained for the fibre reinforced medium dense sands. Furthermore, the boundaries presented in the literature on the sands are shown in comparison with the results of fir reinforced sands of this study. As a conclusion, the outcomes of this study are useful to develop insight into the behaviour of clean and fibre-reinforced medium dense sands under seismic loading conditions. Based on the test results, it was found that the number of loading cycles has significant influence on the generation of excess pore pressure.

Key words: Medium dense sand; liquefaction; pore water pressure; cyclic stress testing.

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Prediction of linear objects deformation caused by underground mining exploitation

Andrzej Kwinta *1, Pelagia Gawronek

University of Agriculture, Faculty of Environmental Engineering and Land Surveying, Department of Land Surveying,
Balicka 253A, 30-198 Krakow, Poland

ABSTRACT

Underground mining activities may have a negative impact on the surface of the terrain and buildings located on it. Mining exploitation causes cavities in the rock mass that generate deformations and displacements on the surface. Calculation of indicators of deformations is carried out at the design stage of mining exploitation or engineering objects. Calculation of the expected deformations is computed to determine the extent of the impact of the exploitation on facilities, and, in consequence, to prevent from property damage. For existing engineering structures mining exploitation can be shaped in order to minimize its negative effects. For newly designed objects the protection against mining damage can be introduced during designing. It is also possible to try to perform mining exploitation before the construction of the object. In mining areas there are often regions heavily urbanized and industrialized (for example: the Upper Silesia, the Ruhr, and the Ostrava-Karvina Area). In these areas there is located a lot of technical infrastructure facilities. A lot of these objects is characterized by an elongated shape. For this type of objects (pipelines, roads, railways, power lines) predictions of deformation are made, keeping in mind the safety of their functioning. The significance of determined indexes of deformations can vary for different types of linear objects. For some objects longitudinal indicators of deformation are important, and for other objects the lateral ones. Strains are dangerous for pipelines transporting various media. For the sewerage system subsidence and slopes are dangerous. For railways and roads indicators of deformations such as slopes, curvatures and strains are important. Slopes are especially important for power lines. The paper presents the various aspects of forecasting deformations for different types of linear objects. It presents also the methodology of forecasting deformations. The calculation model of deformation used in Polish mining is shortly characterized. Deformations and displacements in Poland are generally determined with Budryk-Knothe's geometric-integral theory. In the paper there is discussed the characteristics of forecasting deformation for different types of linear objects. The publication presents also various examples of elongated engineering facilities, for which indexes of deformations were set.

Key words: Influence mining exploitation; deformation prediction; utility networks deformation.

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Effect of void ratio and mean effective stress on small strain shear modulus G_{max} for cohesionless soils

Jakub Panuška *, Jana Frankovská

Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Department of Geotechnics, Radlinského 11, 810 05, Slovakia

ABSTRACT

This article discusses about small strain shear modulus G_{max} and shear wave velocity v_s of cohesionless soils depending on its state parameters such as mean effective stress p' and void ratio e . Bender elements installed in triaxial apparatus were used as a technique for measuring small strain properties of tested soil. G_{max} and v_s are basic parameters for evaluation of soil response due to seismic/dynamic loading, for description of non-linear behaviour of soil in wide range of strains but also in present time design of shallow foundations (settlement, load bearing capacity) is discussed. Review of this topic is made with already published empirical equations for G_{max} and with description of bender element measurement technique and its evaluation. Danube river sand from Győr locality was chosen for testing. This sand material is also tested at Széchenyi István University, Győr on the resonant column testing device. General description of material is made and compared with tested materials in reviewed literature. Time domain technique was used for the evaluation of the tests. Different input signals and frequencies were used. Samples were tested under triaxial state of stress or under vacuum respectively. Results are compared with empirical equations proposed in reviewed literature and also with results obtained by different testing instruments. Some issues about testing method and sample preparation observed during testing are discussed. Type of input signal, frequency of input signal, evaluation method and measurement discrepancies are analysed. Finally authors make conclusions from current research in this field. Effect of state parameters on G_{max} and then thus on v_s are confirmed.

Key words: Bender elements; shear wave velocity; void ratio; small strain.

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Modelling the deformation of a MSW landfill based on tests

Tibor Firgi *, Gábor Telekes

Szent István University, Ybl Miklós Faculty of Architecture and Civil Engineering, 1146 Budapest, Hungary

ABSTRACT

In Hungary significant proportion of the solid waste is get into landfills. In the future we will have to find more modern methods to waste treatment, but these landfills will work for a long time. It is necessary to prepare for the recultivation or possible utilization of the area of these landfills. To solve these tasks we have to know the physical, biological and chemical characteristics on the one hand, and we have to search for law of material and possibility for modelling to estimate and forecast the probable subsidence of the surface on the other hand. To solve the task we had recourse to modelling which is one of the general methods of engineering. We chose the soil mechanical model from rheological, biodegradational, empirical, etc. model. The municipal waste can be examined by the help of the repertoire of mechanics (e.g. tools for examination, theories) since waste can be considered "grainy" material. We were looking for the simplest one from the approximately exact theories, modelling and examinations since it is the most favourable from practical point of view. The municipal landfill examined is the Regional Waste Management Centre in Pusztazámor, which is one of the biggest landfills in Hungary and it has been working for 15 years. The basic area of the hill which filled up with waste is 400 x 400 m and its height is 50 m. We took out 22 samples from four boring holes, and created average samples. The samples were put in categories according to degradation phase and the shear strength parameters were determined in the Technique University Budapest. These data were used for our calculations of the settlement of the landfill hill. A bigger size oedometer was developed for the experiment, because the waste contained bigger "grains" and two pressure-gauge was built in the side-wall of the box. Considering the results of the in situ subsidence measuring, the calculation model was corrected and validated. We used Plaxis 2D FEM program for modelling. We applied models MC, HS and SSC then we validated and controlled it. We found that model SSC describes reality with the accuracy expectable, when we built up the model layer by layer according to degradation phase in the time. We are able to estimate well the settlement of a municipal landfill applying the soil mechanical model.

Key words: MSW landfill; deformation; oedometric test; FEM modelling.

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Response of flexible box-shaped culverts under dynamic loading

Deniz Ulgen ^{*1}, M. Rifat Kahyaoglu ¹, M. Yener Ozkan ²

¹ Mugla Sitki Koçman University, Faculty of Engineering, Department of Civil Engineering, 48100 Mugla, Turkey

² Middle East Technical University, Faculty of Engineering, Department of Civil Engineering, 06800 Ankara, Turkey

ABSTRACT

Large earthquakes such as 1995 Kobe, Japan, 1999 Kocaeli, Turkey and 1999 Chi Chi, Taiwan caused severe damage to the underground facilities and resulted in social disruption and economic losses. These economic and social consequences increased the importance of seismic design of underground facilities. There are basically two main methodologies to assess the seismic performance of underground structures, namely deformation-based approach and forced-based approach. Deformation-based approaches are usually preferred by earthquake engineers to assess the dynamic performance of buried structures using the simplified frame analyses. Due to the challenge of estimating dynamic soil pressures acting on the underground structure, there is not any established forced-based methodology. This study aims to fill this gap and contribute to the existing literature by providing new perspectives on forced-based preliminary assessment of buried structures. For this purpose, shaking table tests were conducted to examine the dynamic soil pressures acting on the box-shaped culverts buried in dry sand. In the study, first, a laminar container was designed and manufactured to provide free-field boundary conditions of shaking table system. Next, flexible culvert models were tested under harmonic loading and dynamic earth pressures exerted on the models were measured. Furthermore, acceleration and shear strain response of soil at different elevations were obtained from accelerometer measurements. Consequently, a forced-based design approach was proposed to make a preliminary assessment of flexible culvert models subjected to dynamic loading. The method was validated with regard to the racking deformations obtained from centrifuge experiments. Results show that proposed approach can be used as a practical tool for engineers to make a preliminary seismic design of box-type culvert embedded in dry sand.

Key words: Flexible culvert; dynamic soil pressure; shaking table test; preliminary design.

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Settlement behaviour of column supported embankments

Mehmet Rifat Kahyaoglu *, Deniz Ulgen

Mugla Sitki Kocman University, Engineering Faculty, Civil Engineering Department, Turkey

ABSTRACT

The construction of column-supported embankments (CSEs) as a part of highways, railways and urban infrastructure on top of soft clay deposits has long been a challenge due to low bearing capacity, high compressibility and a lack of lateral resistance. To overcome these inconveniences, geosynthetics have been utilized as the preferred means of reinforcement and encasement, based on their ability to reduce vertical and lateral displacement. This paper presents two dimensional finite element model studies, simulating a geogrid-reinforced (GR) and geotextile-encased column (GEC) supported embankment on soft soil. The numerical analyses are performed to investigate the effect of geosynthetics on time dependent settlement behaviour of columns. The results reveal a significant decrease in settlement with encasement, which is thought to be a direct consequence of the additional confining pressure produced by the geotextile encasement. With the help of base reinforcement, the surface settlement values of the both soft soil and the column are also reduced significantly.

Key words: Geogrid reinforcement; geotextile; encasement; column-supported embankment; settlement; long term.

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Geosynthetics in coastal applications

Altuğ Saygılı *¹, Ezgi Seyfioğlu ², Mehmet Rifat Kahyaoglu ¹

¹ Muğla Sıtkı Koçman University, Engineering Faculty, Civil Engineering Department, Muğla, Turkey

² Muğla Sıtkı Koçman University, Yatağan Vocational High School, Muğla, Turkey

ABSTRACT

Geosynthetics are first used into civil engineering projects in the 1960's in drainage and separation applications. Geosynthetic usage has grown so rapidly that, nearly every civil engineering project includes geosynthetic applications nowadays. In recent years conventional techniques in coastal works and structures have become very expensive to construct and maintain. There is an increasing trend in developed and developing countries to use economic, environment friendly and novel construction materials and techniques. Scarcity and cost of obtaining natural materials in certain regions can also be another point to look for newer and environmentally acceptable materials and techniques. Geosynthetics are used for several purposes in geotechnical engineering applications such as, drainage, reinforcement, separation, filtration and containment. A brief overview of some traditional and alternative systems for shore stabilization and beach erosion control will be presented in this study. Special attention will be paid to geotubes, geobags, geomattresses and geocontainers filled with sand or mortar and geocurtains in this study. The applications of geosynthetics in such applications have increased their popularity in recent years. These applications can be easily placed and are cost effective. Geosynthetics in coastal applications are mostly used to rebuild beaches, protect properties, and create jetties and to build islands. However, geosynthetics applications in coastal projects have some advantages and disadvantages, which have to be recognized before application. The attention will be on describing the function of geosynthetic applications, discussing failure modes and risks and identifying geotechnical issues of stability. Usage of geotextiles in coastal applications has tested their performance in several projects and geotextiles have been validated as a durable and economic material in civil engineering projects.

Key words: Coastal geotechnics; climate change; shoreline erosion; geotextiles; geotubes.

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Compactness of scrap tyre rubber aggregates in standard Proctor test

Magdalena Kowalska *

Silesian University of Technology, Faculty of Civil Engineering, Department of Geotechnics and Roads, ul. Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

Scrap tyre derived aggregates (TDA) have been used in civil engineering since 1990-ties, mainly in the USA. The material may be used in various forms and sizes – from powder, through granulates, tyre shreds, chips. The TDA applications include: lightweight fills in embankments over soft soils, lightweight backfills behind retaining walls, insulation and drainage layers etc. In most of the works the material needs to be compacted to decrease the void ratio of the aggregate and reduce future settlement. This paper presents a study on compactness of four different fractions of scrap tyre rubber (A: 0.1 – 1 mm (powder), B: 0.5 – 2 mm, C: 2 – 5 mm and D: 10 – 40 mm (chips)) in the standard Proctor test. The results in the form of dependency of dry and bulk density on moisture content are compared also with adequate results obtained for a clean uniform medium sand. It turns out that the optimum moisture content can be clearly estimated only in the case of the finest fraction (sample A) and it is equal to about 45%. The variability of dry density is however small – it changes from 0.52 to 0.62 g/cm³. Coarser TDAs behave more like self-draining materials – the water does not adhere to the rubber grains and the maximum moisture content equals to about 18%, 23% and 35% in case of tyre chips, 2 – 5 mm grains and 0.5 – 2 mm grains respectively. The dry densities for samples B, C and D possible to be obtained with standard Proctor energy have been estimated as: 0.60, 0.59 and 0.58 g/cm³ respectively.

Key words: Scrap tyre rubber; Proctor test; compactness; self-draining materials.

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Seismic behaviour and vulnerability assessment of historic Soltaniyeh dome under earthquake

Kiarash Nasserjadi ^{*1}, Hossein Kalantari ², Saed Mohammadzadeh ², Seyyed Aliasghar Arjmandi ¹

¹ University of Zanjan, Department of Civil Engineering, Zanjan, Iran

² University of Zanjan, Structural Engineering, Zanjan, Iran

ABSTRACT

Most of historic buildings did not designed to withstand to an earthquake, and due to different reasons, such as aging and cumulative damage due to different loads such as small scale earthquakes, winds and environments, these building are vulnerable to earthquake. Experience of past earthquakes such as Bam which demolished the Arg-e-Bam, demonstrate that these structures needs special attentions. Seismic evaluation of these buildings encounters several difficulties such as: 1) existing of cracks in structures, 2) changes of the material due to several rehabilitation lifetime and 3) absent of clear structural systems for lateral loads. Soltaniyeh dome is the biggest brick domes in the world and listed in the UNESCO's sites and is one of the most important monumental buildings in Iran. In this paper, summary of numerical and experimental studied on seismic behavior and vulnerability study on this building presented. First, to identify the dynamic behavior of the buildings, the optimum placement of sensors on the complex structures was located by a modified optimum methodology. Second, the structural response was measured by placement of sensors and the dynamic property of buildings was identified. Third, the material property of different parts of builds are identified by destructive and non-destructive tests and the structure is modeled in ABAQUS, a general FEM software. The existing cracks in structure is considered in modeling. The results have shown that, significant cracks are created and grows around the openings of the first and second floors of building. In addition, significant damage may occur on most parts of dome's supports.

Key words: Soltaniye dome; seismic behaviour; earthquake vibrations; dynamic analysis.

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Development of a soil moisture analyser using IR heat and vacuum

Nihat Dipova *

Akdeniz University, Department of Civil Engineering, Antalya, Turkey

ABSTRACT

The water content of the soil, one of the basic soil characteristics, is defined as the ratio of water mass occurring in free spaces to the dry mass. Water exists in the soil in two forms including free water and adsorbed water. As drying methods are based on evaporation of free water in the sample by heat energy, soil samples are dried at 105 ± 5 ° C temperature. IR (infrared) heating by radiation is an alternative heating method. As rays emitted from the Sun's surface warm the Earth's surface, radiation emitted from infrared heaters warm the body as it slams. One of the areas that infrared heating are most commonly used is drying. Compared to the conventional convective drying it has some advantages such as, shortening of the drying time, to be an alternative sources of energy, to have a high energy efficiency, uniform dispersion of the temperature, ease of control and space saving. In this study; an instrument which allows the soil sample to fast-drying, and during drying, continuous record of the weight of soil has been developed. Evaporation of the soil moisture is provided by an infrared heater. To remove vapour and to increase efficiency, a vacuum has been applied. Drying should be done in environments where the air is drier than the object being dried, which encourages moisture to evaporate out. Under vacuum, advantage is taken of the fact that evaporation of water occurs more readily at lower pressures than at higher ones. A thermistor and a thermostat are used for temperature control. Mass change in the sample was measured by a load cell. Automatic control of system and computer data storage processes have been achieved with a single electronic development card. Soil samples have been prepared at different water contents. One part of soils has been tested with oven method, while the other half with the developed device. Results were compared and has been observed that the water content values are in good agreement. Drying in new device has been completed within 10-30 min.

Key words: Infrared; moisture content; soil drying; vacuum.

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Digital image analysis based determination of grain size distribution of gravels

Nihat Dipova ^{1*}, Altan Yılmaz ²

¹ Akdeniz University, Department of Civil Engineering, Antalya, Turkey

² Mehmet Akif Ersoy University, Department of Civil Engineering, Burdur, Turkey

ABSTRACT

The digital image processing technology includes, storing images of objects and processing with the computer for the specified purpose. Image analysis is expression of the images of objects numerically by means of mimicking the functioning of the human visual system and the generation of numerical data for the calculations which will be made after. Digital image analysis provides the capability for rapid measurement, which can be made in near real-time, for numerous engineering parameters of materials. Recently, image analysis is used in geotechnical engineering practices. Grain size distribution and grain shape are the most fundamental properties used to interpret the origin and behaviour of soils. Mechanical sieving has some limitations; it does not measure the axial dimension of a particle, particle shape is not taken into consideration, especially for elongated and flat particles a sieve analysis will not yield a reliable measure. In this study grain size distribution of gravels have been determined following image analysis techniques, using simple apparatus, non-professional cameras and open code software. The sample is put on a transparent plate which is illuminated with a white backlight. Digital images were acquired with a CCD DSLR camera. The segmentation of the particles is achieved by image thresholding, binary coding and particle labelling. The geometrical measurements of each particle are obtained by automated pixel counting technique. Image analysis based grain size distribution has been compared with sieve analysis distribution. Results show that grain size distribution of image based analysis and sieve analysis are in good agreement.

Key words: Image analysis; image processing; gravel, grain size.

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Static analysis of Mansa Devi Hill landslide

Saiful Islam *¹, Ibrahim Idrees Falqi ²

¹ King Khalid University, Department of Civil Engineering, Abha, Saudi Arabia

² King Khalid University, College of Engineering, Abha, Saudi Arabia

ABSTRACT

This paper investigates the static analysis of Mansa Devi hill landslide in order to assess stability of slopes using FLAC3D software. For modelling, digital elevation model has used in order to obtain co-ordinate data of the study area. The input parameters required for FLAC3D analysis such as unit weight, peak friction angle, peak cohesion, Poisson's ratio and Young's modulus have determined by appropriate geotechnical test in laboratory. The finite difference method would give us the displacements at various selected locations of the study area. As a result, it is evident that the maximum displacement of magnitude 94.57 cm occurs at the top of heel side of the study area.

Key words: Landslide; static analysis; geological hazard; disaster.

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Characterization of subsidence and collapse of subsoil in an urban area using seismic (MASW) and electrical resistivity tomography data (ERT)

Ana Belén Espinosa González ¹, Enrique Aracil Ávila ^{2,3}, Unai Maruri Brouard ², José Antonio Martínez Grande ², Ana Rivera Gallardo ²

¹ Universidad de Burgos, c/ Villadiego s/n 09001 Burgos, Spain

² Análisis y Gestión del Subsuelo, S.L., c/ Luxemburgo, 4, 28224 Pozuelo de Alarcón, Madrid, Spain

³ Facultad de Ciencias Geológicas. Universidad Complutense de Madrid. c/ José Antonio Novais, 12, 28040 Madrid Spain

ABSTRACT

This paper presents the results of subsoil investigation to analyse the subsidence and collapse problems that were taken place in an urban street in Madrid. The main idea of the research was to know the cause and to define solutions, but it was necessary not interfere the traffic and dairy routine in the street. It was performed the combination of two land geophysical survey methods: multichannel analysis of surface waves (MASW), and electrical resistivity tomography survey (ERT). Both techniques have let characterize the different lithologies of the landfill site and the position of the bedrock surface; this contact is identified as an old riverbed. Moreover, the MASW method is an efficient tool to map variations of the compaction degree of the landfill: a low shear-wave velocity is connected with areas without compaction, cavities or holes in the landfill. The comparative study of the results of both techniques has recognized an underground water flow that has caused washed out fines that is the source of the underground cavities, holes and collapses areas. In addition, a combine use of MASW and ERT has defined the position and the limits of anomalous areas in the profile sections, that they can be matched with the subsidences and collapses that has already happen, but the results let predict future similar problems and propose corrective measures. In conclusion, these techniques adapt perfectly to these subsoil investigation needs and they are decisive to define the problems and their more probable causes.

Key words: Electrical resistivity tomography; seismic reflection, subsidence.

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Contribution to the hydrogeological characterization of the Gardunha Mountain - Portugal

Paulo Carvalho *¹, Luís Pais ¹, Luís Gomes ¹, Luís Pinto ¹, Hynek Lahuta ²

¹ Beira Interior University, Covilhã, Portugal

² VŠB-Technical University of Ostrava, Faculty of Civil Engineering, Ostrava-Poruba, Czech Republic

ABSTRACT

The present paper describes the hydrochemical evolution of mineral groundwater of Gardunha Mountain (centre region of Portugal) which is formed by low permeability igneous rocks. For this study were considered 50 water samples and analysed the values of major ions. The methodology used consisted in the use of Piper diagrams that had allowed to identify the water chemistry and in the application of statistical techniques of multivariate analysis, including factor analysis. The results guided to sodium-bicarbonate water type, with very low mineralization, designated by fresh water in relation to total solids and soft in relation to hardness. When using the factor analysis, 4 factors were considered, which explain and identify the origin of the presence of ions and their geochemical processes.

Key words: Groundwater; statistical; multivariate analysis.

* **Corresponding Author**

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Database 3D surfaces for evaluation of joint rock coefficients

Tomáš Ficker *¹, Dalibor Martišek ²

¹ Brno University of Technology, Faculty of Civil Engineering, Department of Physics, Brno, Czech Republic

² Brno University of Technology, Faculty of Mechanical Engineering, Department of Mathematics, Brno, Czech Republic

ABSTRACT

Joint Rock Coefficients (JRC) are well known parameters useful for calculating the shear strength of unfilled rock joints. Geotechnical engineers use this concept when large civil structures (dams, tunnels or bridges) are to be built in the rocky terrains where the mechanical stability of rocky slopes is dependent on the shear strength of rock joints. JRC values are determined either by laboratory measurements or by visual comparison of joint profiles against the standard two-dimensional profile curves. We have recently developed a computerized method capable of performing such a comparison automatically to avoid subjective human factors. The computerized procedure uses more general three-dimensional surface profiles instead of the two-dimensional curves. The three-dimensional profiles have been formed on the basis of fractal geometry. This contribution discusses arguments that have led to forming fractal three-dimensional profiles and illustrates their properties and applications.

Key words: Joint rock coefficients; shear strength; database surface profiles; fractal geometry; computerized procedure.

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Calibration of TDR test probes for measuring moisture changes in the construction layers of the railway line

Libor Ižvolt *, Peter Dobeš, Martin Mečár

University of Žilina, Faculty of Civil Engineering, Department of Railway Engineering and Track Management (DRETM),
Univerzitná 8215/1, 010 26 Žilina, Slovakia

ABSTRACT

In the introduction of the paper there is characterized a way of monitoring the moisture in the structure of the railway substructure and its subgrade in the experimental stand, which is part of the experimental workplace of the Department of Railway Engineering and Track Management. A substantial part of the paper is devoted to the characteristic and calibration of TDR test probes for selected rock materials (crushed aggregate fr. 0/31.5 mm, crushed aggregate fr. 0/63 mm and clay blended with river gravel, which are incorporated into the construction of Experimental stand DRETM II) as a basic prerequisite for the determination of the actual moisture and its changes in the body of the railway substructure and subgrade during the year. The principle of the dielectric constant measurement of the soil using a TDR (time-domain reflectometry) probe is that the TDR system spreads electromagnetic waves along the metal coaxial cable connected to the parallel guide probes, which act as a wave guide element in the ground soil. The system measures the time between the transmitted and received wave and calculates the speed of its spread. The speed of spread of electromagnetic waves thus indirectly relates to the dielectric constant of the soil which allow to determine the moisture content of the surrounding material. Finally, this article outlines a comparison of individual TDR probes used in calibration and their suitability for monitoring moisture in the various materials used in construction layers of the Experimental stand DRETM II. The exact determination of moisture values and identity of its variations, resp. its limits in the construction of the railway line during the year is one of the prerequisites for the modelling of subgrade construction thermal regime (e.g. using the software SoilVision) and then dimensioning of subgrade to the adverse effects of frost (non-traffic load) – protective layer dimensioning of subgrade surface in the subgrade construction, resp. to assess the suitability of the design of new building materials in the subgrade construction of railway track.

Key words: Time domain reflectometry; calibration of TDR test probes; moisture changes; construction layers of the railway line; protective layer.

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Monitoring of moisture changes in the construction layers of the railway substructure body and its subgrade

Libor Ižvolt *, Peter Dobeš, Alžbeta Pultznerová

University of Žilina, Faculty of Civil Engineering, Department of Railway Engineering and Track Management (DRETM),
Univerzitná 8215/1, 010 26 Žilina, Slovakia

ABSTRACT

Moisture changes in the individual construction layers of the railway substructure body are monitored in a model of railway track in 1:1 scale (Experimental stand DRETM II), which is part of the experimental workplace of the Department of Railway Engineering and Track Management. For this purpose there were 6 protective tubes for TDR probes built in Experimental stand DRETM II, where 5 protective tubes is located across the railway substructure body and the next protective tube is located in the foot of embankment – in its subgrade. Structural parts of experimental stand consists of a track ballast fr. 31.5/63 mm, the moisture of which cannot be established using the TDR method (impossibility of adequate consolidation and removal of air spaces), while its moisture content, with respect to the fact that it is clean, varies in a minimum, protective layer of crushed aggregate fr. 0/31.5 mm (at present in conditions of Slovak Railways is the most widely used material) embankment of crushed aggregate fr. 0/63 mm and subgrade consists of clay blended with river gravel. Experimental work aim, characteristic of the railway track model (Experimental stand DRETM II) as well as the calibration of TDR probes used to monitor the moisture in the individual construction layers of the railway substructure body is published in this anthology in an article entitled „Calibration of TDR test probes for measuring moisture changes in the construction layers of the railway line“. A substantial part of the paper is devoted to the determined moisture changes in the individual construction parts of railway track model (Experimental stand DRETM II), where the measurements and monitoring of moisture changes are carried out since the end of 2014. This means that there are measurement results of construction layer moistures of the railway substructure body and subsoil for two winter periods (winter period 2014/2015 and winter period 2015/2016), which further served as one of the input data required for the mathematical modelling of the railway substructure body thermal regime. Finally, this paper is devoted to the assessment of the moisture monitoring in the individual construction layers of the railway substructure body and its subgrade and design moisture values of materials applied into individual structural layers, which are used for subsequent railway substructure dimensioning of non-traffic load (on climatic factors), resp. to assess the suitability of the new building materials design to the subgrade construction.

Key words: Experimental stand DRETM II; substructure dimensioning of non-traffic load; time domain reflectometry; measuring of moisture changes; construction layers of the railway line; protective layer.

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Digital image analysis based automation of soil hydrometer test

Nihat Dipova ^{*1}, S.Gokhan Goksu ²

¹ Akdeniz University, Department of Civil Engineering, Antalya, Turkey

² Akdeniz University, Department of Electronical Engineering, Antalya, Turkey

ABSTRACT

Grain size distribution, which is one of the basic physical properties of soils, is known to affect the permeability, deformability and strength properties. While GSD of coarse-grained soils is determined by mechanical sieving, GSD of fine-grained soils is determined by pipette or hydrometer method based on Stoke's law. Even though hydrometer method is more practical and more preferred, there are some difficulties. Because hydrometer reading is taken up to three days, it requires labour. Reading is done visually, especially when large numbers of samples to be tested simultaneously, attention and sensitivity problems may be encountered. Changes in the ambient temperature during the experiment change the suspension viscosity and density, and consequently test outputs may be incorrect. To resolve these issues, there are some studies which are based on measurements of the mass of the floating body affected by the buoyancy of the suspension. Floating objects geometry and specific gravity can affect the test results. To eliminate the differences from the standard hydrometer measures, it has been decided to use hydrometer directly as floater. The measurement of time-dependent change in hydrometer position is accomplished by means of digital image analysis. Pictures of a small circle attached on top of the hydrometer have been captured using a camera via time lapse photography technique. In order to determine the distance from the camera to the marker, triangle similarity has been utilized. A MATLAB code have been prepared to make digital image processing and converting images to distance values. In this way, the current position of the hydrometer can be measured and saved to the computer in real time. The temperature change during the experiment has been controlled using a thermoelectric ceramic. For this purpose usually hot water baths are used. However, this is insufficient for temperatures over 20 °C. Constant temperature control process is achieved by developing a micro air conditioning unit and an electronic card. Automatic control of the system is provided writing a code in C ++ language on the microprocessor of the development board. Laboratory experiments have been performed in order to check the assembly performance. Clayey samples have been divided into two by the divider box, one half has been tested by improved device and the other half by the standard procedure. The test results have been compared and a high level of similarity has been observed.

Key words: Automation; image analysis; grain size distribution; hydrometer.

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Innovative technological solutions in terms of realization the partial renovation of bitumen roads using SPRIDER

Wojciech Kozłowski

Opole University of Technology, Faculty of Civil Engineering and Architecture, Department of Roads and Bridges,
Katowicka 48 Street, 45 - 061 Opole, Poland

ABSTRACT

The vast majority of roads in Poland have asphalt pavement. Often these were surfaces designed and made in 80 - 90s. Many of these roads are in operation under much greater traffic and exceeded load design values. This results in degradation and destruction of the road surface. Due to the large backlog of road repairs and many years of negligence regarding road infrastructure resulting from financial constraints of road managers, an urgent need arose to repair several kilometres of asphalt roads, colloquially speaking, at the drop of a hat. Resurfacing and overhauls were first performed on national roads and, to a limited extent, on the roads of lower functional classes. Technologies currently used leave much to be desired in terms of quality and economy. One way to reduce the cost of labour and contracting, while increasing the quality of the work, is to search for solutions using new technologies. Those using SPRIDER are certainly innovative. This paper presents this new technology compared to those commonly used and the very system for evaluating the condition of roads and classifying them for repairs.

Key words: SPRIDER; bitumen roads; repair asphalt pavement; renovation.

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Methods for estimating the capacity of pile foundations based on the results of static probing the example of the road viaduct

Wojciech Kozłowski

Opole University of Technology, Faculty of Civil Engineering and Architecture, Department of Roads and Bridges,
Katowicka 48 Street, 45 - 061 Opole, Poland

ABSTRACT

Research using static probing guarantee just measurement precision and reliability of the results of fundamental importance for the entire design process. Based on the direct performance probing, because of the very rapid development of this approach, and the increasing use by designers and constructors in different research centres working in the field of soil mechanics, geotechnical and geo-engineering, has developed a lot, and still are being developed more and more new schemes and concepts of modelling and calculation using the direct results of static probing. In article presents the estimation of capacity on the basis of direct parameters provided by the test probing the static subsoil, which are mainly used in engineering practice, national as well as European and which form the basis for new ideas and concepts of computing. Using methods described in the article presents the calculation of the reference pile foundation based on the actual results of a study conducted for the needs of the road viaduct currently under construction expressway near the Milomlyn - city in the Warmia-Mazury in Poland.

Key words: Capacity of pile foundations; static probing; road viaduct.

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Systematic review of the risks that are resulted in the realization of the landslide analysis via aerial photography

Eray Can ^{*1}, Hikmet Erbiyik ²

¹ Yalova University, Engineering Faculty, Transportation Engineering Department, 77100, Yalova, Turkey

² Yalova University, Engineering Faculty, Industrial Engineering Department, 77100, Yalova, Turkey

ABSTRACT

The landslides is one of the important natural events that might be developed with the different kind of mechanisms of fall of, overturn, sliding, lateral spreading, exudation and cause substantial harms in the life of the societies. While assessing with the global scale nowadays, it is seen that a lot of regions in the world face with the land slide problem and further more geographic, geologic and meteorological conditions also play effective role in the realization of this natural event. The comprehend of the landslides, by the society and the decision making leaders of the society is also a very important issue in the regions that landslides take part or have the potential for landslide. On the other hand, making landslide maps and landslide analysis and doing relevant interpretations by the scientists that carry out research in this field has also critical importance from the point of view for taking relevant decisions and precautions in this field. The utilization of aerial photography is also very useful alongside with making geodetic topographic works in conducting landslide analysis. However, while making landslide analysis with aerial photography, more careful study and review will be essential in order to eliminate the risks and deficiencies that arise from miscellaneous causes. Among the risks and issues in that subject that necessitate prime attention; the scale and resolution of aerial photography, the structuring density in the landslide region, measurement studies in the field that are related to aerial photography...etc. and similar issues can be cited as example. Elimination of the relevant risks in the intended studies, will provide proper guidance to the other disciplines (such as city and zone planning, geology, geotechnical, geophysics, civil engineering, mapping engineering, architecture, industrial engineering...etc.) that benefit from this issue. In our study, it is attempted to provide sufficient information for the definition of critical issues and risks by FMEA and Pareto analysis in the utilization of aerial photography for landslide analysis.

Key words: Aerial photography; landslide maps and analysis; risk analysis; city planning.

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A worth which lose its meaning: Water

Derya Toksoz, Isik Yilmaz

Cumhuriyet University, Department of Geological Engineering, 58140 Campus, Sivas, Turkey

ABSTRACT

Owing to the extraordinary conditions which allow the existence of water, the earth's surface was filled with water and the presence of water made it possible to have life in the earth. Ever since the first occurrence of water, it has continued its existence in a regular cycle. Water cycle is one of the most important cycles in this planet. Unless humans interfere with the water cycle, it works in a healthy way. However, people who are shaped by modern age have an impact on the water cycle with different activities and largely influence quality of water on the cycle. For centuries, water has been conceived as a cultural and cosmological imagery, as the source of life and was considered as an cosmic gift given to humans. This approach completely changed with the modern age and people began to consider water as a technical and economical material. In the present time, the approach to water is based on it is measurable and can be digitized. Actually, this view lies behind today problem called water scarcity. The water that flows freely throughout the centuries has been imposed by modern civilization. The water that flows throughout thousands of kilometers long pipe, which is used by modern people, is not different from antibiotic or an industrial product like cement or petrol. The first of purpose of this study is to reveal the main sense, taste and nice smell of water. Also, the main reasons underlying water problems around the world were investigated and some solutions were offered. Because of modern approaches to the use of water are not unsustainable anymore, the necessity for new initiative is on the increase. It is hoped that this study will be a step in this direction and will support people who defend the protection of the environment.

Key words: Water cycle; water scarcity; modern civilization; cosmic gift; environment.

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A study on the performance of GPR for detection of different types of burried objects

Derya Toksoz ^{1*}, Isik Yilmaz ¹, Aysel Seren ², Isil Mataracı ³

¹ Cumhuriyet University, Department of Geological Engineering, 58140 Campus, Sivas, Turkey

² Karadeniz Technical University, Department of Geophysical Engineering, 61080 Campus, Trabzon, Turkey

³ Gumushane University, Department of Geophysical Engineering, 29100 Campus, Gumushane, Turkey

ABSTRACT

The objective of this research is to evaluate the applicability of Ground Penetrating Radar (GPR) method to detect burried objects in the shallow depths using 250 MHz and 800 MHz center frequency antennas. For this purpose, different objects were burried in several places of a certain test site. GPR data were collected along six paralel profiles using 250 MHz and 800 MHz antennas which are compatible with RAMAC CU II system. The reflections profile data were processed using the computer program ReflexW. After the processing of data, the reflected /scattered reflections on the processed radargrams were examined and the radargrams were interpreted to determine the depths and positions of the objects from the surface. Also, the data obtained from 250 and 800 MHz antennas were compared and the differences between them in terms of resolution were discussed.

Key words: Ground penetrating radar; burried objects; test site; data; resolution.

* **Corresponding Author**

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Proposal of database structure for foundation soil for civil engineering purposes

František Němec ¹, Daniel Kucerka ^{2*}, Jiří Míka ², Petr Hrubý ², Viktorie Weiss ², František Němec ¹

¹ VŠTE-Institute of Technology and Business in České Budějovice, Faculty Technology, Department of Informatics and Natural Sciences, Okružní 517/10, 370 01 České Budějovice, Czech Republic

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty Technology, The Department of Mechanical Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Proposal soil characteristics represent the most important physical-mechanical parameters for foundation engineering purposes. At present, there are a number of databases produced by the Czech Geological Survey, which building companies use free of charge. Further to the existing data, the databases could be completed with the proposal soil characteristics that would provide free information on the benchmark characteristics of different foundation soils in a modern, fast and easy manner, and thus facilitated its preliminary assessment. In the future, such data could be interconnected with the database information on borehole exploration, slope instabilities, information on the area geology, etc., on the basis of which could be generated a complex preliminary assessment report whether a locality is suitable for foundation engineering purposes. This would render a fast and easy orientation in the given locality even before the survey itself and would be completely free of charge.

Key words: Indicative normative characteristics; database; gravel; sand; fine-grained soils.

* **Corresponding Author**

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Heavy machinery required for the proper application of geosynthetic products in the implementation of transport constructions

Ondrej Stopka ^{1*}, Daniel Kučerka ², Rudolf Kampf ¹, Ján Ližbetin ¹, Ladislav Bartuška ¹, Ján Kmec ²,
Miroslav Gombár ², Viktorie Weiss ²

¹ VŠTE-Institute of Technology and Business in České Budějovice, Faculty Technology, Department of Transport and Logistics, Okružní 517/10, 370 01 České Budějovice, Czech Republic

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty Technology, Department of Mechanical Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

The application of geosynthetic materials has become an ordinary part of not only transport constructions. Such materials are very versatile depending on the earth construction requirements and soil character. With regard to their popularity in use, research and development of new material and innovations of the existing ones are under way, so that the demands on their usability were met and their long life was ensured. According to their production methods, geosynthetics may be classified into basic groups of woven, non-woven and knitted materials. According to their function, which is expected from the different types of geosynthetics, we distinguish geosynthetics with a filtration, separation, protection barrier, erosion control, drainage and reinforcement functions. However, the application of the geosynthetic materials is not possible without a conveniently prepared subgrade. The use of heavy machinery thus becomes an important step in the implementation of transport constructions. Without quality preparation of the surface and subgrade of the body, the effectiveness of the geosynthetics would be suppressed and their life would be much shorter. This could lead to the formation of deformations and cause fatal consequences to the overall transport structure. A set of earth works, depending on the type of transport structure, precedes the laying of the geosynthetic material. In general, heavy machinery is used to handle earth in extraction or filling, removal of unsuitable sharp-edged stones and other undesirable objects, to even the surface and to compact it. The article deals with the building machines vital for the preparation of the earth body before the application of geosynthetics. At the same time, it mentions the basic types of geosynthetic materials used in transport constructions.

Key words: Heavy machinery; geosynthetic material; transport constructions; compaction.

* Corresponding Author

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Case study failures of buildings constructed in the geological environment of tuffs

Terezie Vondrackova *, Jan Plachý, Luboš Podolka

VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Civil Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Objective of case studies is to demonstrate the specific character of the buildings, which are not built by using traditional construction materials. They are excavated into the geological environment as the caverns. These specific structures have a specific building construction, but they also tend to be violated by any other way than in conventional constructions. We use the geological environment in its initial in-situ form, which we are not changing. Into this environment, we are creating cavities. They usually have the same morphology as conventional buildings. Violations of these buildings has its specificity. Geological processes that led to the creation of the environment for future construction, this environment, subsequently violates. This is a tectonic processes, gravity, earthquake and erosion. The case study was carried out on the church Karanlik in the region of Cappadocia in Turkey. One part of the church is fully maintained with original paintings. The second part of the church was completely destroyed. At the same time there is seen a gradual violation of the church in its preserved parts.

Key words: Caverns; tuffs; fault structures; geodynamic processes.

* **Corresponding Author**

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The study of Derinkuyu underground city in Cappadocia located in pyroclastic rock materials

Vladimir Nyvlt ^{1*}, Josef Musílek ¹, Jiří Čejka ², Ondrej Stopka ³

¹VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Civil Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

²VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Informatics and Natural Sciences, Okružní 517/10, 370 01 České Budějovice, Czech Republic

³VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Transport and Logistics, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Its aim is to provide a case study of the historical underground city built for up to 20 thousand people. This is a very specific, building-urban concept that is tied to the extraction of tuff rock building materials. These pyroclastic material ejected volcano in contact with Anatolian and Arabian tectonic plates. For the construction of the city were used exceptional boundary conditions. It is a fact that we have easily extractable building material which is self-supporting, and he does not need additionally reinforced. It means that these soft and stable rocks allowed the creation of large cavern system with a complete infrastructure that needed this underground city. It was placed in it both the living area and warehouse, educational, religious, wells, ventilation systems or stables for animals. These cities were in Cappadocia to 36. The exact number depends on the classification criteria that were used.

Key words: Underground city; tuffs; caverns; infrastructure.

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Assessing the relationship of mine ability of rocks and mechanical mechanisms for earthwork

Daniel Kucerka ^{1*}, Ondrej Stopka ², Ján Kmec ², Monika Karková ², Miroslav Gombár ², Jiří Míka ², Petr Hrubý ², Viktorie Weiss ²

¹ VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Mechanical Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

² Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Transport and Logistics, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Classification of the mine ability of rocks is an integral part of the earthworks occurring in the implementation of engineering works. The existence of degrees of excavation difficulty allows us to specify the needs of mechanisms for earthworks. It is determined according to the old standard CSN 73 3050, and new standard CSN 73 6133. Both standards define the mechanical mechanisms that should be used for each degrees of excavation difficulty. Based on this rock may be the most optimal breakage and extracted without machine selection would have been undersized. That would mean its destruction and inefficient extraction of rocks, or contrary oversizing. On that basis, there would be an unreasonable overpricing earthworks. Into force has already entered a new standard but there are a number of differences in their classification. The publication deals with the evaluation degrees of excavation difficulty, and mechanical mechanisms for earthwork and differences between the two standards, respectively their similarities. It is evident that the old standard represents a very detailed division of soil and rock into seven degrees of excavation difficulty and thus represents a substantially transparent calculation of the total price of earthworks. In contrast, the new standard gives only three degrees of excavation difficulty. This represents a major simplification of the process of classification and subsequent utilization of engineering mechanisms.

Key words: Excavation; machinery mechanisms; earthwork; breakage resistance of rocks.

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The dynamic analysis of the green anode processing building

Daniel Papán ^{1*}, Katarína Demeterová ¹, Veronika Valášková ¹, Rudolf Kampf ², Ján Ližbetin ²

¹ University of Žilina, Department of Structural Mechanics and Applied Mathematics, Univerzitná st. 8215, 01026 Žilina, Slovakia

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Transport and Logistics, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

This article is about the dynamic analysis of the green anode processing building, Svalco company in the city of Žiar nad Hronom. The production process contains anode cauterization, and then this anode is put into the air furnace and consumed during producing the primary aluminum by electrolytic process. Anodes are made of calcined petrol – coke and tar. The processing building is built as the steel frame structure, which contains steel girder platforms. The dynamic analysis contains two base steps, and that is the FEM model of the entire construction and the experimental measuring. The FEM model was created via software Scia Engineer vs. 2015. The FEM model comprises elements with designed dimensions of cross sections due to final design documentation. The platforms were modelled as the girder structures. Computing run was done via modal analysis. There were ten natural frequencies and ten modes of natural vibration as the results, in quite low frequency band. Six experimental measurement series were realized. The principal aim of dynamic response experimental measurements was detecting the vibration intensity of machines and the vibration frequency band of machines. These machines are in closeness to the restroom that is why the dynamic response of them was investigated. The vibration intensity was measured with the aim of checking the vibration effects on humans and on building structure. The software of Sigview was used for the experimental analysis. The vibration acceleration auto spectral densities were analyzed. For the vibration records the frequency domain decomposition into the third – octave band was calculated in that part of measuring during active machine working. The value of vibration weighted acceleration was calculated and compared with the legislative limits of the vibration equivalent acceleration (in the part of measuring during active machine working). The vibration effect on humans' health must comply with the statute of Slovak Republic: Ministry of Health in Slovak Republic NO. 549/2007 from the Collection of Laws, ([3] „Vyhláška č. 549/2007 Z.z.“). These values were detected from the selected measurement series in the software of Sigview: minimal, maximal, RMS of the vibration acceleration and velocity and the value of power spectral density. Detected value of the vibration acceleration amplitude was compared with the norm values due to Slovak Technical Standard (STN) 73 0036. The isolation for reducing vibration level was recommended.

Key words: Vibration; the third – octave band; green anode process.

* Corresponding Author

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Comparative analysis of dynamic methods for earthwork controlling

Jozef Vlcek ^{1*}, Terezie Vondráčková ², Jan Plachý ², Vladimír Nývlt ², Daniel Kučerka ³

^a Department of Geotechnics, Faculty of Civil Engineering, University of Zilina. Univerzitná 8215/1, Zilina SK-01001, Slovakia

^b VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Civil Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

^c VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Mechanical Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Dynamic methods are implemented in numerous civil engineering sections. These methods result in speeding up the evaluation of the earthwork quality. The results of the parallel measurements of chosen testing devices for determining the level of compaction of soils were used for comparative analysis. The correlations between values obtained from various apparatuses were derived to evaluate the measurement capability of the devices for tested type of soil. The test field represented the soft subsoil of the road embankment consisting of clay with low plasticity. Correlations show that examined apparatuses are suitable for examination of compaction level of fine-grained soils with consideration of boundary conditions of used equipment. Applied methods are quick and their results can be obtained immediately after the measurement, thus they are suitable in cases when construction works have to be performed in a short period of time. Results of analyses proved that apparatuses Humboldt GeoGauge™ and Clegg Impact Soil Tester are capable of evaluation of the quality of earthworks close to the level of the widely used Light Dynamic Deflectometer (LDD). These instruments are more portable and more practical in cramped areas or places difficult to access. Another benefit is that these devices can be used for rapid control of the subsoil layers during the ground improvement. Generally, both Humboldt GeoGauge™ and Clegg Impact Soil Tester can substitute the LDD test in terms of the earthworks assessment, but boundary conditions of apparatuses stated by the manufacturers need to be taken into account to achieve results with a required accuracy level. All mentioned methods are based on the dynamic effect of the testing equipment on the soil layer and results have to be interpreted carefully considering the type and physical state of the tested soil.

Key words: Clegg impact soil tester; compaction; correlation; lightweight deflectometer; Humboldt GeoGauge™.

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Analysis of reinforcement's influence on the arching in piled embankment

Jozef Vlcek *, Marian Drusa, Ladislav Kais

University of Zilina, Faculty of Civil Engineering, Department of Geotechnics, Univerzitna 8215/1, 010 26 Zilina, Slovakia

ABSTRACT

There are currently several national standards or regulations for the design of the piled embankment, providing suitable solutions for foundation of transport structure on soft, highly compressible subsoil. The most widely used standard is British Standard BS8006, which is now supplemented by other analytical design methodologies (EBGEO, CUR). Today's popularity and versatility of finite element method (FEM) numerical models offers many advantages, which analytical methods cannot provide. However, these models could be verified by scaled physical models. One of the advantages of numerical modelling lies in proving the geometry of the proposed scaled physical model. The optimal piled embankment structure can be designed only when suitable calculation methodology is introduced. Therefore, scaled physical models and real time geotechnical monitoring of these structures are required. Arching effect is a crucial phenomenon for functionality of piled embankments. It allows transfer of load through the embankment fill to the pile caps and reduces stress induced in the embankment subsoil. Several factors influence this mechanism, including the embankment geometry, fill and subsoil properties. It was also assumed that reinforcement properties, especially axial stiffness, have a major contribution to the arching process. This leads off from expected deflection of the reinforcement which creates a space for soil body movement, initialization of the shear resistance in the fill and the start of the arching process. The rate of the deflection should be dependent on the reinforcement properties. However, performed numerical simulations show only a minor effect of the reinforcement axial stiffness on the arching in terms of the load distribution on the pile caps. This finding will be one of the objects of the upcoming large scale tests and corresponding numerical simulations. The observation will be focused on the load distribution in the embankment body to verify the influence of the reinforcement properties on the arching effect.

Key words: Arching; geogrids; physical model; piled embankment; reinforcement; soft subsoil.

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Soil consolidation parameters derived from CPTu Probing

Jozef Vlcek ^{1*}, Roman Bulko ¹, Ladislav Bartuška ², Ján Kmec ³

¹ Faculty of Civil Engineering, University of Žilina. Univerzitná 8215/1, Žilina SK-01001, Slovakia

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Transport and Logistics, Okružní 517/10, 370 01 České Budějovice, Czech Republic

³ VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Mechanical Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Continued development of infrastructure in Slovakia will open new sections of motorways and expressways. The motorway D1 from Bratislava to Košice is being built in section Lietavská Lúčka - Višňové - Dubná Skala. The knowledge of geology has acceded to the engineering geological (EG) survey, which is also considered a static penetration test with piezocones. Department of Geotechnics University of Žilina on a given section made of static penetration probe with measurement of pore pressures. This article deals with vertical and horizontal consolidation calculated from static penetration test (CPTu) in the locality Lietavská Lúčka Žilina west portal of the tunnel and the tunnel Višňové. Nowadays, when the Slovak Republic are building highways, expressways and modernize the railways, it is important to prepare quality but also a time-saving and cost-effective engineering geological survey. The engineering geological survey combined direct and indirect methods of investigation. When conventionally using core drilling with sampling for laboratory use only receives pixel information from different depths, which is the small number of samples and then is not very representative results. If you remove the larger number of samples, the evaluation of the laboratory tests is time consuming and test the samples taken may be affected by the treatment. Therefore, more preferred by more appropriate geotechnical testing in situ. Probed using static and dynamic penetration may be used in addition to or in place of conventional methods of investigation.

Key words: Cone Penetration Test; cone resistance; friction ratio; pore pressure; dissipation; consolidation settlement.

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Numerical modelling verification of earth pressure distribution in the reinforced wall by geosynthetics

Jozef Vlcek *, Marian Drusa, Ladislav Kais

University of Zilina, Faculty of Civil Engineering, Department of Geotechnics, Univerzitna 8215/1, 010 26 Zilina, Slovakia

ABSTRACT

Contemporary analytical design methods of reinforced retaining walls are based on several approaches for the earth pressure determination. New methods are still being developed to bring the calculation model closer to the real conditions. However, the monitoring of the structures reinforced with geosynthetics shows some anomalies of wall displacements and reinforcement loads. A series of real structure measurements and corresponding numerical modelling were carried out to verify the recent design methods. The analyses were aimed at the distribution of the values of the earth pressure coefficients and at the stress distribution along the reinforcement elements. Monitoring data shows that geosynthetic reinforcement cannot be considered elongated for the purpose of internal stability analysis. This finding explains lower values of horizontal displacements of wall facings in comparison to the project assumptions. Moreover, distribution of the vertical stress along the reinforcement with consideration of eccentricity of load does not correspond with the Meyerhof theory of stress distribution. Conservative approach at vertical stress determination leads to overestimation of axial forces in the reinforcement which is one of the causes of differences between project assumptions and monitoring data. Distribution of earth pressure along the reinforcement and in various depths below the top of the structure depends on the material characteristics of the backfill and the axial stiffness of the reinforcements, as well as the length and vertical spacing of the reinforcement. The influence of the reinforcement stiffness on earth pressure distribution confirms the correctness of the structure stiffness method in terms of coefficient of earth pressure determination. In spite of this, the run of the earth pressure coefficients in analytical methods does not correspond to the results obtained from numerical modelling. Restriction of lateral movements at the toe of the wall results in increase of the earth pressure coefficients which is in contrast with analytical methods. The selection of an appropriate value of earth pressure coefficient becomes more complex when the reinforcement layout along with the backfill and reinforcement material characteristics are considered.

Key words: Earth pressure; geosynthetics; retaining wall; stress distribution.

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Proposal of database structure for foundation soil for civil engineering purposes

František Němec ^{1*}, Daniel Kučerka ², Jiří Míka ², Petr Hrubý ², Viktorie Weiss ²

¹ VŠTE-Institute of Technology and Business in České Budějovice, Faculty Technology, Department of Informatics and Natural Sciences, Okružní 517/10, 370 01 České Budějovice, Czech Republic

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty Technology, Department of Mechanical Engineering, Okružní 517/10, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Proposal soil characteristics represent the most important physical-mechanical parameters for foundation engineering purposes. At present, there are a number of databases produced by the Czech Geological Survey, which building companies use free of charge. Further to the existing data, the databases could be completed with the proposal soil characteristics that would provide free information on the benchmark characteristics of different foundation soils in a modern, fast and easy manner, and thus facilitated its preliminary assessment. In the future, such data could be interconnected with the database information on borehole exploration, slope instabilities, information on the area geology, etc., on the basis of which could be generated a complex preliminary assessment report whether a locality is suitable for foundation engineering purposes. This would render a fast and easy orientation in the given locality even before the survey itself and would be completely free of charge.

Key words: Indicative normative characteristics; soil database; foundation engineering; fine-grained soils.

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Comparative analysis of dynamic methods for earthwork controlling

Jozef Vlcek ^{1*}, Terezie Vondráčková ², Jan Plachý ², Vladimír Nývlt ², Daniel Kučerka ³

¹ Department of Geotechnics, Faculty of Civil Engineering, University of Zilina. Univerzitna 8215/1, Zilina SK-01001, Slovakia

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Civil Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

³ VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Mechanical Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Dynamic methods are adopted in numerous civil engineering sections. Especially evaluation of the earthwork quality can be speed up using these methods. The results of the parallel measurements of selected testing devices for determining the quality of soil compaction were used for comparative analysis. The correlations between values obtained from various apparatuses were derived to evaluate the usability of the devices for tested type of soil. Test field represented soft subsoil of the road embankment consisted from low plasticity clay. Correlations show that examined apparatuses are suitable for examination of compaction level of fine-grained soils with consideration of limit conditions of used equipment. Applied methods are quick and results can be obtained immediately after measurement, and the methods are thus suitable in cases when construction works have to be performed in a short period of time. Generally, both Humboldt GeoGauge™ and Clegg Impact Soil Tester can substitute the LDD test in terms of the earthworks assessment, however, limit conditions of apparatuses given by the manufacturers need to be taken into account to achieve results with a required accuracy. Mentioned methods are based on the dynamic effect of the testing equipment on the soil layer, so results have to be interpreted carefully considering the type and physical state of tested soil.

Key words: Clegg Impact Soil Tester; compaction; correlation; lightweight deflectometer; Humboldt GeoGauge™.

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Design of restoration of regulated rivers based on bioindication

Viliam Macura ¹, Zuzana Štefunková ¹, Andrej Škrinár ^{*1}, Peter Halaj ²

¹ Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Radlinského 11, 810 05 Bratislava, Slovakia

² Slovak University of Agriculture in Nitra, Faculty of Horticulture and Landscape Engineering, Hospodárska 7, 949 01 Nitra, Slovakia

ABSTRACT

Historical development of mankind has been associated with rivers and building in their inundation areas. Most of the settlements are built close to the water streams, where flood protection requires resource intensive engineering measures, which in turn causes destabilization of morphologic development of channels. Streambeds of rivers and brooks should form the dominant features in the urbanized areas. Current river regulations were unilaterally focused on flood protection. As a result of these activities the riverbeds in urban areas generally have the character of prismatic channel. This solution inhibits the aesthetic function of the watercourses and has the negative impacts on instream biota. Based on the results of the research that was carried out on the mountain streams of Slovakia we introduce the implementation of river restorations that maintain the flood protection of surrounding area while retaining the landscaping features of the stream. Original field measurements aimed at obtaining a database on ichthyofauna, hydraulic and other abiotic parameters form the basis of the research. A statistical analysis of the preferences of brown trout (*Salmo trutta m. fario*) is presented in the paper. The analysis showed that quality modelling using a bioindicator represented by brown trout reliably interprets morphological changes in the river channel. The paper further describes the optimal procedure for restoring the regulated streams based on bioindication and documents the quality of aquatic habitat of regulated and natural streams on example of the Myjava River. The results of the research that we conducted with the aim to determine the adaptability of streams on changing conditions after river regulation shown, that it is possible to restore the river channel while maintaining basic function of the river regulation - flood protection. Morphology of Slovakia and characteristic settlements near watercourses do not provide any other alternative of effective flood protection and use of the stream for the improvement of the urban area. River restoration should be focused primarily on supporting the variability of the channel complexity. Design of elements forming the variable morphology of the riverbed, which is part of the aesthetic restoration close to the natural conditions, should result from erudite analysis. Selection of the basic elements supporting diversity of the channel riverbed is presented in the paper.

Key words: River restoration; bioindication; morphology of river channels; instream habitat; quality.

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Determination of the qualitative features of watercourses for restoration in the urban environment

Zuzana Štefunková ¹, Andrej Škrinár ^{*1}, Ingrid Belčáková ², Peter Halaj ³, Peter Ivan ¹

¹ Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Bratislava, Slovakia

², Slovak University of Technology in Bratislava, Faculty of Architecture, Bratislava, Slovakia

³ Slovak University of Agriculture in Nitra, Faculty of Horticulture and Landscape Engineering, Nitra, Slovakia

ABSTRACT

Watercourses in a good environmental condition dominate the landscape and urbanized areas. In the most cases, regulated channels only provide a flood protection, but do not add value to the urbanized areas. Therefore, it is necessary to restore the regulated channels on the basis of objective information. The research on the impact of the abiotic characteristics on the quality of aquatic habitat has been carried out on 64 reaches of 43 mountain streams since 1995. Following field works were performed at each reference reach: detailed tachymetric measurements, water surface levelling for discharges defined by hydrometry, ichthyologic survey which consisted of determining the abundance and ichthyomass. Stand-alone ichthyologic survey was aimed to determine the habitat preferences of fish; habitat characteristics were recorded at particular sampling sites. Survey was conducted by electrofishing. The results of the field measurements have been used to create a hydraulic model. Hydraulic parameters of the stream channels represent the abiotic habitat characteristics. Biotic features were determined by the habitat preferences of ichthyofauna, which was expressed by the suitability curves. The general suitability curves for four typical types of mountain streams were derived from a whole database of measured and evaluated stream reaches. Abiotic and biotic features have been implemented into the River Habitat Simulation System (RHABSIM). The advantage of this model is a quantitative expression of the usable habitat in the form of area weighted suitability - AWS (m²/km). This means that a designer can derive the suitable design parameters for the restoration of the regulated stream directly from the model. It is also possible to assess the restoration project in a model or to predict the instream habitat quality. The method presented in this paper was applied on the specific example of the Bebrava River in the village of Timoradza. The current state of the regulated stream in the village was assessed. Based on the results of the evaluation of instream habitat the river restoration was proposed. Rendering of a restored stream is also presented in the article. Finally, the quality of current state of aquatic habitat in the form of AWS was compared with the restoration design. The results show that the presented method provides the optimal tool for the stream restoration designs. The methodology allows maintaining the flood protection and significantly improving the instream biota, while restored stream significantly improves the aesthetics of urban landscape.

Key words: RHABSIM; bioindication; aquatic habitat; suitability curves; IFIM; Area Weighted Suitability.

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The use of bioindication for design parameters of river training in urbanized areas

Peter Ivan *, Viliam Macura, Zuzana Štefunková, Andrej Škrinár *, Martina Majorošová, Jana Vojtková

Slovak University of Technology, Faculty of Civil Engineering, Radlinskeho 11, SK 810 05 Bratislava, Slovakia

ABSTRACT

The rivers dominate the urbanized area, as is confirmed by almost all the European cities, where the concept of the city is historically determined by watercourses. In many cases, the dominant character of streams was suppressed by flood protection measures. This effect was significantly visible in urban area of municipalities. Regulated reach of a stream can be characterised as a stream channelization, which is characterised by a uniform trapezoidal cross section shape with stabilized riverbanks. Monotonous shape of the channel is corresponding to the uniform hydraulic characteristics. In the regulated rivers, the suitable habitat for bioindicator is not created by constant water depths and flow velocities. Natural riverbed is characterised by rugged morphology. The rugged morphology responds to the variability of water depths and flow velocities. Slower reaches are alternated by areas with higher velocities. Considering water depths, very deep areas are alternated by areas with low depths. Research shows that the depths of the stream are decisive elements for the quality of aquatic habitat. The variability of water depths in a stream creates favourable conditions for biota. River restoration measures should fulfil the needs to create conditions similar to a natural stream. It is necessary to point out that the stream depth variability cannot be directly implemented into regulated channel. The main reason is that even after riverbed restoration a flood protection must be ensured. A natural stream has a standard capacity of around $Q1$, while regulated one has a capacity of $Q100$. Therefore, the recent research about a river restoration is focused on the design parameters in a way to preserve a flood protection, to recover aesthetic functions and to maintain favourable habitat as in a natural flow. Such a restoration process is presented on the example of the Nitrica River. The river depths were modelled at the discharge of $Q_{364d} = 0,213 \text{ m}^3 \cdot \text{s}^{-1}$, which is considered to be the minimum natural discharge. Also the biota is most heavily loaded with such a discharge. The verification of depth parameter was carried out on the basis of bioindication. The ichthyological survey was conducted on the natural reach of the Nitrica River. Three fish species, representing bioindicators occurred in the reach in a sufficient abundance. Minnow (*Phoxinus phoxinus*), Schneider (*Alburnoides bipunctatus*) and Stone loach (*Barbatula barbatula*) were among the chosen fish species. The results of aquatic habitat evaluation confirm the hypothesis that the current regulated reach of the Nitrica River does not provide suitable habitat for bioindicators during minimum flows; the reason is the lack of localities deeper than 0.19 m in the regulated channel. Conversely, localities with sufficient depths - up to 0,47m were identified in the natural reach. These microhabitats were mostly established in the curved track. The need of a river restoration was documented in the urbanized areas of the municipality of Diviacka Nová Ves. The data used in the paper were processed in the System for Environmental Flow Analysis (SEFA) software.

Key words: AWS – area weighed suitability; SEFA - System for Environmental Flow Analysis; parameters of aquatic habitat.

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Approach channel modelling with advanced hydroinformatic tool. Study case: Small hydro powerplant Huta Certeze, Romania

Ioan Vlad *, Robert Beilicci, Erika Beilicci, Mircea Visescu

Politechnic University of Timisoara, Department of Hydrotechnical Engineering, George Enescu str. 1/A, 300022
Timisoara, Romania

ABSTRACT

The promotion of electricity produced from renewable energy sources (eRES) is an imperative of the current period for: environmental reasons, increasing energy independence to the diversification of energy imports and for reasons of economic and social cohesion. Romania was among the first candidate which transposed in their legislation the Directive 2001/77/EC of the European Parliament and the Council on the promotion of electricity produced from renewable sources (by GD 443/2003) and set an indicative target for 2020, representing 33% eRES share of gross domestic electricity consumption. The European Commission presented its view on an integrated policy framework for climate and energy policies until 2030 in January 2014 suggesting, among others, the reduction of EU domestic greenhouse gas emissions by 40% below the 1990 level by 2030 as well as a moderate increase of the share of renewable energy to at least 27% of the EU's energy consumption by 2030. EREC, among others on behalf of ESHA, called on the Commission and heads of governments for more ambitious goals for all forms of renewable energy. Intention to invest in small hydropower is considered by many private companies, and for this option an old small hydropower plant can be. The main expenses for placement of small hydro are those related to the intake, penstock and the power plant building. There are conditions for such an investment expenses that depend on environmental compliance. Opportunity to purchase a SHP should be viewed in terms of return on investment compared to other business opportunity. Not all small hydropower plants are in good working condition. Must be considered: the need for investment in automation in consolidation, other repairs and retrofitting even to the extent that they can receive green certificates law. Important is the condition of the dam and adduction and lack of major environmental problems, combined with the ability to produce energy. Numerical simulations with advanced hydroinformatic tools are often the most efficient and practical methods for modelling approach channel loss in complex hydrotechnical systems. This paper analyses the necessity and possibility of approach channel modelling with advanced hydroinformatic tool. The study case shows Small hydro powerplant Huta Certeze For the modelling are use MIKE11 by DHI software, HD module.

Key words: Small hydro powerplant; hydroinformatic tool; hydrodynamic modelling; approach channel.

* **Corresponding Author**

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Assessment of Gura Raului Dam safety using measurements of structural response to ambient vibrations

Daniel Gaftoi *, Altan Abdulamit, Dan Stematiu

Technical University of Civil Engineering Bucharest, 124, Lacul Tei blvd., sector 2, 020396 Bucharest, Romania

ABSTRACT

A very important research direction in today's dam engineering is related to structural ageing of concrete dams and ways to monitor structural and material characteristics changes to reduce and manage the associated risks. In situ ambient vibration measurements used to identify the dynamic characteristics of the structure and the development of hybrid models (the mathematical model bounded to a certain in situ measurement program and calibrated using the recorded data) represent an appealing method for the evaluation of the safety reserves of concrete water retention structures. However, mathematical modelling can be done with varying degrees of complexity and the results obtained for the couple dam model - recorded data can significantly vary depending on the size and complexity of the analysed model. The presented study, developed for Gura Raului buttress dam in Romania, consisted in 2 measurements campaigns and the development of 4 mathematical models, via the finite element method, with different degrees of complexity - a representative maximum height block, a spillway block, the whole spillway made of 3 identical blocks and the complete dam made of 22 blocks. The paper presents the in situ measurement results, the calibration of the maximum height block based on the first measurement data set and the analysis of the results obtained for the other 3 models compared with the recorded data.

Key words: Vibration measurements; hybrid model; finite element method; buttress dam; structural ageing.

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Experimental investigation of the anti-vortex devices of Beyhan 1 dam and hydroelectric power plant (Turkey) water intake structure

Mustafa Gogus *, A. Burcu Altan-Sakarya, Mete Koken

Middle East Technical University, Civil Engineering Department, Hydromechanics Laboratory, 06800 Ankara, Turkey

ABSTRACT

Hydraulic model tests of the intake structure of Beyhan 1 Dam having four units were carried out at Hydromechanics Laboratory of Middle East Technical University, Ankara. In order to investigate the flow pattern, and formation, development and dissipation of vortices at the intake structure under different operation conditions of the units, and to determine the types of anti-vortex devices to avoid the air-entraining vortices, a model of 1/29.43 length scale was constructed. The model area covers an about 200 m × 300 m section of the Beyhan 1 reservoir, the intake structure having four units, the trash racks and penstocks. Experiments were carried out at various reservoir water levels with specified unit operation discharges for various unit operation conditions. From the observations and experimental results, it was concluded that air-entraining vortices were forming at the intakes when the reservoir water level was minimum, RWL=977.0 m. Flow separation zones were forming; along the inner lengths of the side walls surrounding the intake structure and behind the trashrack piers at any RWL tested. In order to reduce the strengths of the vortices forming and to prevent the intakes from air-entraining vortices, in the first phase of the experimental study, several anti-vortex devices; continuous plates constructed on top of the intakes, continuous projected head walls and continuous projected head walls with vertical unit-separation walls were tested under various flow and unit operation conditions to find the anti-vortex device that gave the best performance. It was also stated that the arrangements to be made on the geometries of the side walls and trashrack piers, if possible, will improve the flow conditions at the intakes. Related to the proposed arrangements of the sidewalls and trashrack piers/beams to improve the approach flow situation, a modified design was proposed. In addition, a new set of anti-vortex devices was investigated. The anti-vortex devices investigated can be classified into two groups. In the first group, all of the anti-vortex devices were composed of floating elements, while in the second group the main element was the "anti-vortex device 1", defined in the previous study, and combination of it with different floating elements having varying widths (3, 4.5, and 6 m) which have continuous solid or perforated plates. A series of experiments with the new alternative anti-vortex devices were carried out only at some critical unit-operation cases and their detailed results regarding the formation of vortices and energy losses were investigated.

Key words: Hydraulic model; vortex formation; anti-vortex devices.

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Experimental investigation of the original project of Yukarı Kaleköy dam and hydroelectric power plant spillway (Turkey)

Mustafa Gogus, A. Burcu Altan-Sakarya *, Mete Koken

Middle East Technical University, Civil Engineering Department, Hydromechanics Laboratory, 06800 Ankara, Turkey

ABSTRACT

Hydraulic model tests of the spillway of Yukarı Kaleköy Dam and Hydroelectric Power Plant were carried out at Hydromechanics Laboratory of Middle East Technical University, Ankara. In order to investigate the flow conditions in the approach channel, over the weir structure, around the spillway piers, along the spillway chute channels and after the flip buckets, and also to observe the performance of the aeration devices, a model of 1/70 length scale was constructed. The model area covers an about 400 m × 450 m section of the Yukarı Kaleköy reservoir, the whole spillway structure and a part of the river area of about 150 m × 200 m downstream of the flip buckets. Experiments were carried out at various discharges; QPMF, Q1000 and Q100 with fully open radial gates as well as with partly open radial gates at Q1000. Flow depths, pressure heads of the flows along the spillway structure were measured, cavitation indexes and air concentrations of the flows were determined. From the observations and experimental results it was concluded that the flow conditions in the approach channel of the spillway, over the weir structure, around the spillway piers, along and after the flip buckets are quite good from the hydraulics point of view. However, it was also observed that vortex type motions were present in the gate slots and just downstream of the spillway piers. The flows were not sufficiently aerated in the spillway chutes, in Channel I and II, after the available aerators presented in the original design of the spillway. After this analysis of the experiments conducted on this “original model” it was decided that some modifications should be done. In order to improve the performance of the available aerators, the heights of the aerator deflectors were increased by 0.20 m by keeping their lengths in the flow direction almost as before. In addition, two aeration pipes were placed to the downstream sections of the spillway piers to aerate the wake zones to prevent the channel bottoms from the adverse effects of the vortices.

The same experiments which had been conducted for the “original model” were repeated on this “modified model” too. Consequently, on the modified model it was shown that the flows after the spillway piers and aerators are almost uniformly distributed in each spillway chute and sufficiently aerated without having cavitation risk on the structure.

Key words: Hydraulic model; spillway; spillway aerators; cavitation.

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Efficiency evaluation of irrigation system with optimized management

Duska Kunštek *, Eva Ocvirk, Jadran Berbić

University of Zagreb, The Faculty of Civil Engineering, Kačićeva 26, Zagreb, Croatia

ABSTRACT

Efficiency evaluation of irrigation system can be considered from general aspects like production efficiency, economic efficiency, design efficiency etc. Different methods of irrigation evaluation can be found in literature and the conclusion is that unique attitude about the efficiency term does not exist. Some classical definitions of irrigation efficiency consider it like the ratio of water used by crops and total amount of water applied for irrigation, which is in accordance with the efficient use of water resource. In the paper are analysed different methods of efficiency evaluation. Prompt and appropriate water distribution can increase crop production and at the same time lead to more sparing use of water resource. Considering the previous statement, it is shown that, by optimization technique application, it is possible to increase efficiency, at least in the terms of appropriate water accumulation and also delivered, applied and consumed water.

Key words: Efficiency; irrigation system; crop production, optimization.

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Allowable span length of submerged pipes under the effect of hydrodynamic forces

Ahmadian Pakhshan *, Türker Umut

Eastern Mediterranean University, Civil Engineering Department, Gazimağusa, 99450, North Cyprus, Turkey

ABSTRACT

Transportation of water by submerged pipelines is a challenging engineering solution for international water diversion projects. During the operation of such pipeline systems, changes in seabed topology such as scouring or natural hazards like earthquakes or sudden unevenness on formations will result in free span on pipeline transmission systems. As long as the length of the free span is more than the allowable free span of the pipe, the pipeline suffers from damages due to the hydrodynamic forces. This study aims to calculate the maximum spanning lengths of different size High Density Polyethylene pipes (HDPE) at the intermediate zone of coastal environments. In order to do so, Reynolds number less than 3.5×10^5 and Keulegan Carpenter number between 4 and 7 are accepted as the limitations of the work. The depth limitation was valid at a range of intermediate depths where the ratio of water depth to wave length is considered to be in between 0.05 and 0.5. The assigned limitations were useful to analyse the behaviour of submerged pipes in the absence of vortex induced vibration. Therefore, the velocity of sea current and the wave orbital velocity at intermediate depth are computed to determine the in-line and cross-flow net forces acting on spanning submerged pipes. The preliminary results show that whenever the ratio between the pipe diameter and the eroded surface gets bigger than 1, the importance of lift forces vanishes when compared to the in-line forces. This deduced that importance of the cross flow vibration becomes negligible and in-line vibrations dominates the behaviour of the submerged pipe. Independent of the depth of submerged pipes within the intermediate zone, as the wave height increases, the ratio between total inline force and lift force linearly decreases. Finally, comparing the yield stresses of pipes with the bending stresses due to external forces, the critical spanning length of high density polyethylene pipes are deduced. At constant diameter, the free spanning length of the pipes was increasing as the wall thickness of the pipes was increasing. The ratio of external forces to the weight of the pipe was not effective while deciding on the magnitude of spanning length of the pipes, which shows 0.5% changes while 30% changes occurred on the pipe diameter.

Key words: Drag force; inertia force; lift force; span length; HDPE pipe Keulegan Carpenter number.

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Empirical approach to settling velocity for sediment particles independent of kinematic viscosity

Amin Riazi *, Umut Türker

Eastern Mediterranean University, Department of Civil Engineering, Northern Cyprus

ABSTRACT

Among the variety of methods for estimating the magnitude of settling velocity for sediment particles, Zhang (1989) and Julien (1995) equations are successfully used in laminar to turbulent settling regions. The current paper provides evidence that by incorporating Zhang and Julien equations with an accepted accuracy the effects of kinematic viscosity of the ambient fluid on settling velocity can be eliminated. The reliability, validity, and accuracy of the proposed equation were enhanced using genetic algorithm. The results indicate that the proposed equation has high degrees of prediction accuracy compared with experimental datasets of measured settling velocity of sediment particles. The proposed equation is valid for grain sizes equal or bigger than 0.3 mm (Medium sand) in Newtonian fluids with kinematic viscosity within the range of $[0.3 \times 10^{-6} \text{ m}^2\text{s}^{-1}, 1.8 \times 10^{-6} \text{ m}^2\text{s}^{-1}]$.

Key words: Genetic algorithm; sediment; settling velocity; viscosity; particle size.

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Dynamic behaviour of cable-stayed bridges under multi-support excitation

Barbaros Atmaca *, Zeliha Kuyumcu, Şevket Ateş

Karadeniz Technical University, Department of Civil Engineering, 61080, Trabzon, Turkey

ABSTRACT

In case of infinite speed of propagation of seismic waves as well, it can be observed the differences for varied earthquake excitation in each support of bridge subjected to earthquake excitation in long span bridges. In this study, it is intended to determine dynamic behaviours of cable-stayed bridge supported different soil types for multi-support excitation. Within the scope of the study, Manavgat Cable-Stayed Bridge is selected as an application. The bridge consists of λ -shaped steel tower, double plane semi-harp-type cables and a composite concrete-steel girder bridge deck. 3 dimensional finite element models (3D FEM) of the bridge for soft and firm foundation soils are created with SAP2000 computer software. The foundation soil of the bridge is idealized a series of spring connected to coefficient of subgrade reaction which is represent the elastic behaviour of the soil. To be used for dynamic analysis, ground motions are generated for each support of the bridge depending on properties of the soil and the bridge. In the analysis, the baseline correction method is applied for generated ground motions and displacement time history records are used. In the analysis results, it is investigated variation with time of the axial forces consisted cables.

Key words: Soil-structure interaction; multi-support excitation; cable-stayed bridge; dynamic analysis.

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Assessing retrofit performance of concrete slab bridge subjected to scour and earthquake

Junwon Seo *, Eduardo Torres

South Dakota State University, Department of Civil and Environmental Engineering, Brookings, SD 57007, USA

ABSTRACT

A bridge considered as one of the most vulnerable transportation systems is required to operate against extreme events during its expected lifecycle. Many bridges in the United States have experienced significant damage the loading effects resulting from combined scour and seismic events because such events that occur across flood-prone regions associated with seismic events can intensely reduce serviceability of the bridges. Most of the bridges classified as structurally deficient structures have been typically retrofitted with different measures to improve their structural performance. However, these retrofit measures have limited performance for these extreme events, and associated resources are only invested in upgrading the structural capacity of bridges. Hence, appropriate retrofit performance assessment of bridges under joint scour and seismic events is needed. This paper assesses probabilistic retrofit performance of a reinforced concrete slab bridge under the combined effects of earthquake and scour events. The bridge is located in the central United States where it must resist the effect of scour and, in some cases, the effect of seismic events. To investigate structural response of the bridge under scour and earthquake events, a three dimensional (3D) modelling approach was developed at first, and non-linear time history analyses using synthetic ground motions was applied to the 3D model with different levels of scour depths. Additional analytical modelling techniques for different retrofit measures such as a steel jacket were also developed. Multiple soil springs in the model to account for the soil-structure interaction behaviours were employed to simulate joint scour and seismic response of the bridge. To evaluate probabilistic retrofit performance of the bridge at damage states, fragility curves of the bridge strengthened with different retrofit measures were analytically created that enable bridge owners and/or disaster manager to make a rationale decision for the reduction of risks associated with such events. Preliminary results from the fragility study are encompassed and discussed.

Key words: Retrofit; performance; concrete slab bridge; scour; earthquake; fragility analysis.

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Reducing response of structures by using optimum composite tuned mass dampers

Yoyong Arfiadi *

University of Atma Jaya Yogyakarta, Department of Civil Engineering, Jalan Babarsari 44, Yogyakarta 55281, Indonesia

ABSTRACT

Several methods have been proposed in order to reduce response of structures subject to earthquake. These includes base isolations, various controlled systems as well as improving structural performance through structural detailing. Tuned mass dampers are one of the passive control systems that utilizing additional mass attached to the building in order to increase the damping of the structures. In this paper, the effectiveness of composite tuned mass dampers in reducing the response of structures subject to earthquake are discussed. Composite tuned mass dampers are mass dampers consisted of auxiliary and satellite dampers. The mass of satellite dampers is relatively smaller than the one of auxiliary dampers. The composite tuned mass dampers considered in this paper are the extension of the composite tuned mass dampers known in the literature, where the mass ratio of the auxiliary damper to all dampers is varied from 0.1 up to 0.9; and the optimum stiffness and damping of the auxiliary and the second dampers are obtained using an optimization method. For this case, it is not necessary that the mass of the second (satellite) mass dampers has to be smaller than the one of auxiliary dampers. The optimization method that is used in this paper is real coded genetic algorithms, with the objective function is the H2 norm of the transfer function from the disturbance to the regulated output. In this case, the regulated output is taken as displacement of the structures. Note also that real coded genetic algorithms used in this paper utilize a so called asymmetric crossover that is able to explore a larger domain of interest, while maintaining the sign of design variables. From the optimization's result it is found that the mass ratio of the auxiliary dampers does not significantly affect the response reduction of structures. It is also found that for a certain mass ratio, the resulting stiffness and damping are not unique for achieving the same performance. At the end of the paper it is shown the effectiveness of the composite tuned mass dampers in reducing the response of the structures.

Key words: Composite tuned mass dampers; vibration control; passive control; optimization; real coded genetic algorithms.

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Constructing nonlinear shaping envelops in current architecture

Krystyna Januszkiewicz *

West Pomeranian University of Technology Szczecin, Faculty of Civil Engineering and Architecture,
Piaśtów Ave. 17, 70-311 Szczecin, Poland

ABSTRACT

Designing (CAD) and manufacturing (CAM) integrated the practice of erecting buildings with their designing. Increasingly strong historical relationship between architecture and the means of production is becoming a challenge for the new digital design, manufacturing and construction processes. With digital technologies and techniques at its disposal, the construction industry has new challenges. The leading companies on the construction market are German companies, such as Covertex, Seele, Finneforest Merk, who now implement designs of internationally renowned architects. Digital fabrication and migration of data from the architect to the manufacturer is due to a practical approach rather than the idealized goals. Implementation of geometrically complex structures and building systems with different components is a viable proposition. It is important, therefore, to consider the relationship between non-digital skills and tools and digital techniques as well as technology. The unconstrained creation of free forms has become a new aesthetical paradigm: architectonic requirements have stimulated the search for new types of structures. For the realization of a digital free surfaces, technical mastery of the material is needed, as new geometric solutions often pave the way for exploration of new materials and vice versa. Virtual free surface imposes such technical solutions and materials which question the traditional thinking about a building. This is about the principle of combining the load bearing structure and the "skin" into one tectonic self-supporting element. The structural envelop is the integration of surface and structure into one. As can be seen different types of concrete used as a component of structural envelop. Most popular are: shotcrete shells and fibre glass reinforced concrete and fibre glass reinforced plastic. This material is a relative new development in concrete technology and still subject to many researches. By adopting digital techniques CAD/CAM, architects are again resolving the problems of the relationship between geometric order, materiality and structural complexity of forms. The paper is focusing on a multi-layered nonlinear shaping structural envelops in architecture. A few examples: Experience Music Project in Seattle (2000), POLIN Museum of the History of Polish Jews in Warsaw (2005), Roca London Gallery in London (2011), City of Culture in Santiago de Compostela (2010) and Heydar Aliyev Cultural Centre in Baku (2013) will be presented.

Key words: Digital technology; architecture; structure; nonlinear shaping envelop; new challenges.

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Study of the influence of CFRP strengthening on the behaviour of reinforced concrete columns subjected to cyclic compression loading

Youcef Si Youcef *¹, Sofiane Amziane²

¹ Ecole Polytechnique d'Architecture et d'Urbanisme, Algiers, Algeria

² LAMI, Polytech'Clermont, Université Blaise Pascal, Aubière, France

ABSTRACT

In this experimental research work, we explored the efficiency of external reinforcements, made of carbon fiber composite materials CFRP on high slender reinforced concrete columns. A particular attention has been paid to the reduction of the instability risk of the existing slender columns, using various arrangements of CFRP strengthening. The behaviour under monotonic cyclic compression loads, has been explored on 7 reinforced concrete columns, having a very high geometric slenderness equivalent to " $l/a = 29$ ". The first one without external reinforcement, three columns are confined with one, two and three layers on CFRP, the two other columns are reinforced for the first with one layer of CFRP with fiber disposed longitudinally, the reinforcement of the second one is composed by two layers of CFRP one with longitudinal fibers and one with transversal fibers. In the seventh column two layers of CFRP are disposed diagonally with $\pm 45^\circ$. Experimental responses allowed us, the idealization of the global behaviour by elastic perfectly-plastic simplified models, the highlighting and evaluation of the stiffness variation according to the load, to note the changes on the columns deformability, to measure energy characteristics induced by the different provisions of reinforcements. As interesting observation, we cite the positive effect in terms of bearing capacity and deformability on all of the CFRP reinforced columns.

Key words: Column; reinforced concrete; slender; CFRP; instability.

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Numerical and experimental study on concrete walls for social welfare housing rehabilitated externally with carbon fibre fabrics

Julian Carrillo *, Fabian Echeverri

Department of Civil Engineering, Nueva Granada Military University, Colombia

ABSTRACT

In recent years, construction of Social Welfare Housing, SWH, located in all climates and in all seismic hazard zones has increased significantly in Latin America. Use of SWH made of reinforced concrete walls and using industrialized has incremented due to its seismic performance and its many economical and sustainable benefits. However, most houses having reinforced concrete walls built before upgrading of the earthquake-resistant codes do not meet the new requirements of seismic performance. To provide a solution to these deficiencies, an experimental and numerical study was carried on seismic rehabilitation of walls using fabrics of Carbon Fibre Reinforced Polymers, CFRP. The experimental program includes 16 panels and 5 walls having web shear reinforcement ratio lower than that prescribed by ACI 318-11 Building Code, which is equal to 0.20% for structures having three or lower stories and structures used exclusively for housing, and specimens rehabilitated externally using three reinforcement ratios and four configurations of CFRP. Before rehabilitation, the specimens were not subjected to any damage level. After rehabilitation, the panels and walls will be subjected to monotonic diagonal compressive loads and quasi-static reversed cyclic loads, respectively. The paper shows details of the experimental program and discusses the results of a statistical analysis of the capacity computed using the predictive models available in the literature. The analysis demonstrates that the variation between the models is higher than 40%, and that the walls rehabilitated with the studied CFRP reinforcement ratios and configurations will reach strengths higher than those of the specimen reinforced with the minimum web reinforced ratio currently prescribed by ACI 318-11.

Key words: Seismic rehabilitation; concrete walls; social welfare housing; CFRP; seismic performance.

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Effect of steel micro-fibres on confinement of square concrete columns

Julian Carrillo *, Diana Arango

Department of Civil Engineering, Nueva Granada Military University, Colombia

ABSTRACT

Concrete is one of the most commonly used materials in the construction of earthquake-resistant structures, and therefore, many studies have been carried out for improving its ductile performance using different materials. For improving the bending, shear and confinement performance of square concrete columns subjected to seismic demands, steel micro-fibres are added to the concrete during the mixing process. This paper presents an experimental and numerical study on the confinement of square concrete columns reinforced with steel micro-fibres. Variables of the study are the dosage of steel micro-fibres (30kg/m^3 and 60kg/m^3), and the steel ratio and configuration of conventional transverse reinforcement of columns. The criteria prescribed by ACI Building Code for ordinary and special buildings were used for defining the steel ratio of conventional transverse reinforcement. Therefore, two values of spacing of the transverse reinforcement were defined, each of them having two different configurations. Compressive strength of concrete was 21 MPa and the steel ratio of longitudinal reinforcement of the columns was 1.6%. The experimental program included specimens without longitudinal or without transverse reinforcement, specimens having longitudinal reinforcement only, specimens having longitudinal and transverse reinforcement, and specimens having longitudinal, transverse and micro-fibres. The concrete square columns were subjected to monotonic axial compressive loads. The load-deflection curves are discussed, the contributions of each material are determined, equations are proposed to estimate the behaviour of square concrete columns confined with steel micro-fibres, and recommendations on reinforcement ratio, material and configuration of shear reinforcement are presented in the study.

Key words: Square column; confinement; steel micro-fibres.

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An effective anchorage system for reinforced concrete beams with fibre reinforced polymer composites

Rami H. Haddad *, Catreen S. Marji, Rajai Z. Al-Rousan

Jordan University of Science and Technology (JUST), Department of Civil Engineering, P.O. Box 3030, 22110 Irbid, Jordan

ABSTRACT

The efficiency of using CFRP sheet anchorage to prevent or delay the detachment of CFRP strips, bonded to the tension side of under reinforced concrete beams, was experimentally evaluated. CFRP strips (50 x 800 mm) were bonded to sixteen beams (100x150x1400 mm) before fourteen of which were anchored by either segmented or continuous CFRP sheets, attached above and beyond the strips and extend laterally to the beams' soffits for (50-100) mm. The mechanical behaviour of the beams was evaluated under four-point loading, before the data collected were analysed for load-deflection, and bond stress versus slippage relationships and their characteristics. Crack formation and failure mode were monitored and characterized, as well. Single and double layered CFRP sheets, continuously attached above the CFRP strips with lateral extensions the soffit, achieved significant improvement in structural performance but had reduced both ductility and toughness of strengthened beams by as high as 38, and 63%, respectively. On the other hand, anchoring CFRP strips at their ends by 300-mm-long CFRP sheet segments, with lateral extension, had improved the structural without degrading the ductility or toughness, hence can be considered as the most efficient and economic anchorage technique. Results of bond characteristics and strain in CFRP composites supported the later conclusions. Prior to flexural failure of the strengthened beams, the CFRP composites showed free-end debonding and/or concrete cover rip-off.

Key words: Carbon-carbon composites; bond characteristics; debonding; mechanical testing.

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Restoration of a technological steel bridge located inside a chemical plant

M. Georgescu, Viorel Ungureanu *, D. Grecea

Politechnic University of Timisoara, Department of Steel Structures and Structural Mechanics, Timisoara, Romania

ABSTRACT

The paper presents an investigation performed on an existing steel bridge with reinforced concrete deck, built inside a chemical plant and having a technological role (i.e. transport of chemical materials between two multi-storey industrial buildings). A classic structural system was used for the existing bridge, almost exclusively built of angle section members, connected by welding using gusset plates. The client has required some (minimum) structural interventions and modifications of the existing bridge in view of responding to some required technological improvements inside the chemical plant. These modifications imply the cutting of a lateral diagonal member at the end of the bridge, in view of creating the access gate for a new purchased industrial elevator, part of the improved technological flow. An inspection of the existing steel structure of the bridge has revealed its bad technical state, with installed corrosion zones, mistaken connection details and welding errors. At the same time, the performed structural analysis on the existing structure and then on the modified structure (following technological requirements) has indicated the necessary strengthening measures in order to provide resistance and stability of the resulting configuration. Details of the intervention measures on the reinforced concrete deck are also presented.

Key words: Restoration; steel bridge; structural system; multi-storey industrial building.

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Cantilever steel industrial building located on a rocky hill

M. Georgescu, Viorel Ungureanu *

Politechnic University of Timisoara, Department of Steel Structures and Structural Mechanics, Timisoara, Romania

ABSTRACT

The objective of this paper is an industrial building, part of a vineyard, located in a rocky zone of Arad County Romania, famous for wine production. The investor and architect requirements included two distinct zones merged into the building, i.e. a grape processing zone (industrial function) plus a zone with a role of show-room for wine (commercial function). This division has led to locate the building at a height of 14.00 m, partially supported by the rocky wall of the hill at one end, while the other end is supported by a reinforced concrete rectangular tower, built near the hill. The show room zone of the building goes beyond the support tower, being located into a cantilever zone of the structure, having a span of 10,0 m. Thus, most of the building spans in the air, creating an impression of "suspension". Such distribution of functions, geometry and support system (somehow similar to a bridge) imposed a longitudinal steel structure of lattice girder type, in order to be able to withstand required loading and allow for deflection control, especially at the top of the cantilever zone. The paper describes some of the problems confronted by the structural engineer during the design phase, also influenced by architectural concepts.

Key words: Industrial building; structural engineering; architectural concept; rock hill.

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Application of cellular shell in an overhead electric line tower

Ferenc Orbán ^{*1}, József Farkas²

¹ University of Pécs, H-7624 Pécs, Rókus u 2, Hungary

² University of Miskolc, H-3515 Miskolc Egyetemváros, Hungary

ABSTRACT

A welded steel structure is designed for an overhead electric transmission line tower. The tower has two parts. The upper part consists of a central truss and cantilevers for fixing the conductors. The lower part is constructed as a single or double (cellular) circular cylindrical shell. For the design of a welded steel tower the standard EN 50341-1 (2012) is used. The loads are as follows: dead mass of the conductors, wind and ice load, a torsional load caused by break of the conductors in a half side of the tower. The upper part is welded from square hollow section (SHS) rods according to EN 10219: (2007). The following constraints are to be fulfilled: constraint on reduced stress and on overall buckling of rods, limitation of the horizontal displacement of the tower top, fabrication constraints: limitation of the shell thickness and the shell radius. Numerical data: height of the tower $H_0 = 45.8$ m, height of the lower part: 22 m, upper part 23.8 m. Distance of the towers: $L = 400$ m, angle between the neighbour conductor lines 180°. Steel of yield stress $f_y = 355$ MPa. The maximum shell thickness is 30 mm and radius is limited to 1100 mm. Overhead electric lines are supported in most cases by trussed towers. The aim of the present study is to show that the lower part of the tower can be constructed instead of a truss by a cellular shell. A cellular shell consists of two concentric circular cylindrical shells and longitudinal stiffeners welded between them. Halved circular hollow section (CHS) stiffeners can be used, which enable the welding of the outer shell parts. It is shown that, in the case of certain constraints, a cellular shell is more suitable for fabrication than a single shell. The governing design constraint is the limitation of the horizontal displacement of the tower top. The shell diameter is also limited. For shell radius of 1100 mm a cellular shell needs thicknesses of 24 mm, a single shell needs thickness of 41 mm. The break of one lightning and six electric conductors in the same tower side causes a torsional moment, but the stress constraint for the tower lower part is passive. The trussed cantilevers support two lightning and 12 electric conductors. In the combination of wind and ice loads two cases are taken into account according to EN 50341-1: (a) maximum wind load acting during 50 years period and minimum ice load acting during 3 years period, (b) maximum ice load for 50 years period and minimum wind load for 3 years period.

Key words: Overhead electric line tower; cellular shells; tubular structures; shell structures; welded steel structural design; wind loads; ice loads.

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Wavelet transform based damage detection in plate structure

Rims Janeliukstis *, Sandris Rucevskis, Pavel Akishin, Andris Chate

Riga Technical University, Institute of Materials and Structures, Riga, Latvia

ABSTRACT

In this paper, the area of mill-cut damage in an aluminium plate was identified with a 2D Wavelet Transform technique using 11 numerically simulated vibrational mode shape signals. These vibrational mode shapes were corrupted with various levels of artificial noise of a uniform distribution and reduced by integer values to simulate the performance of damage detection algorithm in real life situations with different sensor densities. The damage was assessed through the calculation of damage indices (DI) over the entire area of the plate and subsequent standardization, yielding standardized damage indices which are based on statistical hypothesis approach. These damage indices were summed over all vibrational modes considered in this study. The largest peak in the damage index profile revealed the location of damage. The confidence of damage identification given in percentage was estimated with a parameter called damage estimate reliability (DER). Results suggested that only an isotropic pethat wavelet yielded satisfactory damage identification. Analysis of DER vs wavelet scale was carried out and results indicate that DER values rapidly decreased as scale increased, thus only 1st scale with a corresponding DER of about 75 % was adopted for further studies. Considering various levels of noise and sensor densities, a DER matrix whose rows correspond to noise levels and columns – to sensor densities was constructed. Examination of this DER matrix revealed that at fixed sensor density damage identification was barely affected by noise except the case with the densest sensor grid.

Key words: 2D wavelet transform; pethat wavelet; vibration mode shape; damage index; noise.

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Steel connections post-earthquake fire tests setup

Tudor Petrina *

Technical University of Cluj-Napoca, 15 Daicoviciu Str., Cluj-Napoca, jud. Cluj, Romania

ABSTRACT

This paper presents the setting up of a test stand, the design and construction of a furnace and the testing procedure in order to analyse the behaviour of steel beam to column end-plate bolted connections under the post-earthquake fire action. 12 real scale beam – connection – column substructures were created for this goal. The main problem was how to simulate the seismic action on the specimens immediately followed by fire action. For the first part, the recommendations inside the document of ECCS – Technical Committee 1, TGW 1.3 were developed and applied for this case; for the fire action (second part), a special furnace was designed and constructed around the connection. After the majority of earthquakes, especially in the urban areas, big fires occurred, sometimes making more calamities than the actual ground movement. During the 1906 San Francisco earthquake, for instance, the post seism fire produced 80% of the total damage; it was the biggest human life loss in California and together with hurricanes Galveston (1900) and Katrina (2005) are the largest natural disasters of the USA. A testing programme was realized in 2014-2015 in Romania, on real scale steel beam-connection-column substructures. The programme was aimed to find the behaviour of steel beam to column end-plate connections under the post-earthquake fire action. After the cyclic action, the deteriorated connections were immediately subjected to fire, following a real time-temperature curve. New connections were also tested for fire action in order to find the differences to the previous deteriorated case. The results obtained during the experimental tests were similar to prior numerical simulations made with the help of advanced nonlinear model VULCAN. The stand and furnace met all prior conditions and the behaviour of the specimens was in accordance to prior made experiments on similar structures. Aspects on the originality of this research: a. design of beam, node, column ensemble and links to the node; b. design of the test stand (sections and dimensions of steel elements for the prior computed and expected internal forces); c. the way to test the specimen, the position of the specimen and the entire programme management; d. the cyclic action on the specimen by using only monotonic pressure devices and displacement translator; e. the design of a removable furnace around the connection, with a low cost and using traditional materials, which permits immediate fire test after the cyclic action; f. the design of a cooling mode to protect gas burner's blower when stopping fire.

Key words: End-plate connections; post earthquake fire action; testing procedure; furnace; connection deterioration.

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Steel connections deterioration coefficient introduction for post-earthquake fire analysis

Tudor Petrina *

Technical University of Cluj-Napoca, 15 Daicoviciu Str., Cluj-Napoca, jud. Cluj, Romania

ABSTRACT

This paper follows the results of an experimental testing programme on steel beam-to-column end-plate connections on scale 1:1, realized in 2014. After a seismic movement, connections are important parts of a structure that may carry permanent damage. This effect is not taken into consideration by today's advanced models for fire analysis like Vulcan, Safir and other. In the first part of this work the deduction of the deterioration coefficient is done. In the second part examples of fire and post-earthquake fire analysis by applying the coefficient is done. The conclusions are in terms of difference in the fire resistance of the structure for the above mentioned cases. The experimental testing programme had as objective the achieve of information on the real behaviour of steel beam-to-column end-plate connections, used for steel structures made by 3D frames, subjected to fire, after the deterioration of the nodes produced during an earthquake. The specimens were identically executed, the sensitivity of the nodes, when varying the fire action parameters and applying connection degradation by cyclic loads, was studied by help of experimental tests. The post-earthquake tests were done during tests 4 and 6 of the above mentioned programme. The results of these tests were compared with test 1 and 2, when the specimen failed under mechanic action at 200C, with test 3 when cyclic action was applied on the specimen, following a special procedure and after that subjected to mechanic action at a temperature of 200C, with test 5 and 7 when mechanic action was applied on new specimens at 6000C and 4000C, respectively. According to these parallels, the magnitudes of applied forces and vertical displacements on the free end of the cantilever were analysed, understanding what safety measures should be applied when designing beam-to-column end-plate connections that have to resist earthquakes, accidental fire action and also under the combined action of fire after earthquake. The calibration of the advanced model by deterioration coefficient introduction showed a different behaviour of the structure in the case of post-earthquake fire. The results obtained by applying this procedure (experimentally deduce the coefficient + calibration of advanced model) were similar to results of other authors which applied numerical methods to find out the deterioration of the structure.

Key words: Post-earthquake fire; end-plate connections; deterioration coefficient; fire tests; fire resistance.

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Fire resistance of steel beam to column end plate connections

Tudor Petrina *

Technical University of Cluj-Napoca, 15 Daicoviciu Str., Cluj-Napoca, jud. Cluj, Romania

ABSTRACT

The study describes numerical simulations that were conducted on a substructure of a steel building, namely a beam-to-column endplate connection. These simulations were made in order to know more about the behaviour of this connection before putting up and start experimental tests. The fire action is simulated by applying time-temperature curves on the studied structure. The model is advanced, taking into account for all types of nonlinearities, the computation being iterative. Two main fire cases were studied while the applied force was increasing on the structure. According to the European design codes, fire resistance of structures may be determined by simplified methods or table methods. Many times instead, a numerical analysis based on an advanced method may be necessary in order to determine the behaviour and the fire resistance of the structure. The advanced models need to take into consideration the fact that at high temperatures, the material changes its properties, and they also need to take into account the geometry nonlinearity. Such an advanced model is VULCAN and with its help the substructure beam-to-column connection was analysed. From the resulted data it yields that for such a type of connection which is very robust under the normal loading, the fire resistance is low – under 30 minutes which is not satisfying for a steel structure made up of elements of the studied type. The need for fire protection for the connection is obvious.

Key words: Beam-to-column connections; advanced model; steel section; fire action; fire resistance.

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Use of different numerical models to evaluate the robustness of reinforced concrete frame structures

Dario La Mazza *, Luca Giordano, Gabriele Bertagnoli, Diego Gino, Giuseppe Mancini

Politecnico di Torino, DISEG, Corso Duca degli Abruzzi, 24, 10129 Torino, Italy

ABSTRACT

According to Eurocode, robustness is the ability of a structure to withstand events like fire, explosions, impact or the consequences of human error, without being damaged to an extent disproportionate to the original cause. Avoiding the progressive collapse of a building in presence of accidental loading conditions is one of the challenges for the designers. The tie-force method is actually one of the most used design techniques for resisting progressive collapse, whereby a statically indeterminate structure is designed with reference to local simplified models determined in accordance to the failure mode considered. In this work a computational study of a reinforced concrete frame is presented. The structure studied is a beam-column assembly which represents a portion of the structural framing system of a ten-story reinforced concrete frame building and is subjected to monotonically increasing vertical displacement of the centre column to simulate a column removal scenario. Two different finite element models, with distinct levels of modelling, are used in order to compare the numerical results with the experimental ones coming from a full-scale test, and evaluate the ability of the models to simulate the structural behaviour of the frame. After this stage, it has been studied the assembly behaviour taking into account the presence of a distributed load on the beams, in order to simulate the actual working conditions of the structure. In this phase the model that has been considered is that, in the previous stage, has achieved the better results in terms of simulation of the actual behaviour of the structure.

Key words: Structural robustness; tie-force method; progressive collapse; reinforced concrete.

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Practical application of CAE using the examples of the floating stages of the lake side festival in Bregenz (Austria)

Gerhard Lener *

University of Innsbruck, Institute of Structural Engineering and Material Sciences, Unit of Steel Construction and Mixed Building Technology, Technikerstraße 13, A-6020 Innsbruck, Austria

ABSTRACT

The design of modern and architectural sophisticated constructions in civil engineering can practicable only be realised by using CAE. This means on the one hand the use of full 3D CAD Systems during the architectural design process and on the other hand the use of full 3D numerical calculation methods like the Finite Element Method (FEM) during the engineering construction process. The combination of the mentioned CAE methods allow the development of highly sophisticated buildings. The practical use of these methods will be shown by the examples of the floating stages of the lake side festival in Bregenz (Austria), which were new designed and built every two years. The aim is to show the development process from the first designs up to the finished stage, which is only possible by a close collaboration between designers and engineers.

Key words: CAD; FEM; floating stage; steel construction.

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Refurbishment of existing residential building stock by over-roofing with modular steel intensive solutions

Andra Floricel ^{*1}, Viorel Ungureanu ^{1,2}

¹ Politechnic University Timisoara, Department of Steel Structures and Structural Mechanics, Romania

² Romanian Academy –Timisoara Branch, Romania

ABSTRACT

In present economic, environmental and social climate, refurbishment or conversion of existing residential buildings comes in aid to both producer and consumer needs for comfort, efficiency and affordability of expanding the liveable spaces. One of the most appealing and popular solutions for building adaptation to which engineers incline is refurbishment by over-roofing. Together with over-cladding, this becomes an integrated global solution, which not only achieves the main goal of enlarging the living spaces, but also gives energy efficient “new-born” buildings, implicitly solving the lack of space for new constructions that modern dense populated areas are confronted with. In this manner, steel-intensive solutions are ideal systems for over-roofing the existing precast concrete panel buildings due to their lightness, reversibility and clean sites. Also, they can adapt to existing structural systems, several structural typologies can be thought, not to mention that the cost-benefit balance is improved due to prefabrication. Present paper presents and compares three types of over-roofing structural solutions based on intensive use of steel elements, i.e.: a) hot rolled steel; b) rectangular hollow sections; c) cold-formed steel profiles. The steel intensive solutions were analysed from structural and numerical point of view, by implementing the entire modular solutions together with the existing concrete building in a FEM software for determining the behaviour of both the additions and of the building after conversion, for each case scenario. After preliminary structural comparative analyses, the column-based solutions based on cold-formed profiles are further detailed, by using a finite element numerical analysis, in order to determine the optimum column-based connection solution for these over-roofing of existing residential buildings systems. Different anchoring solutions are implemented: bolted connection with angle profiles, as well as connection by chemical anchors. Even though the first solution is the traditional one, the latter seems to be the most favourable for minimum concrete damage and disruption to the last level inhabitants.

Key words: Over-roofing; light steel structure; numerical analysis.

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Short steel thin-walled columns subjected to eccentric axial loads

Radoslav Pavazza, Frane Vlak *, Marko Vukasović

University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Rudjera Boškovića
32, Split, Croatia

ABSTRACT

The purpose of the article is to estimate a simple analytical solution for the stresses and displacements of short thin-walled columns of open bisymmetrical cross-sections subjected to eccentric axial forces. The theory of bending and torsion with the influence of shear is applied. Simple analytic closed form solutions are investigated, both for the stresses and displacements. The normal stresses are expressed by the compression component, the bending components in two principal column planes and the torsion component with respect to the principal cross-section pole (the shear centre). The displacements are expressed with respect to the longitudinal axis, to the two principal cross-section transverse axes and to the angle of torsion with respect to the principal pole. The displacements with respect to the transverse axis and to the principal pole are given by the bending and torsion components according to the classical theories of bending and torsion (Vlasov, 1961) and by the additional components due to shear in bending and torsion according to theory of bending and torsion with influence of shear (Pavazza, 2005, 2013). The method of initial parameters is applied (Pavazza, 2007). Columns clamped at one end and simple supported at the other are examined. The results are compared with the results of the shell finite element analyses. Even extremely short columns are examined and good agreement with the results of the finite element analysis is obtained. The obtained simple analytic solution for short columns can be a useful tool in structural analyses, even for extremely short columns, when buckling may be neglected, especially in the early design stage of thin-walled structures.

Key words: Columns; thin-walled; compression; bending; torsion; shear.

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Toward a structural comprehension of a Spanish Colonial Stone Masonry Monument: the church of Mission San Jose y Miguel de Aguayo in Texas

Angela Lombardi *, Saadet Toker Beenson

University of Texas at San Antonio, 501 W. Cesar E. Chavez Boulevard, 78207 San Antonio, Texas, USA

ABSTRACT

The Catholic Church and the Spanish government established mission compounds and a small military base in San Antonio in 18th century as a part of Spain's territorial expansion from Mexico. The missions were used to introduce native people to Catholicism, to teach them Spanish, trading and citizenship skills. With more than 80 structures surviving, the mission compounds are a tangible and well-preserved representation of the influence of Spain in the New World. The focus of this study is the structural assessment of the church of the Mission San Jose y Miguel de Aguayo, in San Antonio, Texas which is one of the most elaborated mission, regarding size and design. After the collapse of part of its original structure in 1868 and 1874, the church of Mission San Jose underwent a major restoration in 1936 that called for reconstruction of one of its longitudinal walls, barrel vaulted ceilings, dome and the front façade bell tower. For the restoration of the church, originally built with rubble stone masonry walls and ceilings, 'innovative' construction techniques were used – when needed -, such as reinforced concrete elements, hidden behind stone veneers. In this study, a finite element model of the church will be used to determine the effects of the reconstruction on its overall structural performance. The finite element model was created on the basis of a recently undertaken building survey documenting reconstructed monument's portions. Therefore, model and the analysis will cover the differences between the original and reconstructed structures as well as the differences between the masonry construction techniques of the 18th and 20th centuries. Based on these differences, two sets of analyses will be realized under gravity and dynamic loads. The results of the analyses, along with the adoption of historic preservation principles, provide essential tools for future integrated conservation plans. These plans are crucial for San Antonio missions, now more than ever, since their properties have been included in the UNESCO World Heritage Site list in July 2015.

Key words: San Jose Mission Church; masonry structure; structural assessment of historic masonry; analytical modeling of historic masonry vaults.

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Lifelong learning in structural engineering: the SEISMOCODE platform

Radu Pascu ^{*1}, Iolanda-Gabriela Craifaleanu ^{1,2}, Ovidiu Anicai ³, Livia Stefan ³, Viorel Popa ¹, Vasile Virgil Opreşoreanu ¹, Ionuţ Damian ¹, Andrei Papurcu ¹, Cristian Ruşanu ¹

¹ Technical University of Civil Engineering Bucharest, 124 Lacul Tei Blvd., Bucharest, Romania

² INCD "URBAN-INCERC", 266 Pantelimon St., Bucharest, Romania

³ Institute for Computers, ITC S. A., 11A Fabrica de Glucoza St., Bucharest, Romania

ABSTRACT

The enforcement of the European harmonized structural design codes in Romania represented a major turning point for the national regulatory system in the field of civil engineering. Some of the most significant changes were introduced by the new version of the seismic code for the design of new buildings, P100-1. With its first version published in 2006, followed by a revision in 2014, the code poses, until today, several problems to practitioners. For a seismically-prone country like Romania, the earthquake resistant design of buildings is of utmost importance. The first Romanian instructions for the seismic design of buildings were issued in 1941, while the first compulsory prescriptions were enforced in 1963. Several versions of the national seismic code were issued since, each implementing lessons from the destructive earthquakes that affected the country in 1977, 1986 and 1990. In preparation of the accession of the country to the European Union in 2007, the whole regulatory body was harmonized with the European one. This included the adoption of Eurocodes as national standards, as well as the harmonization of the national building codes with European norms. Some of the newly-introduced concepts and methods were found rather difficult to assimilate by practitioners. Even though several initiatives for the dissemination of the new regulations were made, there is still very much to do for the full understanding and correct application of the new provisions. The SEISMOCODE online lifelong learning platform aims to provide an easy accessible and efficient system for the active assimilation of these provisions. Developed by a team that includes authors of the new versions of the code, the platform, based on the Moodle system, will consist of a body of knowledge, several wiki sections, as well as exercises, tests and quizzes and a collection of multimedia resources. A forum will be also configured, to allow for user interaction and feedback. The platform, which focuses on the seismic design of reinforced concrete structures, is developed in the framework of an ongoing national R&D project. The concept of the platform, its present state, as well as several methodological aspects are presented.

Key words: Lifelong learning; online education; seismic design codes; European harmonized regulations; structural design; reinforced concrete.

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Latin Hypercube sampling for simplified probabilistic seismic assessment of continuous span RC bridges

Ricardo Monteiro *

IUSS Pavia, Palazzo del Broletto, Piazza della Vittoria n.15, 27100 Pavia, Italy

ABSTRACT

The assessment of the seismic response of bridges, or structures in general, is dictated by the influence of a large number of aleatory and epistemic uncertainties related to the estimation of the structural capacity and demand. If reinforced concrete structures are taken into account, the uncertainty levels associated to each relevant material variable may be considerably high. Specifically, the characterization of the capacity will essentially depend on the material properties (concrete and steel) of the resisting members' cross-section whereas the demand will largely depend on the probability associated to different intensity measure levels and the selection of corresponding ground motion records. When seismic safety assessment is sought, probabilistic frameworks are typically employed, in which the different variables are statistically defined and processed. To such extent, random simulation is a primary tool, in order to take into account as accurately as possible the different sources of uncertainty. This manuscript addresses the use of Latin Hypercube sampling (LHS), an advanced and optimized aleatory simulation scheme with respect to traditional algorithms evermore employed, for the calculation of the failure probability of existing RC bridges through a relatively simple framework. Different variables typically considered in a seismic assessment procedure (material properties, earthquake records, intensity level) are statistically characterized, within a global simulation process, to define capacity and demand. The LHS scheme is scrutinized with a view to further probe its suitability in the safety assessment of RC bridges, assess its robustness under different conditions and define the necessary sample size to ensure accurateness in the analysis of the selected bridges. Recommendations to the users of the method, with a view also to practitioners, are made accordingly.

Key words: Seismic assessment; RC Bridges; Latin Hypercube; random sampling; failure probability.

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Parametric characterization of Italian RC bridges for seismic vulnerability assessment

Claudia Zelaschi ¹, Ricardo Monteiro ^{*1}, Rui Pinho ²

¹ IUSS Pavia, Palazzo del Broletto, Piazza della Vittoria n.15, 27100 Pavia, Italy

² University of Pavia, Department of Civil Engineering and Architecture via Ferrata n. 1, 27100 Pavia, Italy

ABSTRACT

The nodes of a road transportation network of a certain region can represent a population of bridges. In view of a sound characterization of corresponding fragility or vulnerability functions, the knowledge of real data, such as geometrical and material properties available from a national bridge inventory database, is a crucial element. In fact, the outcome of damage seismic assessment can be strongly affected by the variability of such information. When only limited information for each node is known and the relevant structural behaviour needs to be assessed for e.g. loss estimation studies at macro-scale level, the use of statistical tools is of extreme importance. Accordingly, the present paper furnishes a double-fold contribution: (1) provide the systematic statistical characterization of geometrical and material properties of typical Italian reinforced concrete (RC) bridges and (2) simplified formulae for the quick evaluation of the fundamental elastic period of vibration of RC bridges. This allows the development of typological fragility curves for RC bridge classes, which might be chosen according to their fundamental period of vibration. As such, the bridges can be identified with a specific bridge class, characterized by a representative fragility curve, used for expedite large-scale seismic assessment.

Key words: Seismic loss assessment; random sampling; goodness-of-fit tests; statistical distribution; Italian RC bridges.

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Numerical determination of dynamic response of the structure on the example of arch bridge

Stefan Pradelok *, Marcin Jasiński, Tomasz Kocański, Grzegorz Poprawa

Silesian University of Technology, Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

In this paper method of dynamic analysis of structure subjected to passage of high speed trains is proposed. Application of the European Standards and results of calculations are shown. As an example single track arch railway bridge designed for a normal railway line was chosen. Authors shows that presented structure may not comply with all the conditions specified in the design code. In Western Europe, passenger trains reach speeds up to 320 km/h. In Poland, the maximum speed is reaching 200 km/h. currently, widespread modernisation of key railway lines is realised. This results in an increase in investments in rail infrastructure of which a sensitive part are bridges. According to standard PN-EN 1991-2:2007, railway bridges often require a dynamic analysis of the structure's response to the passing train at the design stage. This analysis is aimed at verifying two factors - first, whether train passing with high speed will not cause greater displacements of the structure than the effects of static load with taking into account the dynamic factor; and second - whether the condition of not-exceeding maximum vertical accelerations of the bridge deck under the passing train is satisfied. For the purpose of time history analysis, steel, one-track through arch bridge was chosen. With assumed stiffness parameters and masses of the entire superstructure, modal analysis was conducted, which determined the main mode shapes and corresponding natural frequencies. Calculations of bridge under the load of one HSLM-A8 train at speeds ranging from 140 to 300 km/h was conducted. In time history analysis, vertical displacements and accelerations of bridge in 4 selected points were determined. The conducted analysis proved that the limit value of vertical acceleration of span was exceeded several times. The most dangerous velocity of the passing train in the considered structure, due to acceleration, turned out to be 260 km/h. Maximum acceleration, obtained from calculations for speeds up to 200 km/h, do not exceed 3.50 m/s². This speed is the limit value, below which it is necessary to conduct dynamic analysis only if the conditions of natural frequency of the structure are not satisfied. It can be concluded that the analysed bridge does not meet the standard conditions related to high-speed rail due to significantly exceeded limit acceleration of the span. Structures on HSRL should be massive structures with high inertia and low response to dynamic excitation. The considered structure was designed with consideration of static loads only. This gave a relatively slender, lightweight object. Such objects, unfortunately, cannot fulfil their role in the case of high-speed rail.

Key words: Arch bridge; railway bridge; numerical analysis; time history analysis (THA); high-speed load model (HSLM); high-speed railway.

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Theoretical analysis of the possibilities to improve the dynamic parameters of the road arch bridge

Stefan Pradelok *

Silesian University of Technology, Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

During the load test of the road arch viaduct, it was found that it is very sensitive to dynamic effects. The occurrence of beats at the frequency of 2.50 Hz was registered. The sensitivity of the viaduct may therefore be associated, at the mentioned frequency, with the resonance and coupling of the forms of similar frequencies. Such behaviour is unusual for bridge structures. In order to clarify the causes of this phenomenon, a number of numerical analyses of the structure were conducted. Analysed structure of the viaduct consists of a pair of hingeless steel arches connected to the reinforced concrete deck by the steel hangers. Computational model was developed on the basis of the as-built documentation of the viaduct. In the calculations, a spatial bar model of stiffness and mass resulting from the characteristics of the steel-concrete arch structure were used. It was found that in the arch structure, which has infrequently distributed inclined hangers, it may be possible for the frequencies in similar forms of flexural vibrations to appear. During the operational extortion, it leads to their disadvantageous consonance. There are several technical possibilities to improve the dynamic parameters of the analysed type of the arch viaduct (assembly of tuned mass dampers, the change of bearings and change of the layout of hangers). Each of the mentioned methods requires changes more or less intrusive in the structural system of this arch viaduct. Usually, tuned mass dampers, in terms of regulation of dynamic parameters, gives the greatest opportunities. However, the use of this damper is pointless due to small amplitude of vibrations in the analysed viaduct. In terms of effectiveness, in the analysed structure, additional inclined hangers turned out to be the most beneficial. On the basis of the conducted theoretical analyses, the installation of the monitoring system was recommended.

Key words: Arch bridge; numerical analysis; dynamic parameters; resonance frequency.

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Evaluation of seismic performance factors in high rise steel buildings with dual lateral systems consisting of buckling restrained braced frames and intermediate moment frames

Sipan Yavarian, Rais Ahmad *

California State University, 18111 Nordhoff Street – JD 4507, Northridge, California – 91330, USA

ABSTRACT

Dual lateral systems are commonly used in high rise buildings for various architectural reasons. Buckling Restrained Braced Frame (BRBF) is an emerging seismic force-resisting system that is currently being permitted by ASCE to be used either as a single seismic force-resisting system or in combination with other seismic force resisting systems. American Society of Civil Engineers (ASCE) provides distinct directions regarding the estimation of Seismic Response Modification Factor (R), Over Strength Factor (Ω_o) and Deflection Amplification Factor (Cd) when Eccentrically Braced Frames (EBF) and Special Moment Resisting Frames (SMRF) are been used in combination. But ASCE does not give any clear suggestion about what should be the R, Ω_o and Cd when stiffer Buckling Restrained Braced Frames (BRBF) are used in conjunction with softer Intermediate Moment Frame (IMF) Systems. Since, these seismic parameters (R, Ω_o and Cd) vary significantly for BRBF systems in comparison with IMF systems, it is essential to estimate and evaluate the correct values for them. In conventional practice, American Society of Civil Engineers (ASCE) suggests that in general when a stiffer lateral system is used in conjunction with a softer system in a dual configuration, the lowest Response Modification Factor (R) pertaining to the softer system shall be used. According to ASCE, when BRBF systems ($R = 8$) are used in combination with IMF systems ($R = 4.5$), we should use $R = 4.5$ as the Seismic Response Factor for analysing the entire structure. This will result in significant overdesigning of structures as higher contribution from the BRBF system are often remain unutilized. This research aims at developing a methodology for calculating modified Response Modification Factor, R for structures where dual system occurs horizontally. This research investigates the effect of using the newly suggested Modified Response Modification Factor (R) for dual systems, where a BRBF system is combined with an Intermediate Moment Frame (IMF). The study aims at proposing an innovative way of calculating Response Modification Coefficient (R), Over-strength Factor (Ω_o) and Deflection Amplification Factor (Cd) pertaining to the dual system. A wide variety of archetype sets are designed following FEMA guidelines with modified R as trial values for different seismic zones. To validate the trial values for R, system over-strength and period-based ductility, nonlinear 3D static (pushover) analyses were performed. The nonlinear models directly simulate essential deterioration modes that contribute to collapse behaviour. Afterwards, for collapse assessment, nonlinear incremental dynamic analyses are conducted.

Key words: Buckling restrained braced frame; intermediate moment frame; response modification factor; over strength factor; deflection amplification factor.

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In scale model of the bridge for system identification

Milan Sokol, Michal Venglár *

Slovak University of Technology, Faculty of CE, Department of Structural Mechanics; Radlinskeho 11, SK-810 05, Bratislava; Slovakia

ABSTRACT

The article deals with a part of structural health monitoring (SHM) of in scale model. Investigated experimental model is similar to the bridge situated in western part of Slovakia. After laboratory tests we want to continue with in-situ monitoring of original bridge. During the first stage of testing only the basic dynamic characteristics - mass and stiffness have been verified. Therefore, the different boundary conditions were assumed and namely boundary conditions for cantilever beam instead of those for simply supported beam. This set up allowed us to construct the boundary conditions easier. Many difficulties have occurred during the preparation and validation e.g. different thickness of individual cross-sections, modelling of hinge joints according to the experimental model, modelling of real supports, appropriate parameters of bolts etc. It was necessary to measure every single cross-section because of the big variation between them. The emphasise was done to modelling of the selected joints especially of the set of 6 bolts on two diagonals of the bridge. The changes in dynamic characteristics according to the different numbers of bolts in a joint have been measured. Of course at the beginning the natural frequencies were calculated and compared for both cases model and test. Modal analysis of the structure was performed in FEM software ANSYS. After a few steps of tuning the result was sufficient precise and the difference between measured and analysed results was small. Finally, the test set up and numerical model similarity was quite acceptable. The next step which is currently being started is the investigation of the damage in joints of two diagonals. The methodology of dynamic testing appropriate for identification is now being verified.

Key words: Validation; modal analysis; system identification; truss model, joint, bolt connection.

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Assessment of Gura Raului Dam Safety Using Measurements of Structural Response to Ambient Vibrations

Daniel Gaftoi *, Altan Abdulamit, Dan Stematiu

Technical University of Civil Engineering Bucharest, 124, Lacul Tei blvd., sector 2, 020396 Bucharest, Romania

ABSTRACT

A very important research direction in today's dam engineering is related to structural ageing of concrete dams and ways to monitor structural and material characteristics changes to reduce and manage the associated risks. In situ ambient vibration measurements used to identify the dynamic characteristics of the structure and the development of hybrid models (the mathematical model bounded to a certain in situ measurement program and calibrated using the recorded data) represent an appealing method for the evaluation of the safety reserves of concrete water retention structures. However, mathematical modelling can be done with varying degrees of complexity and the results obtained for the couple dam model - recorded data can significantly vary depending on the size and complexity of the analysed model. The presented study, developed for Gura Raului buttress dam in Romania, consisted in 2 measurements campaigns and the development of 4 mathematical models, via the finite element method, with different degrees of complexity - a representative maximum height block, a spillway block, the whole spillway made of 3 identical blocks and the complete dam made of 22 blocks. The paper presents the in situ measurement results, the calibration of the maximum height block based on the first measurement data set and the analysis of the results obtained for the other 3 models compared with the recorded data.

Key words: Vibration measurements; hybrid model; finite element method; buttress dam; structural ageing.

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Strengthening under load: the effect of preload magnitudes

Martin Vild *, Miroslav Bajer

Brno University of Technology, Faculty of Civil Engineering, Institute of Metal and Timber Structures, Veveří 331/95, 602 00 Brno, Czech Republic

ABSTRACT

Strengthening existing structures under load by welding plates is often conducted but little research into this subject was presented. Some researchers claim that the column strengthened under load has the same ultimate capacity as the built up column welded without preloading. Others disagree and recommend safe design not allowing the steel to yield. The paper presents the parametrical study of wide flange columns HEA 100 strengthened under load via two plates parallel to flanges conducted on numerical models validated by experiment. The varying parameters are thickness of strengthening flange, column length, initial bow imperfection, preload magnitude and direction of the axis which is pinned while the other axis is fixed. The experimental research was performed in the Test Laboratory of the Institute of Metal and Timber Structures of the Faculty of Civil Engineering, Brno University of Technology and it consisted of two built up columns welded without preload and two columns strengthened under preload ratios (preload magnitude divided by base column ultimate strength) equal to 0.5 (200 kN) and 0.75 (300 kN). All columns were 3 m long and the boundary conditions were determined by knife-edge bearings which ensured pinned supports in the direction perpendicular to the stronger axis and fixed perpendicular to the weaker axis. All strengthening plates were welded to columns with intermittent welds. Shielded metal arc welding method was used for the columns built up without preloading and gas metal arc welding process was used for the columns strengthened under load. All columns failed by flexural buckling and local buckling occurred only after ultimate strength was reached. The numerical models used for the parametrical study were created in ANSYS software. Design values and procedures recommended by EN 1993-1-5, Annex C were used. The most commonly used steel S235 (yield stress $f_y = 235$ MPa, Young's modulus of elasticity $E = 210$ GPa) was selected for all plates. Shell 181 element type was used for mapped meshing of steel plates. Element birth and death feature was convenient to simulate strengthening under load. Equivalent initial bow imperfection of the first eigen buckling shape was included, the model was loaded by force and geometrical and material nonlinear analyses were performed. From provided results some conclusions can be reached. The load under which the column is strengthened slightly weakens the column but not by far to the extent of design recommendations used in the Czech Republic. The reduction ratio (ultimate load capacity of column strengthened under load divided by ultimate load capacity of column built up without preloading) decreases with increasing preload magnitude and column slenderness. Surprisingly, the initial geometrical imperfection, while affecting ultimate capacity greatly, has almost no effect on the reduction ratio.

Key words: Steel structures; strengthening; finite element analysis; column; welding; flexural buckling.

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Assessment of the vibration influence on humans in buildings in the standards of different countries

Alicja Kowalska-Koczwara *, Krzysztof Stypula

Cracow University of Technology, Cracow, Warszawska 24 St., 31-155, Poland

ABSTRACT

In an increasingly globalized world it is striving to unify of regulations of standards also in the field of civil engineering. Concerning the influence of vibration on humans residing in buildings similar trend is noticeable. After 2003 there have been changes in standards in this area in many countries. It is evident striving to unify the regulations of the standards for passive perception of vibration with standards for active perception of vibration by humans. When occupants can percept vibration in buildings, this may potentially influence on their quality of life or working efficiency. In contrast it is well known that people tolerate much higher vibration values in vehicles than in buildings. It is because excited vibrations in buildings and in vehicles are in different frequency range. Percept frequencies in buildings are in low-frequency range close to frequencies of human body internal organs. That is why active and passive perception should be considered separately. Occupants can detect building vibration values that are much below those that can cause any risk of damage to the building or its contents. The level of vibration that influence on human comfort is lower than that associated with building damage. Therefore nowadays the dominant design and diagnostic parameter in the context of the vibration is their perception by humans. Seemingly similar regulations specified in standards can be interpreted differently in various countries. This study presents analysis of such interpretation in the following standards: Polish PN-88/B-02171, British BS 6472-1, Japanese AIJ-GEH-2004, Australian AS 2670.1–2001, American ANSI S3.29-1983, German DIN 4150-2, and ISO international standards ISO 2631-1 and ISO 2631-2. There were analysed in particular parameters for assessing the influence of vibration on humans, the range of considered frequencies, duration of vibration, signal processing and general approach to the problem.

Key words: vibrations, human perception of vibrations, standards regulations, RMS value, VD_V, duration of vibration.

Key words: Vibration influence; human; buildings; standards.

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FRP composites and their using in the construction of bridges

Robert Sonnenschein *, Katarina Gajdosova, Ivan Holly

Slovak University of Technology, Faculty of Civil Engineering, Department of Concrete Structures and Bridges,
Radlinskeho 11, 810 05, Bratislava Slovakia

ABSTRACT

Traditional material for concrete reinforcement is steel. In recent times, non-metallic fibres (steel, glass, aramid, carbon, polyethylene and polypropylene) as dispersed short fibres (together with different structures such as yarn, chopped yarn, strings, nets, fabrics, and polymer composite material reinforcement (bars and cages)) have been intensively investigated and some of them used for construction of bridges. FRP composites are durable materials which are different from the steel reinforcement for their resistance to the electrochemical corrosion. The advantages of FRP composites are high tensile strength, low density, electromagnetic neutrality and non-conductivity. With respect to steel, different mechanical behaviour of non-metallic reinforcement, however, involves some drawbacks - namely the lack of thermal compatibility between concrete and FRP reinforcement. Due to the difference between the transverse coefficients of thermal expansion of FRP bars and concrete, the temperature increase is inducing tensile stresses within the concrete member. These tensile stresses may cause splitting cracks within the concrete and eventually lead to degradation of the member's stiffness. FRP composites belong among anisotropic materials. Their properties depend on the type, volume and alignment of the fibres, the matrix type, form and quality of the construction. The analysis of causes of failures on German bridges shows that reinforcement corrosion initiated by chlorides makes up 2/3 of all the failures recorded in the bridge construction. Corrosion of reinforcement initiated by chlorides is the main cause of the loss of serviceability of bridge structures. In such an environment, fibre-reinforced polymer (FRP) reinforcement can fully replace the traditional steel reinforcement. The paper presents the mechanical properties and durability of different types of FRP rebars and their use in construction of bridges.

Key words: FRP composites; serviceability of bridge structures; properties of FRP composites.

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Influence of SPH regularity and parameters in dynamic fracture phenomena

Martin Hušek *, Jiří Kala

Brno University of Technology, Faculty of Civil Engineering, Institute of Structural Mechanics, Veveří 331/95, 602 00
Brno, Czech Republic

ABSTRACT

The Smoothed Particle Hydrodynamics (SPH) method can be with advantage used in the field of fracture mechanics, especially when quasi-brittle materials are involved. Advantages of the SPH method are more evident when loading speed increases and dynamic material fractures start to occur. Since the SPH method is one of the mesh free methods the large deformation and eventual fragmentation of material in simulation can be solved without major complications. This happens because of a phase of SPH method – neighbouring particle searching and constraints creating between them in chosen time interval. The number of neighbouring particles depends on the size of the area where the search takes place. This area – support domain may therefore be considered as one of the key control elements in simulations using the SPH method. The SPH method (as other numerical methods) also suffers from some numerical issues resulting from the properties quality of the SPH algorithm, e.g. the support domain size. Dependence of the number of particles and their initial distribution on the results is also a question. Particle clusters (areas with increased particles concentration) may be formed in case of poor regularity. If material density is constant then mass of these particles is minor. Consequently, false (numerical) cracks which bypass these clusters may appear in the simulation. It is not generally known how much these irregularity in initial particle distribution may affect the results. The article describes an experiment from the field of concrete L-specimens dynamic loading simulated by the SPH method. Different density distributions and regularity of the initial particle distribution are chosen in the simulation. Other variables are e.g. support domain size, frequency of neighbouring particle searching, loading rate and volume ratios per individual particles. The results show that especially the regular particle distribution of initial configuration is necessary for a successful execution of the simulations. The results are also influenced by the density of the particle distribution. However, the regularity of this distribution in the initial stage of the simulation is a greater problem. False cracks tend to occur more frequently with increasing particle distribution irregularities. A certain degree of compensation can be achieved by appropriate choice of support domain size with its variations during the simulation.

Key words: Smoothed particle hydrodynamics; nonlinear constitutive model; numerical fracture; concrete.

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Analysis of the behaviour of foundations of historical buildings

Monika Zielińska *1, Jarosław Przewłócki, Ilona Dardzińska

Technical University of Gdańsk, Faculty of Architecture and Faculty of Civil and Environmental Engineering, ul.
Narutowicza 11/12, 80-233 Gdańsk, Poland

ABSTRACT

An understanding of the work of foundations of historic buildings requires not only a deeper knowledge of soil mechanics and foundations but the history of building technology and construction materials. For each specific case, the foundation of the historic facility would include a number of different types of detailed research. Currently, foundations are made almost entirely of reinforced concrete although other materials are also still used. Foundations of monuments were mostly constructed in the form of benches or footings made of stone or brick and also concrete, often supported by wooden structures. To evaluate the quality of materials used in foundations of historical objects it is necessary to follow currently used requirements. Comparison of specific physical-mechanical parameters of ancient and modern foundations may be one of the elements of the analysis of their behaviour. The paper is mainly limited to the basic material and form of construction, i.e. stone strip footing. Characteristics of historical foundations are describe in the paper. The article is devoted to the analysis of the behaviour of the foundations of historic buildings. Some basic aspects of foundation engineering are briefly discussed, with an emphasis placed on its development, applied techniques, and materials. Several different approaches and methods for the analysis of foundations of historical buildings are presented. A particular analysis has been focused on an example of a typical stone foundation from the sixteenth century. First, the calculations have been performed using the finite element method, then the bearing capacity and the settlement analysis has been determined according to EC-7. Next, the bearing capacity has been evaluated using so called "tabular method", applicable in the previous Polish standard. A settlement of the foundation has been also estimated using Kerisel's proposal. The information should allow for a better understanding of the behaviour of foundations discussed in this research, and especially of methods of their analysis. A comparison analysis has been performed and possible directions for further research in this field have been indicated.

Key words: Historical buildings; foundations; settlements; bearing capacity; numerical analysis.

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Foam concrete layer as sub-structure of industrial concrete floor

Marta Kadela *¹, Marcin Kozłowski ²

¹ Building Research Institute, 00-611 Warsaw, 1 Filtrowa Street, Poland

² Silesian University of Technology, Faculty of Civil Engineering, Department of Structural Engineering, 44-100 Gliwice, 5 Akademicka Street, Poland

ABSTRACT

Nowadays, development of building industry and increasing demand for building materials related make that new warehouse centres emerge. This policy allows for delivering of building materials within shorter time and thus make them cost-attractive. At the same time, due to sustainable development policy new materials and solutions are favourable to decrease amount of materials applied and energy consumption by industrial buildings. Concrete industrial floors must meet a number of various requirements, such as limited cracking, flatness and sufficient load-bearing capacity. Besides redundancy and visual aspects, the industrial floors must also show good thermal performance. Development and application of foamed concrete layer, due to its mechanical performance together with reinforced concrete slab and thermal properties, seem to be adequate solution a sub-structure layer for industrial floors. The article provides literature review on foamed concrete and shows results of numerical simulations of concrete industrial floor with foam concrete layer as sub-structure and soil conditions based on real project. It includes also comparison of numerical results with a simplified analytical approach commonly used by structural engineers. Mechanical and thermal properties of foamed concrete used in the numerical models were based on tests performed within research project. The numerical simulations were performed with the use of ZSoil finite element software.

Key words: Layered structures; numerical model; finite element analysis.

* Corresponding Author

This work was supported by the on-going research project "Stabilization of weak soil by application of layer of foamed concrete used in contact with subsoil" (LIDER/022/537/L-4/NCBR/2013) financed by The National Centre for Research and Development within the LIDER Programme.

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Numerical investigation of load-bearing timber glass composite beam

Marcin Kozlowski ^{*1,2}, Marta Kadela ³

¹ Eckersley O'Callaghan, 9th Floor, 236 Gray's Inn Road, London WC1X 8HB, England

² Silesian University of Technology, Faculty of Civil Engineering, Department of Structural Engineering, 44-100 Gliwice, 5 Akademicka Street, Poland

³ Building Research Institute, 00-611 Warsaw, 1 Filtrowa Street, Poland

ABSTRACT

Current trends in modern architecture are focused on minimising the boundaries between the external environment and interior of the building. This requires a continuous increase of the amount of translucent surfaces allowing natural sunlight to enter the building, not only in facades but also as interior elements. The research project on hybrid timber-glass beams is based on an assumption that timber and glass work together to carry external loads. Glass no longer acts as a filling, as in traditional solutions, but actively participates in load transfer. The research project involves the most important mechanical properties of very different materials: the stiffness and strength of glass and ductile nature of timber to build a modern, safe and durable building components. The research project involves a single pane web made of annealed float glass and timber block flanges bonded together with an adhesive. Even if the glass web fails, due to overloading or an act of vandalism, the glass shards are held in place by the timber flanges and the beam can still withstand loading. The bottom flange with the bond line adhesive connection acts as a bridge: the tensile forces that before failure were carried by the tensile zone of the web are now transferred by the timber flange. Therefore, the concept prevents brittle failure of the beam, provides ductility and offers a high post-breakage strength after possible glass failure. The post-breakage strength relates to an increased value of the load at final collapse of a beam in relation to the load at which an initial crack in the web occurs. The paper presents results from numerical simulations of beam specimens using Finite Element Code ABAQUS. Explicit solver and Brittle cracking material model for glass were used to simulate cracking of glass. The Influence of element geometry, element size and value of fracture energy on results were analysed. From these studies the most suitable model parameters were chosen for final models of composite timber-glass beams. The models were validated by comparing their results with experimental studies.

Key words: Timber-glass composites; beams; brittle materials; brittle failure.

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Vibration of a double-string complex system with viscoelasticity interlayer under a moving force

Jarosław Rusin *

University of Zielona Góra, Faculty of Civil Engineering, Architecture and Environmental Engineering, prof. Z. Szafrana 1,
65-516 Zielona Góra, Poland

ABSTRACT

This paper focuses on the free and forced transverse vibration of a double-string complex system with viscoelastic interlayers under a moving force. The complex systems are very important as structural members with high strength to weight ratios. The paper includes the study of a dynamic behaviour of a finite, simply supported double-string flexible complex system subject to concentrated force moving with a constant velocity on the top string. The strings are non-identical, parallel one upon the other. The viscoelastic interlayer is described by the viscoelasticity Kelvin-Voigt model consists of a Hookean elastic spring and a Newtonian damper distributed in parallel. The solution of the response of complex systems subjected to a force moving searches as a classical form of an infinite series by the method of Bubnov-Galerkin (MBG). Responses of structures to moving loadings are often complex and difficult to understand, especially because of the complex nature of vibration and moving load speed repeatedly complicated systems. A string as a simple model of a one-dimensional continuous system resistant to tension but not to bending is often used in analysis of numerous engineering structures and has been a subject of great scientific interest for a considerable time. The reason for this interest is that the vibrations of a string are described by the wave differential equation. This allows one to see the wave effect in a string, contrary to many more complex systems where it might be either not present or not clearly visible. The double string connected in parallel by linear elastic elements and dampers can be studied as a theoretical model of composite system or pre-stressed structure in which impact of layers interaction, damping interlayer coupling effects, and transverse wave effects are taken into account.

Key words: Flexible model; vibration complex system; viscoelasticity interlayer; moving load.

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Evaluation of FRP-concrete bond in repaired concrete bridge girders and columns

Nur Yazdani ^{*1}, Eyosias Beneberu ¹, Hemachand Pallemapati ²

¹ University of Texas at Arlington, Department of Civil Engineering, Box 19308, Arlington, TX 76019, USA

² AG&E Structural Engenuity, 15280 Addison Road, Suite 310, Addison, TX 75001, USA

ABSTRACT

Fibre Reinforced Polymer (FRP) strengthening is being increasingly used to strengthen deteriorated, damaged or structurally unsafe concrete bridge girders and columns. Many highway departments are using the technique due to the economy, durability, convenience and low labour requirements. The performance evaluation of the FRP-epoxy-concrete bonding is important because of possible long-term environmental degradation, and also possible lack of quality control during the initial FRP installation. The carbon FRP (CFRP) wrapping on girders and columns on eight concrete bridges in the greater Dallas-Fort Worth area was evaluated with ASTM pull-off testing to assess the current condition of the interface bonding. A majority of the samples failed in the concrete substrate (the preferred ASTM mode of failure indicating strong bond presence). However, large variations in the test data on failure modes and pull-off strengths, possibly due to age related environmental degradation or improper quality control during the initial CFRP application. A majority (83%) of column samples failed adequately in the desired ASTM Mode G failure. Girder FRP samples predominantly failed in Mode G (44%), although less in proportion than that in column samples (83%), possibly due to greater chance of improper initial application of FRP on girder surfaces with various sides, change in angles between surfaces and accessibility issues than that on column surfaces. For the same initial application procedure and FRP age, average bond strength from columns samples was 12% lower than that from the girder samples, most likely due to the higher strength concrete used in precast girders in general. The bond strength decreases with age in general with a wide scatter around a straight line model (with a low correlation coefficient).

Key words: FRP wrapping; bridge strengthening; bridge repair; ASTM pull-off test; bridge evaluation.

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Automated system for displacement frequency and amplitude determination of high-rise structures based on GNSS

Maciej Wrona, Wioletta Piotrowska *

Military University of Technology, 00-908 Warsaw, Poland

ABSTRACT

This paper describes research that have been taken by Centre of Applied Geomatics at Military University of Technology. The main task of the work was to develop efficient measurement system for constructions displacement monitoring using Global Navigation Satellite System. Authors focus on precise positioning methods that may be implemented as efficient source of information about constructions health and became a specific sensor for Structural Health Monitoring systems. First step of workflow presents off-line solutions for construction displacement measurement. For this solution results of bridge construction measurements were described. Second step was focused on developing on-line monitoring solution. As a result of this work, authors describes automated system for high-rise concrete chimney displacement monitoring. Basis information that determine such constructions health is amplitude and frequency of displacements caused by heat and wind loading. Developed system brings a new automated tool for permanent monitoring of this parameters including on-line quality check solutions. Results of measurements taken with this system at different weather conditions are presented in details. Paper also describes proposal of system improvement in two ways. First way is an idea of using low cost solutions what become possible after new GNSS precise positioning solution development. The second way is the methodology which use GNSS simulator device that enables to analyse and optimise newly designed systems.

Key words: GNSS; GPS; SHM; amplitude; frequency; displacement.

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Study of light concrete masonry walls with horizontal reinforcement under compression and shear

Radosław Jasiński *, Łukasz Drobiec

Silesian University of Technology, Department of Building Structures, Gliwice, Poland

ABSTRACT

In the article research of the influence of bad joint reinforcement on the AAC masonry compressive, shear strength and a modulus of elasticity were described. The tests of masonry samples with a few types of reinforcement were made. Including 18 reinforced models under compression and 18 specimens under diagonal compression were tested according to guidelines of the European PN-EN 1052-1 and American ASTM E519-81 code. The investigations of compressive walls showed that the reinforcement influenced on the compressive strength and deformability of wall. Research of diagonal compressive walls has shown, that the most beneficial effect on cracking shear stresses and shear strength obtained using steel structural truss type reinforcement when mortar applying on the upper and down bed surfaces of units (this technology conventionally called double joints).

Key words: Autoclaved Aerated Concrete; compressive strength; shear strength; modulus of elasticity.

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Experimental examination on damping variations in a concrete beam reinforced by CFRP sheets

Mohammad Reza Davoodi *, Hossein Fallahnejad, S. R. Nabavian, H. Enayati

Babol University of Technology, Department of Civil Engineering, Iran

ABSTRACT

In this article, natural frequency and damping ratio of concrete beams reinforced by CFRP sheets undergo examination in different cracking stages. The experiments were conducted by static and dynamic loads and on beams which has reinforcing sheets in tension area and on the ones which were not reinforced. For this purpose, six concrete beams undergo experiment and become subject to static loads. This loadings continued step by step until the last stage, failure. In these series of experiments, two beams were employed as the reference beams, two of them were reinforced by one CFRP sheet after the load reached to half the ultimate load, and the other two were reinforced by two CFRP sheets after the load reached to the 75% of the ultimate load. After each step of loading and damaging, dynamic (modal) experiment was carried out on hanged beams; as a result, natural frequency and damping coefficient were obtained in each step. One of the results was the reduction of natural frequency in all the beams after loading and the creation of cracks, which can be assumed to be the result of decrease in beam hardness. This reduction continued in all loading stages until reinforcement. After reinforcement of the beams with CFRP fibers, the natural frequency increased as a result of increase in hardness.

Key words: CFRP sheets; natural frequency; dynamic experiment; modal experiment.

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Research of light concrete precast lintels

Wojciech Mazur *

Silesian University of Technology, Department of Building Structures, Gliwice, Poland

ABSTRACT

The paper presents the results of precast lintels made of Autoclaved Aerated Concrete with a total length 2.0m. The study was divided into two series of basic and general. In a basic series studied only lintel according to the recommendations of the European codes EN 846-9: 2002 and EN 1356: 1999. In a general series consisting of the 6 models examined lintels with an interacting wall of varying heights. During test, it was measured forces, displacements and deformations using inductive transducers forces and displacements. In one of the models in the study used a non-contact method of measuring strain and displacements. In a basic and general series demonstrated, among other things that the destruction of the elements followed in the zone of supporting due to shear.

Key words: Autoclaved aerated concrete; precast lintels; shear capacity; optical measurement system.

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Steel structure apartment extensions for existing large prefabricated panel collective dwellings

Miodrag Popov ^{*1}, Daniel Grecea ², Adrian Dogariu ²

¹ Politechnic University of Timisoara, Department of Architecture, No. 2/A, Traian Lalescu Street, 300223 Timisoara, Romania

² Politechnic University of Timisoara, Department of Steel Structures and Building Mechanics, No. 1, Ioan Curea Street, 300224 Timisoara, Romania

ABSTRACT

The Romanian existing building stock of collective dwellings is in a vast majority composed of reinforced concrete large prefabricated panel blocks of flats, erected in the Communist Regime. According to the 1992 Census, these standardized and widespread buildings housed almost 60 percent of the urban population of the country. Due to the small, inflexible apartments on one hand and the changing living conditions of the contemporary Romanian society, a need for extending the inner surface of the existing flats has been identified. This situation led to the adoption of technically restrictive ground-floor spatial additions and other vernacular solutions that are being applied to upper stories, some of them not being able to provide, in many cases, any forms of long term structural guarantee to their users. The present paper describes a prefabricated steel structure solution for cantilevered apartment extensions that can be independently attached to the façade, as well as some technical connecting details to the existing building. A global structural analysis performed on a virtual model depicting a widespread type of block of flats (Model 770) proves the non-intrusive influence the proposed cantilevered apartment extensions have over the existing buildings, in multiple different scenarios of attachments. Moreover, a FEM analysis of the proposed details further show the reliability of the examined solution.

Key words: Existing buildings; large prefabricated panels; collective dwellings; steel structures; independent apartment extensions; FEM analysis.

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Historical beam bridge model identification after changing its structural system into an arch

Grzegorz Poprawa *, Marek Salamak

Silesian University of Technology, Faculty of Civil Engineering, ul. Akademicka 5a Gliwice 44-100 Poland

ABSTRACT

Historical steel beam bridge over Gliwice Canal located in a small city close to the eclectic palace from 19th century has been strengthened by suspension to new steel arches. The old structure was insufficient for fulfilling current demands of road traffic and clearance. Other issue was its localisation in the vicinity of palace and lake, attractive recreational areas. Therefore the new structure should be also ready for safe pedestrian and bicycle traffic. To fulfil those conditions and also to create a landmark bridge in this interesting spot, an arch structure was chosen. Designer decided to use the old bridge and its abutments as a part of the new structure. The deck was renovated and suspended to two inclined hingeless steel arches. To accommodate pedestrian and bicycle traffic two external footbridges were also suspended to the same arches on both sides. Static and dynamic load tests of the bridge were conducted. An Operational Modal Analysis method was used to identify dynamic model of the bridge. Due to limited number of transducers and simple procedure of the test, the compromise between effort and quality was established. Good correlation between assumptions from design stage and response of erected bridge was confirmed.

Key words: Arch bridge; operational modal analysis; renovation.

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Earthquake vulnerability of masonry infilled frame structures

Mircea Barnaure *, Ana Maria Ghita, Daniel Nicolae Stoica

Technical University of Civil Engineering, Faculty of Civil, Industrial and Agricultural Buildings, Bucharest, Romania

ABSTRACT

Reinforced concrete frame structures with masonry infill are frequently used for small and medium rise residential and office buildings. Recent earthquakes have shown that the interaction between the infill panels and the frames can lead in some cases to premature structural failure. In particular, buildings that have ground floor commercial or parking spaces can have an unfavourable seismic response. The structural behaviour of masonry infilled reinforced concrete frames under earthquake loads is examined through numerical modelling. Nonlinear push-over analyses are carried out for a range of alternative configurations of a four stories frame structure. A particular attention is given to the situations where no infill walls are present at ground floor level while infills are present in the upper stories. The infills are considered in the numerical models by means of pin joined diagonal frames. Several force-displacement curves are considered for the equivalent diagonal frame. The numerical simulations lead to the conclusion that masonry infills can modify the earthquake behaviour of frame structures. Infill materials with low stiffness and strength values do not have a significant influence over a structure's behaviour. Infill materials with high stiffness and strength can significantly modify the structural behaviour of a bare frame. Firstly, the building's stiffness is much higher and secondly, frame members' stresses distribution is modified such that the building's failure pattern is different. This can be beneficial for low and moderate intensity earthquakes, as the building practically remains in the elastic state and no damage occurs. In the case of high intensity earthquakes, the lack of deformation capacity can lead to a much faster collapse of a building. A particularly unfavourable structural behaviour is obtained for soft-storey configurations with solid bricks infills. For this situation, significant horizontal displacement occurs at ground floor level only, while the upper levels remain practically undeformed. Because of this, plastic hinges at beams ends only develop at the ground floor level and the building displays very low ductility. The energy required in order to deform the building until collapse is much lower for soft storey configurations with solid bricks infills than for the bare frames. This means that these configurations are very unfavourable and can lead to serious damage and even to the partial or full collapse of the buildings during earthquakes.

Key words: Masonry infill; earthquake; soft story; nonlinear modelling; energy.

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Test arrangement of small-scale shear tests of composite slabs

Josef Holomek *, Miroslav Bajer, Martin Vild

Brno University of Technology, Faculty of Civil Engineering, Institute of Metal and Timber Structures, Veveří 331/95, 602 00 Brno, Czech Republic

ABSTRACT

Composite slab consists of the layer of concrete above the trapezoidal sheeting. The sheeting serves as a lost formwork as well as a tensile bearing member after hardening of concrete. The interaction between the sheeting and the concrete is necessary for composite action and can be ensured by prepressed embossments in the sheeting. According to nowadays codes, full scale bending tests are required in the design of the new sheeting of this type of composite slabs. An alternative longitudinal shear tests of a small part of the slab have already been derived by many authors. However, the testing arrangement is not unified. The results of the shear tests can be influenced by the magnitude and the way of application of the clamping force, the loading speed, the interface conditions and others. This paper presents a proposal of the testing arrangement and the recommendations for the testing procedure of small-scale shear tests. The recommendations are posted based on the results of several series of performed laboratory tests. The results of the proposed test arrangement are used by alternative design methods for composite slabs which use the small-scale tests results: Slip-Block Test, Simplified Method and Built-up Bars method. The calculated bending resistances from these methods are compared to the results of the performed bending tests of the slabs. The design methods are mutually compared and a sensitivity study of the influence of coefficient of friction, shear bearing capacity of mechanical interlock, overall shear bearing capacity and other chosen parameters is presented.

Key words: Composite slab; longitudinal shear; small-scale test; design method; end anchorage.

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Experimental verification of the buckling strength of structural glass beams

Ondřej Pešek *, Jindřich Melcher, Martin Horáček

Brno University of Technology, Faculty of Civil Engineering, Institute of Metal and Timber Structures, Veveří 331/95, 602 00 Brno, Czech Republic

ABSTRACT

This paper deals with experimental research of axially loaded members made of structural (laminated) glass. The purpose of the research is the evaluation of buckling strength and actual behaviour of the columns due to absence of standards for design of glass load-bearing structures. The experimental research follows the previous one focusing on measuring of initial geometrical imperfections of glass members. Within the frame of the research 15 specimens were tested. All of them were of the same geometry (length 1500 mm, width 150 mm and thickness 12 mm) but different composition – monolithic glass or laminated double or triple glass made of annealed or fully tempered glass panes bonded together by PVB or EVASAFE foil. Due to rectangular cross section and considered boundary conditions, flexural buckling perpendicular to the weak axis of cross section occurred. Specimens were loaded by constantly increasing force up to failure. During testing lateral deflection and normal stresses at midspan were measured. Maximum force achieved during testing has been adopted as buckling strength. Euler's critical loads and equivalent geometrical imperfections were evaluated using a Southwell's method. The results of experiments were statistically evaluated according to the European standard for design of structures EN 1990, appendix D. There are significant differences between specimens made of annealed glass or fully tempered glass and between specimens laminated with using PVB or EVASAFE foil – the differences are in the values of buckling strengths and load – deflection, load - stress plots. The next step was to determine the design strength by calculation procedure based on buckling curves approach intended for design of steel columns.

Key words: Structural glass; laminated glass; flexural buckling; Southwell's method; buckling strength.

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On the problem of lateral torsional buckling of beams with web holes

Martin Horáček ¹, Ondřej Pešek ^{*1}, Jindřich Melcher ¹, Ján Brodniansky ²

¹ Brno University of Technology, Faculty of Civil Engineering, Institute of Metal and Timber Structures, Veveří 331/95, 602 00 Brno, Czech Republic

² Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Department of Steel and Timber Structures, Radlinskeho 11, 813 68 Bratislava, Slovakia

ABSTRACT

This paper deals with the problems of analysis and design of perforated thin-walled steel Sigma beams with respect to lateral torsional buckling. The Sigma beams are mono-symmetrical profiles loaded in the plane perpendicular to axis of symmetry. The application of these profiles is in the storage systems and expedient flooring structures as floor girders which are subjected to the bending. In some cases the beams are not laterally restraint and therefore the effect of lateral torsional buckling may occur. First the theoretical calculations according to the design procedure listed in European standard EN 1993-1-1 and Czech national annex NB.3 are being performed. These calculations are valid for the beams with the uniform cross-section without any notes or any recommendations for the beams weakened by holes. Therefore the substitute cross-section is being established and the cross-section characteristics, used for the calculation of elastic critical moments, are defined as the weighted average of the characteristics for the full section and characteristics for the section weakened by hole. The calculated elastic critical moments for the substitute cross-section properties are verified by the analysis based on the EUGLI method (Equivalent Unique Global and Local Initial Imperfection). The theoretical approach of determination bending resistance of the beams weakened by holes in web with respect to lateral torsional buckling is verified in laboratory conditions. The experiments are being carried out on the specimens of three different beam lengths loaded with two concentrated loads situated in the thirds of the beam span. The test results are statistically evaluated according to EN 1090 and the characteristics bending resistances obtained from tests are compared with the selected theoretical approach based on the calculation of elastic critical moment according to Czech national annex NB.3 of EN 1993-1 using the cross-section characteristics of substitute cross-section.

Key words: Beam; hole; lateral torsional buckling; experimental verification; elastic critical moment; substitute cross-section.

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A methodology for landslide damage assessment

Fabrizio Palmisano *, Claudia Vitone, Federica Cotecchia

DICATECh, Politecnico di Bari, Via E. Orabona 4, 70125, Bari, Italy

ABSTRACT

The assessment of landslide vulnerability is a research topic of increasing interest all over the world, given the widening of urbanization and transport infrastructures that interact with unstable slopes. In the Italian peninsula the diffuse high landslide susceptibility makes the problem of landslide vulnerability particularly relevant, as made evident by the frequent damages to structures and infrastructures. The study here presented intends to contribute to deepen the knowledge in this field through the introduction of an original methodology for landslide damage assessment of ordinary (masonry and reinforced concrete) buildings at the urban scale (i.e. from detailed to large scale according to Cascini 2008). At the urban scale, it is both technically difficult and economically inconvenient to perform detailed investigations of structures. Both the complexity of the investigations and the variety of the vulnerable elements, make it necessary to implement in the analysis different levels of detail (the so-called 'multilevel approach'; Palmisano 2015), depending on the size of the area, the number of elements, the time and the economic constraints. Therefore, the approach to the vulnerability assessment being proposed is organized into multiple levels, from that applying to the urban scale, to that of use at the scale of the single building. The aim is to sort out the vulnerability level of buildings in order to budget the different intervention options and support the definition of mid-term and long-term mitigation strategies. The first level of the analysis, necessarily quick, should be extended to all the buildings of the territory under study. The objective is to identify the buildings that require a deeper investigation. The second level involves only the buildings at high vulnerability, as selected in the previous Level. At this level a complete structural vulnerability analysis has to be carried out: detailed inspections, standard and non-standard tests, strategies for remedial actions. In this scenario, this article presents a methodology for the 1st level damage assessment of buildings subjected to landsliding. In the first part of this approach (Step 1), simple methods (Roca et al. 2011; Palmisano 2014) are used to interpret the behaviour of buildings subjected to foundation settlements due to landsliding and to back-analyse their crack patterns. Step 2 of the approach represents an original methodology for landslide damage assessment of ordinary buildings that can be applied at the urban scale. The main aims of this step are to provide rapid and objective data that, together with geomorphologic and geotechnical ones, are fundamental for both the diagnosis of the distribution of the landslide damage across the territory and the vulnerability assessment (i.e. Step 3). It is worth mentioning that damage assessment at the urban scale (Step 2) may be also very useful in urban areas also to acquire indirect evidence of landslide activity, otherwise of difficult detection solely on geomorphological basis.

Key words: Landslide; vulnerability; load path method.

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Parameter identification for a multivariable nonlinear constitutive model inside ANSYS Workbench

Filip Hokeš, Jiří Kala, Martin Hušek *, Petr Král

Brno University of Technology, Faculty of Civil Engineering, Institute of Structural Mechanics, Veveří 331/95, 60200
Brno, Czech Republic

ABSTRACT

This contribution aims to describe the process of the inverse identification of the parameters of a nonlinear material model from experimentally obtained data. This process takes place with the aid of approaches utilising optimization procedures based on population methods which are currently implemented in the ANSYS Workbench environment. The input data for the described numerical procedure took the form of the points of a load-displacement curve which was measured during the performance of a three-point bending test on a concrete beam. This experiment was numerically simulated via the finite element method with the use of the Menétrey-Willam nonlinear material model. Great attention is paid to the description of the sensitivity analysis and the parameter correlation performed with the utilization of a programmed script that enables the correct understanding of the used material model. Emphasis is therefore placed on the analysis of individual parameters whose understanding and correct setting have a significant influence on the convergence of the nonlinear solution. The basic principle of the identification by optimization is the minimization of the difference between experimentally and numerically obtained load-displacement curves. However, the problem is how to formulate this difference as precise as possible because the right choice of objective function is crucial for achieving the optimum. One possible way is to use the root-mean-squared error that is often used for evaluation of accuracy of economy or weather mathematical models. The text also deals with the possibility of a reduction in the design vector according to the results of sensitivity analysis and shows how this reduction affects the accuracy of the sought parameters. The contribution provides another view on the utilization of optimization algorithms in the area of the design of safe and effective structures.

Key words: Optimization; ANSYS Workbench; sensitivity; nonlinear material model; root-mean-squared error; identification.

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Free vibration analysis of beams with variable flexural rigidity resting on one or two parameter elastic foundations using finite difference method

Masoumeh Soltani *, A. Sistani, B. Asgarian

University of Kashan, Kashan, Iran

ABSTRACT

In this paper, the Finite Difference Method (FDM) is applied to investigate natural frequencies of non-prismatic beams, with different boundary conditions and resting on variable two parameter elastic foundations. Finite difference method is one of the most powerful numerical techniques for solving differential equations especially with variable stiffness coefficients. Between various computational methods to solve the equilibrium equations, this method requires a minimum of computing stages and is therefore very suitable approach for engineering analysis where the exact solution is very difficult to obtain. The main idea of this method is replacing derivatives present in the stability equation where only the twist angle and boundary condition equations with finite difference expressions. In the first stage, the governing motion equation of a non-prismatic beam resting on elastic foundations is formulated and the related boundary conditions are expressed. In the second stage, the obtained fourth-order differential equation and boundary conditions are discretized by central finite difference formulations. In this regard, the expressions of derivatives of displacement represented in the motion equation are presented based on aforementioned numerical method. Finally, the system of central finite difference equations culminates in a set of simultaneous and linear equations and the natural frequencies are calculated by solving an eigenvalue problem of the obtained algebraic system. In order to demonstrate the accuracy and efficiency of this method to calculate natural frequencies of various forms of non-prismatic beams resting on two parameter elastic foundations, some numerical examples are expressed. The obtained results are compared to finite element simulations using ANSYS software and to other available numerical and analytical benchmarks. The free vibration analysis of uniform members as well as non-uniform ones can be done through the present method.

Key words: Non-uniform beams; two parameter elastic foundations; free vibration analysis; Finite Difference Method; Eigenvalue problem.

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Investigation of punching behaviour of steel and polypropylene fibre reinforced concrete slabs under normal and cyclic loads

Fethi Sermet *¹, Anil Ozdemir ²

¹ Ege University, Faculty of Engineering, Civil Engineering Department, 35040 Bornova, İzmir, Turkey

² Gazi University, Faculty of Technology, Civil Engineering Department, 06500 Teknikokullar, Ankara, Turkey

ABSTRACT

Punching is among the most important risks leading to abrupt and brittle fracture in reinforced concrete structures. Punching effect at the end-parts of columns takes place during the transmission of loads from the slab to the columns and this effect is as important as the resistance of slab against bending. In this paper, punching performances of plain, steel fibre and polypropylene fibre incorporating reinforced concrete slabs were compared experimentally. Research program involved testing of six specimens. Two specimens were cast as reference specimens and normal and cyclic loads were applied. Two steel fibre and two polypropylene fibre-reinforced concrete specimens were produced as flat slab and normal and cyclic loads were applied. For comparison with other studies, the dimensions of test specimens were 1000 x 1000 mm and slab thickness was selected as 100 mm. Reinforcing bars were placed in only bottom parts of the slabs in all specimens. Ø10 S-335 steel reinforcing bars were used in the study. It was decided to locate the column in the middle part of the slab for providing formation of punching. The column shape was selected to be circular with a diameter of 150 mm. In the first phase of the experimental study, results of load-displacement curves were interpreted. In the second phase, the punching performances of specimens under normal and cyclic loads were compared and some suggestions were made.

Key words: Punching; fibered reinforced concrete slabs; normal and cyclic loading.

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Moment-curvature model for steel plate-concrete composite beams

Dawid Kisała *

Cracow University of Technology, Department of Civil Engineering, Cracow, Poland

ABSTRACT

The rapid development of the composite structures led to a new design concept steel plate-concrete composite beam, in which a thin steel plate is attached to a reinforced concrete beam. Shear connection is established by the use of headed studs and the joined parts can act as a unit due to the appropriate bond between steel and concrete. The behaviour of this type of structures can be classified as intermediate between composite and reinforced concrete structures. The experimental studies of steel plate-concrete composite beams have shown that the methods described in standard codes allows to determine the ultimate load of the structure, while the structure's deflection is underdetermined. More sophisticated analyses of the beams are more accurate but they are reluctantly used in practical design. The purpose of this paper is to present moment-curvature model which can be used in simplified calculation of deflection of steel plate-concrete composite beams. Instead of adopting the complex theoretical analysis, three-linear model is represented by pre-cracking, post-crack and post-yielding stages. The additional deflection due to shear slip at the interface plane is taken into account. The slip effect always exists both in fully and partially composite beams and experimental studies have shown that it has a significant impact on structure's response. Tension stiffening effects are also considered since beam rigidity is reduced when cracking is developing due to increasing the applied load. For the validation purposes theoretical analysis based on presented model was performed and compared to experimental results. The predicted results of the analytical studies were compared with the measurements of the tested beam to confirm the validity of the proposed method. It was confirmed that including shear slip effect has significantly improved the accuracy of prediction.

Key words: Steel plate-composite beam; moment-curvature; deflection; slip; interface.

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Nhat Tan Bridge - the biggest cable-stayed bridge in Vietnam

Grzegorz Świt¹, Luong Minh Chinh², Anna Adamczak^{*1}

¹ Kielce University of Technology, Faculty of Civil and Environmental Engineering, Kielce, Poland

² Thuy Loi University, Faculty of Civil Engineering, Vietnam

ABSTRACT

In recent years, Vietnam rapidly expanding construction of transport infrastructure, especially roads and bridges and a major bridges due to the very large number of large rivers. A significant part of the construction of bridges in this country are the cable-stayed bridges. From the first major suspension bridge My Thuan, which was completed in 2000 to the finished in 2012 Can Tho Bridge - cable-stayed bridge with the largest span length in Vietnam - 500m. Cable-stayed bridges are very effective structures for lightweight decks and large lever of arms forces. The most important element of these impressive and elegant structures are closely spaced wires suspensions, which through the pylon transmit loads to the foundation. Today, in Vietnam is a dozen such similar constructions. In 2015 it was opened the largest bridge of this type - Nhat Tan Bridge connecting Hanoi to the airport. Noi Bai International Airport and the centre of Hanoi are separated by 1 km wide Red River. Thang Long Bridge, built 30 years ago, was the only link across on this river. Nhat Tan Bridge is an alternative and more direct access to the road, shortening the travel time from the airport. The main bridge, 1500m long cable-stayed bridge with many spans, is a very rare type of bridge in the world and this is one of the longest bridges in Southeast Asia. This bridge, the gateway to Hanoi, also serves as a symbol of friendship between Vietnam and Japan. In this article, we present the design of the bridge, the course of its construction and the technologies that have been applied on this bridge. At present, several large bridges is also under construction throughout the country.

Key words: Cable-stayed bridge; suspension bridge; Nhat Tan; the largest bridge in Vietnam.

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An attempt to optimize the theoretical model of sandwich beam made of wood and polyurethane foam supported by experimental studies

Rafal Idzikowski ^{*1}, Pawel Sniady ¹, Bartlomiej Cmielewski ²

¹ Wroclaw University of Environmental and Life Sciences, Faculty of Environmental Engineering and Geodesy, Institute of Building Engineering, Wroclaw, Poland

² Wroclaw University of Technology, Laboratory of Scanning and 3D Modeling, Wroclaw, Poland

ABSTRACT

This article presents an attempt to optimize the theoretical models of sandwich beam. The motivation to undertake the theoretical analysis were experimental studies on sandwich beams. It was assumed that three-layer sandwich beams consisting of pine wood face sheets and core made of polyurethane foam will be examined under destructive loading. The face sheets cross-sectional dimensions were 150 mm x 45 mm and the foam core cross-sectional dimensions were 150 mm x 300 mm. Wood layers and the core material were connected using a polyurethane adhesive. Static scheme of a sandwich beam was a single-span freely supported beam. The length of a span was 2700 mm. Beams were loaded with two concentrated forces which were applied at a distance of 850 mm from the left and the right support. Middle section with a length of 1000 mm was thus subjected to pure bending. During destructive tests the displacements of the upper and lower timber face sheet were observed and normal stresses were measured with a help of strain gauges. The result of experimental studies was a database of displacements and deformations of each sandwich beam. Due to the fact that the lower timber face sheet was supported only and the upper timber face sheet was under loading compression of polyurethane foam core was observed. Contemporary literature on the sandwich constructions presents many theoretical models of sandwich beams. In contrast, authors have decided to supplement the already known solutions by independently derived equations. For the first solution the general Zig-Zag Model was assumed. Authors considered sandwich beam which consisted of two outer layers so thick that they were bended and sheared and a core layer being subject to shear only. In this model a sandwich beam was assumed that the vertical displacement was caused by both bending and shear of outer layers. This is why the state of displacement of the sandwich beam was describe three functions: the function of vertical displacements w , the function describing the rotation of the section θ and the rotation angle α indicating misalignment of the outer layers and thus the core shearing. In the second solution it was assumed that each face sheet is a separate beam. These beams were connected by the resilient layer (core). Core connecting beam was treated as we treat as a two-parameter Pasternak substrate. A situation was considered when the upper face sheet was a beam resting on two-parameter support (with free ends) and the lower face sheet was a freely supported beam. The deflections of both beams was described by the coupled system of two ordinary differential equations. This system of equations was solved using finite difference method.

Key words: Sandwich beam; foam core; wood; experimental investigations; finite difference method.

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Elastic instability of non-prismatic Timoshenko beams by the power series method

Masoumeh Soltani *, A. Sistani, B. Asgarian

University of Kashan, Kashan, Iran

ABSTRACT

This paper presents a numerical approach based on the power series method for linear stability analysis of non-prismatic Timoshenko beams with symmetric arbitrary cross-sections subjected to a constant axial load tangential to axis of beam. The governing system of equilibrium equations are derived from principle of stationary total potential energy. For this purpose, the total potential energy is derived from the elastic strain energy and the potential energy due to effects of the initial stresses resultants. Then the equilibrium equations lead to a unique homogeneous second-order differential equation in term of bending rotation, since in the presence of flexural and axial rigidities of cross-section of the considered Timoshenko beam, the obtained system of stability equations are coupled and simultaneous. In the case of non-uniform members, all stiffness coefficients are variable along the beam's length. The power series approximation is then adopted to ease the solution of the differential equation with variable coefficient of Timoshenko beam with non-constant geometrical parameters. Regarding this, it can be noticed that the functions describing the beam's displacement component and geometrical properties are expanded into power series form of a known degree. The critical buckling loads are determined by solving the eigenvalue problem of the obtained algebraic system. According aforementioned method, explicit expressions for deformation shape is also identified. In order to illustrate the correctness and performance of proposed numerical method, several comprehensive examples of Timoshenko beams with non-constant section are presented. The obtained results are compared with available numerical or analytical solutions. The accuracy of the method is then remarked. The elastic stability analysis of uniform Timoshenko beams as well as non-uniform ones can be done through the present numerical method.

Key words: Non-prismatic Timoshenko beam; linear stability analysis; power series method; Eigenvalue problem.

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Damage detection of bridges considering environmental temperature effect by using cluster analysis

Changxi Yang ¹, Yang Liu ^{*1}, Yaqi Sun ²

¹ Harbin Institute of Technology, School of Transportation Science and Engineering, Harbin, China

² Northeast Petroleum University, School of Mechanical Science and Engineering, Daqing, China

ABSTRACT

It is difficult to detect the damage of practical bridges by using the variation of monitoring modal parameters directly since the varying environmental conditions may mask the change of modal parameters induced by the damage of bridges. In this study, Gaussian mixture model (GMM) combining with novelty detection was proposed to eliminate the effect of environmental temperature on vibration frequencies of bridges. Firstly, GMM was applied to classify the monitoring modal parameters, obtained by using the long-term monitoring data of bridges, into different clusters. The monitoring vibration frequencies of bridge satisfying the same probability distribution were classified into the same cluster, which means that these vibration frequencies were acted by the similar environmental temperature load. Secondly, at each cluster, the novelty detection was implemented to detect the damage of bridges. Finally, the effectiveness of proposed method was demonstrated by using a numerical example.

Key words: Structural health monitoring; bridges; damage detection; Gaussian mixture model; novelty analysis.

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A few comments on metrics and optimizing of simple conical heads of circular columns for beamless reinforced concrete monolithic slabs

Radimír Novotný *

VŠTE-Institute of Technology and Business in České Budějovice/Department of Construction, Czech Republic

ABSTRACT

This paper deals with dimensional aspects of circular column heads supporting beamless reinforced concrete monolithic (also locally supported) slabs with regard to their stressing in terms of so-called bursting safety, and it analyses possibilities of their metrics and shape optimizing.

Key words: Circular column; beamless reinforced concrete; monolithic slabs.

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Dynamic response analysis of the Ondrej Nepela Stadium Grandstands (Bratislava, Slovak Republic)

Daniel Papán *, Veronika Valášková

University of Zilina, Faculty of Civil Engineering, Department of Structural Mechanics and Applied Mathematics,
Univerzitná 8215/1, 010 26 Zilina, Slovak Republic

ABSTRACT

Behaviour of the spectators in the grandstands during a sports match may generate excessive vibration that can cause problems with the serviceability limit state. Construction of modern stadium due to architectural design and improving the material properties of the elements are made more efficient. This type of structural design brings many benefits. On the other hand, the size of its vibration, caused mainly by a coordinated motion spectators, became of great values, which may exceed the limit values given in the respective standards. In this article we are dealing with modal analysis of structures Andreja Nepelu stadium in Bratislava and finding natural frequencies adjacent grandstands. Global support system and his description is based on the original design project documents from 1988 and subsequent project documentation from 2009. Complete reconstruction of the stadium in shape as it looks today, was in 2009. Ground plan dimensions of the hall are 86.0 x 102.8 meters and maximum theoretical amount at mid- range is 23.3 meters. The mods of natural vibration and natural frequencies were calculated by the computational model in computer program Scia Engineer with using the Lanczos mathematical method. Software package Scia Engineer uses the principle of finite element method (FEM) - numerical method for solving boundary value of continuum mechanics. FEM solves a system of differential equations transformed to a system of linear algebraic equations. The mods of natural vibration of construction is the motion of the construction in the direction of least energy expenditure, with which we can predict the behaviour of construction under dynamic loading. The mods of natural vibration of vibration and natural frequency of the structure were determined static load from spectators and deferent intensities excitation (for example walking, jumping or Mexican wave). The impact of variable loads on the construction was investigated for an empty stadium, a full stadium, during the match and during the break of the match. The load on the construction has been caused by coordinated movement of the crowd, as is in the real situation on grandstand stadium becoming rarely. Dynamic vibration of sports stadiums is in generally difficult to simulate and determine the design of structures. Is is due to the unpredictable behaviour of the spectators during the match. Currently in abroad a substantial number experiments to determine the load values induced by spectators in the grandstands in various situations. These would be used in the design of this type of construction in the future.

Key words: Dynamic analysis; custom shape; finite element method; natural frequency; dynamic response; Ondrej Nepela grandstands.

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The dynamic analysis of the green anode processing building

Daniel Papán *, Katarína Demeterová

University of Zilina, Faculty of Civil Engineering, Department of Structural Mechanics and Applied Mathematics,
Univerzitná 8215/1, 010 26 Zilina, Slovak Republic

ABSTRACT

This article is about the dynamic analysis of the green anode processing building, Slovalco company in the city of Žiar nad Hronom. The production process contains anode cauterization, and then this anode is put into the air furnace and consumed during producing the primary aluminium by electrolytic process. Anodes are being made of calcined petrol – coke and tar. The processing building is built as the steel frame structure, which contains steel girder platforms. The dynamic analysis contains two base steps, and that is FEM model of the entire construction and the experimental measuring. The FEM model was created via software Scia Engineer vs. 2015. The FEM model comprises elements with designed dimensions of cross sections due to final design documentation. The platforms were modelled as the girder structures. Computing run was done via modal analysis. There were ten natural frequencies and ten modes of natural vibration as the results, in quite low frequency band. There were realised six experimental measurement series. The principal aim of dynamic response experimental measurements was detecting the vibration intensity of machines and the vibration frequency band of machines. These machines are in closeness to the restroom that is why the dynamic response of them was investigated. The vibration intensity was measured with the aim of checking the vibration effects on humans and on building structure. The software of Sigview was used for the experimental analysis. The vibration acceleration auto spectral densities were analysed. For the vibration records the frequency domain decomposition into the third – octave band were calculated in that part of measuring during active machine working. The value of vibration weighted acceleration was calculated and compared with the legislative limits of the vibration equivalent acceleration (in the part of measuring during active machine working). The vibration effect on humans' health must comply with the statute of Slovak Republic: Ministry of Health in Slovak Republic NO. 549/2007 from the Collection of Laws. These values were detected from the selected measurement series in the software of Sigview: Minimal value of the vibration acceleration from the time recording, Maximal value of the vibration acceleration time history, the value of vibration acceleration aRMS, the value of vibration velocity vRMS, and the value of power spectral density. Detected value of the vibration acceleration amplitude was compared with the norm value due to Slovak Technical Norm (STN) NO. 73 0031. The isolation for reducing vibration level was recommended.

Key words: Dynamic analysis; natural mode; finite element method; natural frequency; dynamic response.

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The dynamic FEM models results comparison of the New Bridge over Danube River in Bratislava (Slovak Republic)

Daniel Papán *, Katarína Demeterová

University of Zilina, Faculty of Civil Engineering, Department of Structural Mechanics and Applied Mathematics,
Univerzitná 8215/1, 010 26 Zilina, Slovak Republic

ABSTRACT

In general the actual approach to achieve the dynamic parameters of bridge structures is supported to use standard FEM software. The final element model can be created many different ways. The best way to obtain the objective results is to create at least two variants of FE model. Currently each standard FEM software is enabled to use variable types of elements. This papers shows the two basic models types of real slender road bridge. This bridge name is "The New Bridge over Danube". This bridge is one of the Slovak capital dominants. For both models creation the historical documentation and the real dimensions measurements were applied. The first type of FE model is created in older version of final element software and is composed only of 1D elements. In this software the load bearing cables was already modelled as nonlinear. The second type of the bridge final element model was created in modern FE software where 2D with 1D element combination were used. The load bearing cables were also modelled as nonlinear. As a comparative results the natural frequencies and modes of natural vibration were computed. The dynamic experimental verification of this bridge structure were performed. The basic dynamic parameters were experimentally monitored for last ten years by annually repeat testing. Many existing slender long – span bridges are structurally adequate with respect to the maximum design axle loads, they may suffer from fatigue related to the cyclic application of modern freight equipment axle loads. Only the relevant FE model can consider the real dynamic behaviour of the bridge. This is the idea for the best identification of dynamic parameters and FE model tuning.

Key words: Dynamic analysis; natural mode shape, finite element method; natural frequency; dynamic response.

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Shaping innovative forms of buildings roofed with corrugated hyperbolic paraboloid sheeting

Jacek Abramczyk *

Rzeszow University of Technology, Al. Powstancow Warszawy 12, 35-959 Rzeszow, Poland

ABSTRACT

The aim is to propose an innovative method of shaping free original building forms roofed with profiled sheeting transformed freely from plain into shell shapes as a result of unfolding the sheeting onto skew directrices. The effective transformation consists in free twisting of each fold around its neutral axis so that a freedom of fold's transversal width increments is ensured on the entire fold's length. In such a case, effort of each freely twisted fold is minimized and a contraction of the shell sheeting passes crosswise fold's directions through halves of the shell folds. The effort of the consecutive folds in the shell is controlled by means of adopting curvature and a mutual position of two skew directrices supporting the shell sheeting at its crosswise ends. The above supporting conditions make that the consecutive folds in the same shell sheeting undergo various twist degrees and have diversified lengths of the supporting lines. These lengths have to be accurately calculated to obtain the free transformations of each shell fold. The above assumptions enable designing the shell fold as a thin-walled beam simple supported at its ends. In this case, open cross-sections changing on the fold's length have to be strengthened by additional bracings and supported by additional members stiffening the building framework as well as their twist degrees have to be limited. In the work, selected geometrical and structural problems characteristic of the proposed innovative forms are considered. The geometrical shaping consist in: a) calculating the fold's supporting line lengths and an arrangement of supporting points of the fold's ends with the shell directrices; b) relevant adopting the shape and position of the shell directrices. The main problems related to the structural shaping rely on: a) diversification of a shell roof inclination towards a horizontal plane, so their load vectors have to be decomposed into components parallel and perpendicular to the direction of each fold including tangent and normal to its neutral surface at any considered point of its neutral axis; b) an assumption that adjacent folds in the shell undergo big displacements and small strain in the initial stage of the fold assembly. The integration of the proposed building forms with their natural and built environments is considered too.

Key words: Corrugated shells; profiled sheets; free forms; buildings; shell structures.

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BIM-based energy analysis using Edilclima EC770 plug-in: case study of Archimede Library, EEB Project

Francesca Maria Ugliotti *, Maurizio Dellosta, Anna Osello

Politecnico di Torino, Corso Duca degli Abruzzi, 24 -10129 Turin, Italy

ABSTRACT

In recent year, energy efficiency issues as well as Building Information Modelling (BIM) are the greatest and most challenging paradigms for the Architecture Engineering and Construction (AECO) industry in the context of Smart Cities. Digital models are used to analyse the existing building stock to promote a better management and retrofitting actions. At the same time, the digitalization process of public buildings involving BIM method represents a significant opportunity for the Administrations to monitor and control the Public Real Estate. Data modelling is the first step to pursue an integrated approach for the building lifecycle allowing simulations and analysis for different purposes through the interoperability process. This study aims to investigate the potential and the limitations still exist of a BIM-based energy analysis by means of an Italian commonly used software for energy diagnosis and certificates, according to the quasi-steady method specified in the UNI/TS 11300-1:2008. The case study is a library with municipal offices in Settimo Torinese (Italy), which is the demonstrator of the ongoing Zero Energy Buildings in Smart Urban Districts (EEB) national cluster, which has the main scope to create a data management infrastructure able to integrate heterogeneous networks. The energy rate is evaluated from a simplified Revit architectural model, where the most significant components of the building in terms of energy are defined with a proper Level of Detail/Development (LOD) to easily set the energy model through the EC770 plug-in. In this way, the acquisition of geometrical data is allowed by the interoperability among software, speeding up the redundant preliminary phases of the simulation concerning the description of the building envelope. The graphical interface needs to be improved to facilitate the general understanding of the building components provided by the BIM model. Shared parameters, schedules and families have also been implemented to maximize the information exchange as the process is still imperfect. However, the critical comparison of methodology and results has shown that the use of BIM in energy modelling practices can strengthen the reliability, consistency, and usability of energy data for a cost-effective building simulation.

Key words: Building energy performance analysis; building information modelling; energy model; data exchange; existing buildings; EEB Project.

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Climatology applied to Architecture: an experimental investigation about internal temperatures distribution at two test cells

Grace Cardoso ^{*1}, Francisco Vecchia ²

¹ School Architecture and Urbanism, Faculdade Meridional - IMED, Rua Senador Pinheiro, 304 - Passo Fundo - RS, Brazil

² School of Engineering of São Carlos, University of São Paulo Av. Trabalhador são-carlense, 400 – São Carlos-SP, Brazil

ABSTRACT

This investigative work analysed the spatial distribution of internal surface temperature (IST) and dry bulb temperature (DBT), in two different test cells, for a typical experimental day under the influence of tropical mass. The main goal of this research is to provide guidelines to collect temperature data experimentally since there is not an appropriate standard to guide this methodological procedure in buildings. This research was based on the spatial and temporal approaches of dynamic climatology to know the influence of weather fluctuations on internal temperatures. The data series of DBT and IST were measured in a test cell with a green roof and the other with conventional ceramic roof by thermocouples installed at predetermined locations. The data regarding the main climatic variables were recorded by the automatic weather station. The results led to the conclusion that the distribution of the IST is almost uniform in the two test cells, but in relation to the DBT there is a small vertical temperature gradient in the conventional cell. In this way, the surface temperature can be collected at any point, provided that the surface is uniform. For the measurement of dry bulb temperature is recommended to be performed in a place equidistant from all surfaces, but the height for positioning of sensors may vary according to each study. Therefore, this work will contribute significantly to future studies in the area of human comfort and environmental suitability of buildings.

Key words: Dynamic climatology; test cells; spatial distribution; internal temperatures.

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Vertical subway an internal transport system in a 1200m tall building

Stefan Niewitecki *

Gdańsk University of Technology, Faculty of Architecture, Department of Technical Fundamentals of Architectural Design, ul. Narutowicza 11/12, 80-233 Gdańsk, Poland

ABSTRACT

This article is concerned with designing an efficient internal transport system in a 1200m tall multifunctional building later on called the “World’s Tower” due to its symbolism and specific architectural form. The building comprises four towers whose bases are 75m/75m each and whose height is 1200m. Two of the towers are located along the north-south axis while the two others along the east-west one. The idea is to construct the building consisting of four towers joined at the top, which makes it significantly higher than ever before (even up to 2 km). It has been achieved with the help of a batten plate joining the towers at the height of 900 m. The opposite towers are joined with the arch structure having the same cross-section as the towers thanks to which the building constitutes the monument – the symbol of the unity of south and north, east and west. Additionally, the fifth component – a spherical structure with a diameter of 220 m (the distance between the two opposite towers is 250 m) has been placed on the batten plate. There are outlines of the continents on the elevation of the spherical structure. Thus, the whole building symbolizes the mankind that has taken under its wings the planet earth. The internal transport system in the building has been called a “vertical subway” due to its similarity to the actual subway system. The system consists of 40 elevator cars connected with each other and which, in a given shaft, move only in one direction, for example, they all move up and then move one by one into the other shaft in which they go down. It creates, unknown so far, possibilities of using the internal transport systems in very tall buildings, as the “vertical subway” of this type can take a few thousand people at the same time and it can operate every three minutes at peak times. Two sets of these “trains” plus eight traditional elevators can work in the tallest buildings in the world while taking up only a small fraction of their area. It is a new quality in the vertical internal transport because of its efficiency which is several times bigger than this of the vertical transport systems used so far.

Key words: Tallest tower blocks; vertical subway; the height over 1 km; efficient internal transport system.

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Evaluation of the energy performance of post-war housing estates in Europe

Julia Garrido-Piñero *, Pilar Mercader-Moyano

University of Seville, Department of Building Constructions I, Spain

ABSTRACT

Up to this day there are specific urban fabrics in European and Spanish cities. These fabrics, the post-war housing estates, causes imbalances in the energy cycle of urban ecosystems where they take part, thus contributing to the creation of environmental impact. In the case of Spain, these fabrics are mainly materialized as neighbourhoods made up of open-block building typologies, built mostly from 1950 to 1980. Their current situation is the result of significant quantitative needs of existing housing at the time of construction (short-run work processes and reduced costs), the existence of poor industrialized production, and the then emerging of comfort far inferior to those demands proposed by current European Directives (Directive 2010/31/EU on the energy performance of buildings, the Europe 2020 Strategy, the Europe 2030 Strategy , Directive 2012/27/EU on energy efficiency and the Royal Decree 56/2016 regarding energy audits in Spain). The objective of the research is to study the constructive and energy characteristics of the buildings that make up housing estates, in order to evaluate their behaviour to reduce energy consumption and pollutant emissions from their use. The ultimate goal is to promote the energy-efficiency of these obsolete urban fabrics, working towards environmental refurbishment. To do this, a representative case study model is established in the city of Seville, Spain. The energy consumption is set by a housing estate through the energy simulation of the different building typologies that make it. DesignBuilder software is used to run the simulations. With this research the energy performance of a housing estate model is obtained as well as strategies for action on these fabrics for decreasing consumption. The main finding is that any energy consideration was not taken into account in the construction of these estates. That is why acting on the building thermal envelope significantly increases the energy performance of the housing estate's buildings, contributing to the reduction of imbalances in the energy cycle of urban ecosystems and minimizing the environmental impact.

Key words: Housing estate; energy consumption; building envelope; environmental impact minimization; environmental renovation; energy-efficiency.

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Getting results in an historical dwelling stock in a thermal simulation with EnergyPlus

Beatriz Montalbán Pozas *, Montaña Jiménez- Espada

University of Extremadura, Department of Construction, School of Technology, Avenida de la Universidad s/n 10003.
Cáceres, Spain

ABSTRACT

Nowadays, the historical and valuable housing stock of many cities needs an accurate analysis in order to implement a relevant research for its conservation, maintenance or refurbishment. Additionally, the energy efficiency studies are essential in every case to guarantee the sustainability. On these situations the simulation process will be suitable to achieve the results. However, the historical dwellings are complicated to simulate. They require a comprehensive research about the ancient constructions, their traditional crafts and techniques, which rely heavily on local builders' design skills and tradition; as well as the regional materials and architecture knowledge. Furthermore the intricate geometries and the large number of different housing cases demand a simplification, besides a representative building typology definition. In addition, in energy simulation process, it is indispensable knowing the lifestyle. In a traditional housing the ancient customs have to be taken into account. The occupation, the metabolism, the activities and the traditional clothing are studied to define a reliable computer model. Moreover an operation usage program has to be defined in order to set other building simulation parameters, such as the ventilation, the shading or the internal gains. In that way, this work proposes a methodology to introduce and simulate an historical dwelling energy model through a case study of an historical housing stock in Sistema Central in Spain, developed in Design Builder, an Energy Plus software. This method describes how the type was generated going on from a real case, with an architectonic, constructive and activity definition. It includes guidelines for the building modelling, and the necessary simulation parameters to obtain the correct results.

Key words: Building simulation; historic building type; thermal model, model simulation inputs.

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Defects and failures influencing the mechanical performance of bridge structures

Tomasz Kamiński *

Wrocław University of Technology, 50-370 Wrocław, Wybrzeże Wyspiańskiego 27, Poland

ABSTRACT

Bridges are very important though especially fragile components of transportation infrastructure which undergo intensive influences from environment and traffic or can be exposed to various other threads inevitably causing some damage to their structure. In the paper the most common defects influencing the mechanical behaviour and failures of bridge structures are analysed. Basic damage types are indicated and classified as well as some corresponding case studies are presented. The whole problem of the defect's development is described: starting from the most common threads to bridges, through damage cases representing some real, complete and often complex situations (usually including a number of basic defects), process of selected damage formation or failure occurrence up to possible post-failure behaviour scenarios and the final consequences of initial defects. The second part of the study concentrates on representation of the defects and failures in numerical models of bridge structures. A method of damage quantification and numerical description is given what enables its precise implementation in the models. Three basic parameters defining location, extent and intensity of defects represent a sufficient set of data for description of a single damage type. A specific difference between various defects related to possible damage intensity variation is indicated. Several examples of damage cases represented in Finite Element models of various classes are presented and thoroughly commented. A special attention is paid to importance of history of each defect that usually raises a need to apply nonlinear type and appropriate initial conditions of the numerical analysis. Final conclusions on defects' influence on mechanical behaviour of bridge structures are given and effectiveness of numerical models' application in representation of such an effect is evaluated.

Key words: Bridge; defect; failure; numerical modelling; Finite Element Method.

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Simulation of colliery environment based on deterioration of reinforced concrete beams

Yuan-Zhou Wu^{1,2}, Heng-Lin Lv^{1,2*}

¹ China University of Mining and Technology, School of Mechanics and Civil Engineering, Xuzhou, 221116, China

² JiangSu Collaborative Innovation Center for Building Energy Saving and Construction Technology, Xuzhou, 221116, China

ABSTRACT

Database of colliery environment was established and the main features were analysed after ten years of in-situ test. And then investigation was conducted to simulate it with the purpose to research its deterioration mechanism on concrete structure. Results indicated that hydrogen chloride gas and chlorine were the main corrosive mediums and deteriorated the concrete structure seriously as the relative humidity exceeded 75%, the normal value in the coal mine. Corrosive fluid rich in chloride and sulphate made medium deterioration to the concrete structures. Effect of solid corrosive mediums may be ignored due to its less fractional amount. As the results of test and investigation compared, an important role was impressed to the alternation of wetting and drying for influencing the effects of corrosive mediums heavily. Based on the actual average temperature values of each season, the humidity value of simulate environment were adjusted finally.

Key words: Colliery environment; main feature; simulation; gases; mixed salt mist; temperature and humidity.

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Indoor air quality monitoring in retrofitted apartment buildings

Robert Wawerka *, Vojtěch Hrůza, Petr Komínek

Brno University of Technology, Faculty of Civil Engineering, AdMaS Centre, Purkyňova 139, 612 00 Brno, Czech Republic

ABSTRACT

The demand for energy consumption reduction and overall energy efficiency in buildings (Directive 2010/31/EU) in recent years led to an improvement in buildings envelope quality in terms of thermal properties and airtightness of newly constructed buildings as well as of those of an older age. And while this is certainly a good progress, there are also some not so positive effects. As we focus on energy consumption reduction and energy efficiency, we often neglect other equally important parameters such as indoor environment quality, mainly indoor air quality (temperature, relative humidity or CO₂ concentration, etc.). And while this isn't much of an issue for modern office, commercial and other mechanically ventilated buildings, it becomes an increasing problem of the naturally ventilated ones, especially for the newly renovated buildings such as schools, apartment buildings etc. CO₂ concentrations in these buildings oftentimes get alarmingly high. The paper describes long term indoor air quality monitoring (temperature, relative humidity, CO₂) in the existing housing estate, within the pilot project in the city district of Brno - Nový Lískovec in the Czech Republic. The indoor air quality monitoring was performed in selected concrete block of flats in retrofitted buildings from communist era. The simulation software was used to perform indoor air quality calculations to present potential improvements and recommendations within the regulation requirements.

Key words: Indoor air quality; CO₂; apartment; energy; simulation.

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Assessment of buildings' thermal needs hourly profiles for district energy planning in Southern European context

Simone Ferrari *, Federica Zagarella

Politecnico di Milano, Built environment and Construction Engineering (ABC), Department of Architecture, via Bonardi 9, 20133 Milano, Italy

ABSTRACT

For decreasing the fossil fuels consumption and reducing air pollution at urban level, current policies encourage a transition to distributed energy generation (DG) and support initiatives towards district heating and cooling networks (DES - district energy systems), promoting the integration of renewable energy sources (RES). Based on these approaches, the assessment of the energy demand fluctuations of the building stock is preliminary for energy planning at district scale, since systems' operation requires a complex balancing for maximizing the efficiency or minimizing the cost, combining the intermittent nature of RES (except biomasses) with non-RES and/or storage technology. Surveyed literature concerning recent studies aimed at optimizing district energy scenarios revealed that most of the assessment are limited to the seasonal and/or annual based buildings energy needs, while the ones that deal with a proper time scale (i.e., hourly based) refer to specific case studies, which are hardly replicable in other urban contexts. The purpose of the study presented in this paper was to provide reliable reference profiles of buildings thermal energy needs (for both space heating and cooling) with reference to the Italian context. Therefore, a set of building prototypes, representative of typical solutions of different historical periods, was defined for both residential and diffuse tertiary (offices) use. Once elaborated hourly internal loads curves based on the accurate Swiss standard (SIA 2024), it was possible to provide, performing detailed simulations with TRNSYS model, energy need profiles of typical buildings placed in different climatic locations, covering the wide range of Italian context. Resulting specific values, referred to cubic meter of building volume, can be used for assessing the overall hourly energy needs of any built area in Italy, once the actual built volume associated to each construction period of the considered building stock is known. Based on both the building typologies and the climatic variability considered, the results of the study could be extended to other comparable locations in southern Europe.

Key words: Urban energy planning; buildings hourly energy loads; the thermal energy need; specific power profiles.

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Energy performance certificate classifications across shifting frameworks

Morten Brøgger *

A.C. Meyers Vænge 16, 2450 Copenhagen SV, Denmark

ABSTRACT

Large amounts of valuable data are being collected in the energy performance certificate schemes. These data offer a huge potential, in terms of enabling researches to study energy demand in buildings and related causalities. However, revisions of the national schemes and calculation methods necessitate a standardization of the results from the various schemes. The primary focus of this research is on checking the consistency of converting labels with a given classification from an old scheme directly into that of a newer scheme. Furthermore, a general check is carried out, to review the consistency within each scheme, since the collected data are handled by several stakeholders which use different calculation tools. Several instances were found, where a simple conversion of a building's energy label classification did not agree with the classification calculated anew, according to the present scheme. The number of inconsistent records was found to vary from scheme to scheme; most of the inconsistent classifications were found in the early schemes however. Fortunately, most information is stored at a disaggregated level, which means that classifications can easily be recalculated. Moreover, the disaggregated level that the information is gathered at, allows for various other calculations. In addition to the inconsistent energy label classifications, a number of corrupt records were observed, in which the energy frame did not seem to agree with the calculated energy demand for heating and electricity. Energy performance certificate classifications cannot simply be converted from an old scheme into the present scheme, since calculation preconditions are modified from time to time. However, energy performance certificate classifications from previous schemes can easily be converted to match the present scheme, by recalculating the classification. Therefore, data should be collected and stored as disaggregated as possible. This way inconsistent and corrupt data can easily be detected and accounted for. By including additional information about the calculation software, the scheme could be further improved, since more data inconsistencies, which are otherwise impossible to account for, can more easily be detected and accounted for. This way data collected in early versions of the scheme can be used, even though the scheme is modified and the huge potential, that the scheme offers, can be utilized.

Key words: Energy performance certificate; energy; building data; buildings.

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Effect of different solutions of damping railway vibrations on their sensibility by man

Krzysztof Koziol *

Cracow University of Technology, Cracow, Poland

ABSTRACT

Buildings located near the railway tracks are often exposed to the harmful effects of vibration caused by trains. Effects of vibrations on the human body can be minimized by various activities including: a. influence on the source of vibration by changing the rolling stock or speed of a moving train, b. changing the path of vibration propagation by changing the characteristics of the material, in which the waves transfer or mounting so called anti-vibrating screen on the way of vibration propagation, c. changing characteristics of the vibration receiver. Due to renovation of the track and necessity to reduce pollution (in accordance with Polish standards and EU Directive's) defined by vibrations generated by passing trains, investor was forced to ensure building safety and comfort of people living in nearby buildings. The paper presents proposals for reducing vibrations using special anti-vibration screen placed on the wave propagation way. The structure of the anti-vibration screen consists a concrete matrix (thickness of 25 cm) with vibro-isolating material (thickness of 5 cm) adhered on surface. With a large database of extortion, author could recreate it in a good way. It should be noted that the kinematic signals were recorded for trains similar to the expected in future on the modernized railway line. The database also includes kinematic excitations on analysed line before its renovation. Analysing the responses presented in the form of acceleration of the soil showed that mounting in the ground described anti vibration screen brings unsatisfactory results. Large decreases of the excitation amplitudes are observed just behind the screen (up to 90% for vibrations in the vertical direction and 80% for vibrations in the horizontal direction), but there are areas (about 1.5 height of screen) where strengthening of extortion have to be dealt. It can be concluded, that in order to protect objects using screens, it should be located as close as possible to analysed building. However, the described solution cannot be completely disqualified. In case of the analysed building almost 40% increase in vertical vibration and several percent increase in horizontal oscillation but at a point located at a considerable distance, causes that the kinematic excitation of the building is reduced. We move away point of the occurrence of extreme loads which generally lowers dynamic loads. Because of the unsatisfactory results related to the application in the wave propagation the screen mounted vertically it was decided to use another solution - apply mats between layers of subgrade in order to cut off source of vibrations. Various thickness of the damping layer were analysed, until a thickness of 45 mm was found to provide desired effects. In case of effects on humans, according to Polish standards for mid-band frequency of 10 Hz, limits of perceiving vertical vibrations were achieved. However, one should be aware of the fact that in the present case we are dealing with an attempt to interfere in lowering low frequency vibration (same embankment dampens vibrations of higher frequencies) and vibration isolating mats are not good materials in this case, because using only their damping properties apart from the possibility of tuning of the natural frequency of the whole structure. Nevertheless, under these terrain conditions, it seems that there is no alternative solutions.

Key words: Traffic induced vibrations; vibration propagation; dynamic response of the building; paraseismic vibrations.

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Time-of-day visibility-based pedestrian gap acceptance model for two-way stop controlled crossings

Virginia P. Sisiopiku ^{*1}, Shrikanth V. Mamidipalli ², Bastian Schroeder ³, Lily Elefteriadou ⁴

¹ University of Alabama at Birmingham, 1075 13th St S, Hoehn 311, Birmingham, AL 35294, USA

² University of Alabama at Birmingham, 1075 13th St S, Hoehn 211, Birmingham, AL 35294, USA

³ Kittelson & Associates, Inc., 272 N. Front St, Suite 501, Wilmington, NC 28401, USA

⁴ University of Florida, 512B Weil Hall, Gainesville, FL 32611, USA

ABSTRACT

Conventional traffic engineering studies at two way stop controlled (TWSC) locations have been largely interested in figuring capacity and delay impacts due to pedestrian impedance. With growing embrace of active transportation modes, a corresponding uptick in pedestrian behavioural analysis is observed. Still, pedestrian gap acceptance at TWSC locations has not been investigated in great detail. The objective of this research was to analyse empirical observations from study sites in Alabama and develop pedestrian gap acceptance models at TWSC crossings. A new aspect impacting pedestrian gap acceptance choices, namely visibility due to daylight conditions, was further explored. Discrete choice models with underlying normal and logistic distribution of error terms were developed. From the set of developed models, a probit model considering the daylight visibility term was found to be suitable for further empirical validation. Based on this model, gap length, presence of vehicle at minor street waiting for right of way, opportunity to cross the street in lag, and daylight visibility were found to affect pedestrian gap acceptance. The model qualified the basic goodness of fit criterion with Max Rescaled R-squared of 0.8695. This study broadens empirical pedestrian behaviour model development to TWSC locations and is the first of its kind to elaborate visibility impacts.

Key words: Two-way stop controlled; pedestrian gap acceptance; time-of-day; visibility.

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Decision support systems in transport planning

Ebru Vesile Ocalir-Akunal *

Gazi University, Faculty of Architecture, Department of City and Regional Planning, Ankara, Turkey

ABSTRACT

Modern transport planning professionals are no longer capable of solving ever developing problems by using traditional methods. Instead, contributions from other fields of science, such as artificial intelligence, optimization algorithms and some advanced statistical analyses, in addition to modern technologies, such as, GIS, Intelligent Transport Systems (ITS) and smart solutions are the tools in modern transport planners' hands. During the last three decades, the use of computers has contributed a lot to the practice of transport planning. In addition to gaining the ability to build up more complex models in order to analyse collected data, some new approaches, which take human behaviour into consideration, have been added to transport planners' tools. Increasing use of computers gives transport planners possibilities to handle much more data with increasing precision in very limited timeframes. This modern perspective in decision-making in transportation planning is mainly fed by scientific approaches of systems thinking, GIS, information systems and artificial intelligence. The results of any analysis regarding any transport decision can easily be visualized and presented to decision maker. A single solution is usually replaced by a set of solutions with a comparative list of advantages and disadvantages. Use of decision support systems help mainly to professionals of transport planning, urban planning, public-policy planning, public transport operating, service industry and logistics but also individual users of transport systems. Monitoring of traffic conditions, listing all possible travel alternatives or calculating fares are now a part of transport users' daily life. User friendly interfaces in web applications and smart devices in transport decisions not only help individuals but also pave the way for formation of smart societies. The decision support systems for transportation planners cover a wide perspective, ranging from traffic control centres, passenger movements, public transport management for the scheduling and routing of cargo, automated transport systems, etc. In this paper, decision support systems as a tool in transport planners' hands will be presented through a literature survey. Different classifications of decision support system examples in transport planning area will be given in order to better understand the relationships and differences in various modes and scales.

Key words: Decision Support Systems (DSSs); Intelligent Transport Systems; smart solutions.

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Modelling railway pre-stressed concrete sleepers with holes and web openings

Sakdirat Kaewunruen *

University of Birmingham, Birmingham Centre for Railway Research and Education, Gisbert Kapp Building, Birmingham,
B15 2TT UK

ABSTRACT

Pre-stressing in concrete railway sleepers yields endurance property under high-cycle fatigue. This structural effect plays a positive role in durability of the sleepers. However, as a common practice, track engineers often generate holes or web openings in concrete sleepers to enable the accommodation of rail equipment cables and signalling equipment. This study aims to provide a principle understanding of the structural capacity and energy toughness of pre-stressed concrete sleepers with and without holes and web openings. It will investigate the design criteria and effects of holes and web openings on the structural capacity of concrete sleepers under rail loading. The modified compression field theory and finite element modelling for ultimate strength design of concrete sleepers will be highlighted in this study. Static experimental testings have been carried out to validate the finite element models using ABAQUS. The models can predict the failure planes and can help provide practical guidelines for the holes and web opening for track engineers.

Key words: Pre-stress; concrete; railway sleepers; finite element models.

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Static and dynamic behaviours of railway pre-stressed concrete sleepers with hole and web openings

Sakdirat Kaewunruen *, Remennikov

University of Birmingham, Birmingham Centre for Railway Research and Education, Gisbert Kapp Building, Birmingham, B15 2TT UK

ABSTRACT

As the crosstie beam in railway track systems, the pre-stressed concrete sleepers (or railroad ties) are principally designed in order to carry wheel loads from the rails to the ground. Their design takes into account static and dynamic loading conditions. It is evident that pre-stressed concrete has played a significant role as to maintain the high endurance of the sleepers under low to moderate repeated impact loads. In spite of the most common use of the pre-stressed concrete sleepers in railway tracks, there have always been many demands from rail engineers to improve serviceability and functionality of concrete sleepers. For example, signalling, fibre optic, equipment cables are often damaged either by ballast corners or by tamping machine. There has been a need to re-design concrete sleeper to cater cables internally so that they would not experience detrimental or harsh environments. Accordingly, this study will investigate the effects of holes and web openings on static and dynamic behaviours of concrete sleepers under rail loading. The modified compression field theory for ultimate strength design of concrete sleepers will be highlighted in this study. The outcome of this study will enable the new design and calculation methods for pre-stressed concrete sleepers with holes and web opening that practically benefits civil, track and structural engineers in railway industry.

Key words: Railway; pre-stress; concrete; hole and web openings.

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Design of Polish Logistics Network

Dariusz Grzesica *

Cracow University of Technology, Warszawska street 24, Cracow, Poland

ABSTRACT

The paper presents the design method of Polish logistics network based on the administrative division of the country. For this purpose, the centre of population gravity method was used to determine the centroid representing the distribution centres. Then, Voronoi diagrams were used to determine the proximity between centroids and Delaunay triangulation to create connections between distribution centres which are characterized by the shortest distances. This approach can be used to create networks in all areas of knowledge, having regard to the nature and specificity.

Key words: Logistic network; Voronoi diagram; Delaunay triangulation.

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Natural hazard risks on railway turnout systems

Serdar Dindar, Sakdirat Kaewunruen *, Min An, Jack Anson

University of Birmingham, Birmingham Centre for Railway Research and Education, Gisbert Kapp Building, Birmingham,
B15 2TT UK

ABSTRACT

Railway turnout is constructed on a complex geometry and grade, which makes it one of the most critical railway infrastructures. These characteristics pose various risks in rail operations. A considerable number of derailment incidents have occurred every year. Not only do these incidents yield operational downtime and financial losses, but they also give rise to the casualties and sometimes the loss of lives across the world. One of fundamental reasons is that railway industry barely pays attention to risk elements on railway turnouts. The paper presents how turnout components work as a system, the diversity of emerging risks considering natural hazards and global warming potential to the system. In addition, various qualitative and quantitative based risk analysis methods are proposed for appropriate risk management of railway turnouts and crossings e.g. aging, degradation and signalling faults on the railway turnout systems.

Key words: Railway turnout; natural hazard risk; diversity of emerging risks; risk management.

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Need and opportunities for 'Plan B' in track inspection planning

Mohd Haniff Osman ^{*1,2}, Sakridat Kaewunruen ¹, Serdar Dindar ¹

¹ University of Birmingham, School of Civil Engineering, B15 2TT, UK

² Universiti Kebangsaan Malaysia, Faculty of Engineering and Built Environment, 43600, Malaysia

ABSTRACT

Track inspection is purposely performed to recover tracks from defects and damages and eliminate potential safety hazards. It is planned through an exhaustive process that usually integrate many disciplines such as optimization, statistics, risk analysis, etc. Spending so much of a monetary and an emotional investment in an original plan (refer as master plan afterwards) that the planner want to deliver might be a good excuse not to develop a solid 'Plan B'. Plan B here refer to planner responses or a contingency plan when the master plan doesn't go as expected. It is admitted that there is often low probability of a crisis occurring when a plan is executed in a real environment. Nevertheless, its impact left transportation services to the mercy of the catastrophe as shown by past events happened in the UK in the last couple of years. Thus, this communication paper aims to discuss the potential of considering 'Plan B' or contingency plan if situations arise that were not expected during track inspection plan execution. Benefits, general guidelines and relevant strategies of creating a contingency plan are also discussed. We present the argument to support the claim that an original plan of track inspection jobs should be adapted to respond to new context e.g. inspection vehicle machine breakout, new inspection requests, etc. It is however required to develop a new performance metric that is used for plan repair strategy selection due to track inspection planning is bonded with an international safety standard.

Key words: Track inspection planning; contingency plan; plan repair; strategic management.

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Disruption management of resource schedule in transportation sector; perspective, strategy and application

Mohd Haniff Osman ^{*1,2}, Sakdirat Kaewunruen ¹, Jack Anson ¹

¹ University of Birmingham, School of Civil Engineering, B15 2TT, UK

² University Kebangsaan Malaysia, Faculty of Engineering and Built Environment, 43600, Malaysia

ABSTRACT

Disruption in a schedule (or plan) can be managed but not all is visible. A study of disruption management is particularly performed to minimize the differences between the expected and actual context of execution. The purpose of this paper is trifold, first to offer an introduction to disruption management, provide a description of the resource scheduling process, and deliver a detailed overview of the numerous aspects of disruption management. Second, it is to construct a knowledge inventory of practical strategies to manage disruption in the area of resource scheduling. Real world applications from airline to track are used as basis of the inventory development. All the above works are then systematically organised as a framework before it is applied to a transport inspection and maintenance area of study. Discussion on future development of disruption management for that particular interest is provided at final part of this paper.

Key words: Track inspection planning; contingency plan; plan repair; strategic management.

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A GIS-based accessibility modelling approach to evaluate performance of transportation networks

Kivanc Ertugay *

Selcuk University, Faculty of Architecture, Department of Urban and Regional Planning, Konya, Turkey

ABSTRACT

Understanding performance of transportation networks is a challenging research area. Ranging from simple to sophisticated, numerous types of accessibility measures are found in the accessibility modelling literature such as Travel time/distance, Cumulative opportunity, Population to provider ratio, Gravity, Kernel density, Two-step floating catchment area (2FCA) etc. Whether simple or sophisticated, all types of accessibility measures are widely used by geographers, economists, urban and transportation planners to “identify regions that have inadequate or excessive service”, “to select appropriate sites for new or re-located services” or “to evaluate the performance of the transportation networks”. The basic purpose of this research is to introduce a new GIS based approach which could be used to test the accessibility performance of the transportation networks considering Euclidian and Network based costs between regularly produced origins and destinations on the network. The proposed model could be considered to produce a new type of Travel time/distance based accessibility measure and could be used by decision makers to test the performance of the transportation networks in terms of accessibility and to compare different networks with each other. The developed approach consists of 3 major steps; 1-Data preparation phase: This phase includes the preparation of GIS based input data in order to model accessibility. The main inputs of the proposed model are the transportation network, the supply locations and the demand locations. 2-Accessibility modelling phase: This phase covers accessibility modelling in GIS environment in order to evaluate the performance of transportation network. This phase could produce accessibility measures considering the ratio of Euclidian and Network based traveling costs (generally; time or distance) between regularly produced origins and destinations on the network by using the network analysis and spatial analysis capabilities of GIS. The modelling process is also automated in model builder environment in order to create a decision support tool for the decision makers. 3-Evaluation phase: This phase covers evaluation of the results by the decision makers in terms of the central tendency, the dispersion and the distribution statistics to support their accessibility related policy making efforts. Each type of the statistics can help decision makers to understand different aspects about the performance of the transportation networks. The proposed model produces ratio scores between 0 and 1. When the mean of the ratios is analysed as central tendency statistics, the higher mean could mean better accessibility performance for the transportation network. When the skewness of the ratios is analysed as distribution statistics, the right skewed distribution could mean better accessibility performance for the transportation network. This means that most of the ratio values are closer to 1 and Network based costs between supply and demand locations are very close to the Euclidian based costs. When the standard deviation of the ratios is analysed as dispersion statistics, the lower standard deviation in a right skewed distribution mean better accessibility performance in a transportation network when compared with a higher standard deviation score in a right skewed distribution.

Key words: GIS based accessibility modelling, test transportation network performance.

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New tramway infrastructure in Bratislava (Slovakia) – How can influence the well prepared traffic engineering analysis and planning tools the decision making

Tibor Schlosser ^{1*}, Peter Schlosser ²

¹ Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Department of Transport Structures, Bratislava, Slovakia

² DOTIS Consult, s.r.o., Bratislava, Slovakia

ABSTRACT

The first idea of mapping the situation from traffic engineering point of view in Petržalka, Bratislava (Slovakia) in 2008-9 defined the possibility to create a new situation for development of Tramway infrastructure across the river Danube. The paper is dealing with the tools of traffic engineering surveys mapping the situation in modal split and capacity of bridges in Bratislava from which were created a complex transport model. The results from the transport model showed the overflowed situation and find the way to start with preparing the new Carrying System of Integrated Public Transport using the multi-modality of rail tracks in the agglomeration of Bratislava. Nowadays Bratislava has its first section of new tramway infrastructure from the downtown of the city connecting the all radials of the city toward the southern largest housing estate Petržalka. This section is prepared for operation.

Key words: Public transport; integrated transport infrastructure; tramway; traffic engineering and planning; transport model.

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Development the energy absorbing sign post and test the impact performance for minimizing impact severity

Dukgeun Yun ^{1*}, Mangi Ko ², Minhyung Nho ², Jaehong Park ¹

¹ Korea Institute of Civil Engineering and Building Technology, Highway and Transportation Research Department, 283, Goyang-daero, Ilsanseo-gu, Goyang-si, Gyeonggi-do, 10223, South Korea

² Kongju University, Department of Civil & Environmental Engineering, Chungnam Cheonan Subuk Cheonan-Daero 1223-24, South Korea

ABSTRACT

Even though the total road accident fatalities have been decreased for decades, but the number of single-vehicle accidents fatalities were decreased slightly when concerns the total road accident fatalities. The highest portion among the single-vehicle accident is collision to the fixed objects alongside the road such as road sign post and lighting pole. Especially unshielded or rigid posts on roadside are a critical hazard to the safety of impact vehicle to the posts. To solve this problem, some countries adopted breakaway sign supports. However the breakaway sign support could be caused the secondary accident or damage after initial impact and separated from its base and fall back onto the upcoming vehicles. Therefore a crashworthy (energy absorbing) post was designed and tested using computer simulation. In the first phase, it dissipates the impact energy by the linear momentum conservation principle while the plastic impact between the post and vehicle takes place, then, the second phase dissipation follows by the deformation of the energy absorbing modules embedded in the guide trough of the foundation. Simulations of impacts to a rigidly connected post and crashworthy post were made using LS-DYNA program, which demonstrated the danger of unshielded rigidly connected post and the effectiveness of the proposed crashworthy post to the 0.9ton-80km/h impact. To evaluate the occupants' safety, the THIV (Theoretical Head Impact Velocity) and PHD (Post Head Deceleration) were used. The result showed, even though the rigid post didn't satisfied the occupants safety factor, the crashworthy post satisfied the THIV and PHD under the 0.9ton-80km/h crash condition.

Key words: Crashworthy post; passive safety; energy dissipation; impact; momentum conservation; simulation.

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Analysis of road surface condition affecting traffic crashes

Jaehong Park *, Dukgeun Yun

Korea Institute of Civil Engineering and Building Technology, 283, Goyang-daero, Ilsanseo-gu, Goyang-si, Gyeonggi-do,
10223, South Korea

ABSTRACT

Road environment characteristics have been known as one of the most significant factors that have impact on traffic safety. Although many researchers and public institutes have been making their efforts to increase safety of roadways, there is still a need to investigate the relationship between various factor and crashes. Therefore, this study investigates the correlation between the road surface condition and traffic crashes the Support Vector Machine (SVM). In order to obtain more precise and accurate data, the advanced investigating vehicle with multiple sensors was used. In particular, the water-reservoir level, which can relate the appearance of slipping crashes, was identified using the texture laser sensor and used in the analysis. The results show that correct classification rate derived from SVM analysis is 56%. It was also found that there is a significant correlation between the road surface condition and traffic crashes. This study is expected to contribute for research on safe driving under the road environment.

Key words: Traffic crashes; Support Vector Machine (SVM); road surface; sensors.

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Liveability and transit use in rural areas

Luca Quadrifoglio ^{*1}, Eleonora Sottile ², Italo Meloni ²

¹ Texas A&M University, Zachry Department of Civil Engineering, CVLB 301-I, 3136 TAMU, College Station, TX 77843, USA

² Universita' di Cagliari, Dipartimento di Ingegneria Civile, Ingegneria Ambientale e Architettura, via Marengo 2, 09123 Cagliari, Italy

ABSTRACT

The concept of liveability has recently attracted a lot of attention, in particular when referred to rural communities; its formal definition and components are still under continuous discussion. Transit is one of many factors that influence liveability of rural areas. Some rural communities do not have public transit services of any kind, while others operate a wide variety of services. The demographic, social, and economic fabrics of rural communities also vary widely. This case study includes a survey of the public and transit riders to collect information about perception of liveability, transit use and demand analysis for potentially developing on-demand transit services, often the only ones able to satisfy the weak demand of these areas more efficiently than others, finding suitable trade-offs to maximize users' service level and simultaneously minimize transit agencies' costs. The benefits of a potential wise development of these services also include multimodal accessibility in response to the typical "first and last mile" problem and tourism development. Surveys are conducted through a combination of web-based and in-person questionnaires. The ultimate objective of the research is to collect and organize the information collected from residents for immediate benefit to transit agencies, rural communities, and policy-makers in their efforts to engage in local dialogues about community liveability and public transit. This study is part of an international effort originally conducted in the rural areas of United States and then expanded to rural Sardinia (Italy) as a part of a Fulbright Award, to eventually compare and evaluate differences between similar areas in different Countries.

Key words: Demand responsive transit; liveability; rural area; multimodal connectivity.

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Discovering relationships between factors of round-trip carsharing: by using association rules approach

Dahye Lee ¹, Luca Quadrifoglio*¹, Benedetta Sanjust di Teulada ², Italo Meloni ²

¹ Texas A&M University, Zachry Department of Civil Engineering, CVLB 301-I, 3136 TAMU, College Station, TX 77843, USA

² Universita' di Cagliari, Dipartimento di Ingegneria Civile, Ingegneria Ambientale e Architettura, via Marengo 2, 09123 Cagliari, Italy

ABSTRACT

To maximize private vehicle usage efficiency and alleviate urban congestion, many studies and actual field operations on vehicle sharing have been done since the mid '90s. The classic carsharing system, which is known as a round-trip, is operated out of fixed stations so that customers can pick up and drop off the vehicle at the same station. Although many private carsharing companies offer one-way or free-floating trips currently for customers' convenience, studying characteristics of round-trip carsharing is still significant in making cost-beneficial, fuel-efficient, and less-congested driving environments in urban areas. The main objective of this research is a comprehensive analysis for discovering relationships between critical factors of round-trip carsharing operations based on the city of Cagliari, Italy, by analyzing data retrieved from the local carsharing providing company, PlayCar, with the association rules approach. This paper investigates round-trip carsharing behavior characteristics from various angles, including demand analysis of reservation by hourly and daily manner, geographic analysis, and connectivity to public transportations. The association rules technique was used to discover the relationships between the characteristics and understand their attributes. The demand analysis shows that customer's carsharing usage does not follow typical hourly and daily flow patterns in urban areas and even one-way carsharing systems at some point. Results of association rules analysis show that the strongest dependent variables do not have high correlations with the variables of distance from customers' residence locations, and the rule that has peak hour driven travels and yearly subscription customers has considerably high support value. Although the results gave an idea of connections of round-trip operations characteristics with various combinations, the degree of impact of each variable still need to be investigated. The ultimate goal for future studies is to use these information to improve the performance of these services for providers and customers and maximize connectivity to public transportation to eventually help in reducing congestion and pollution.

Key words: Car sharing; demand analysis.

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Detection of chaotic features in traffic flow forecasting model using time series analysis of non-linear dynamic system: two lane motorway case studies

Anamarija L. Mrgole *, Beno Mesarec, Drago Sever

University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture, Smetanova 17, 2000 Maribor, Slovenia

ABSTRACT

Traffic flow and congestion are one in all the most social and economic issues associated with transportation in industrialized countries. In this respect, good traffic management on a network is needed along with an understanding of traffic flow operations. That is, insights into what causes congestion, what determines the time and placement of traffic breakdown. Paper presents new model for forecasting traffic flow on two lane motorways using time series analysis of nonlinear dynamic system. Forecasting model provides an innovative and new process of identification and detection chaotic features in times series analysis. New method is grounded on the theory of chaotic feature, which provides a framework for reasoning about a domain that approximates traffic flow prediction. Proposed new method of forecasting short-term congestion in traffic flow is using Wigner-Ville frequency distribution. The method enables the display of a chaotic attractor without the use of reconstruction phase space. It is possible to shorten the time of the forecast calculation denser traffic flow and reduce the time series. The results of the experimental work shows the credibility of the model identification and prediction of congestion chaos in traffic flow. Comparison of the results obtained chaotic neural network and targeted neural networks shows that with the missed step we have a more accurate short-term forecast. Chaotic identification forecasting model (CIFM) is focused only on short term forecasting. We estimate the emergence of traffic flow congestion in road traffic when the traffic load on a specific section of the road in a specific time period is close to exceeding the capacity of road infrastructure. Under certain conditions chaotic features can be seen in concentrating traffic flow parameters. After a learning period, the model is capable of predicting short term predictions on motorway. A quality measure assessing the performance of states and state sequences was developed that optimizes the state machine, resulting in an accurate short term prediction model. The CIFM orientated model is validated on six locations with a specific requirements. It could be shown through a simulator study that the algorithm is capable of significantly reducing the severity or even avoiding, traffic flow congestion on motorway. The paper points out the issue of importance for traffic flow forecasting and simulations for preventing or possible rerouting to avoid traffic flow congestions.

Key words: Traffic flow; prediction; time series; dynamic system.

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Analysing transport problems in Tirana on a sound scientific system base

Aksel Seitllari *

Meliksah University, Faculty of Engineering and Architecture, Department of Civil Engineering, 38039 Kayseri, Turkey

ABSTRACT

The globalization process taking place recent years has significantly increased the need for mobility. Due to the urban population growth and urbanization, the role of transportation engineering in daily life has mainly increased accompanied by the challenges featuring it. Of importance is the mobility on urban areas, considering the socio-economic and environmental effects. According to Olayiwola et al. the main challenges concerning urban mobility are traffic congestions and management. Furthermore in developing countries to such situations contribute the weak enforcement of traffic rules and regulations.

This study tends to illustrate, analyse and provide new methodologies on optimizing traffic congestion in the capital of Albania, Tirana. Focusing on the road network and public transportation impacts on mobility, the research seeks to outline new strategic solutions for the rapid developing capital, oriented toward society wealth as follows; i) The investigation and illustration of the strengths, weakness and improvements that could be implemented on road network and reorganization inside the urban area of the capital is of first call. ii) As the main motorized transportation mode, reorientation and coordination of public transportation system directly affect the socio-economic behaviour and smoother traffic flow. In addition, the improvement of public transportation system facilities increase the user's number thus reducing the private vehicles usage. iii) The lack of coherent data concerning traffic information system in problematic bottlenecks directly affect traffic management in those zones. In this context, implementation of different techniques for data gathering and application of intelligent transportation system in particular areas like CBD, improves the management of the congestion. Beside, reassessment of the existing and implementation of new parking areas due to future requirements, efficiently smoothers unpredicted congestion situations. iv) Last but not list, the establishment of a framework for actions for the road network and public transportation systems of Tirana results in provision of successive recommendations and analysis. Moreover it shall evaluate the relationship and impact that and public transportation system have on each other and their effect to socio-economic development and environmental issues of the capital.

Key words: Road network; traffic volume; public transportation systems; congestion; socio-economic development.

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Estimation the saturation flow rate at far-side and nearside legs of signalized intersections: case study of Rasht City (Iran)

Iraj Bargegol *, Afsaneh Tahri Amlashi, Vahid Najafi Moghaddam Gilani

University of Guilan, Faculty of Engineering, Department of Civil Engineering, P.O.Box 3756, Rasht, Iran

ABSTRACT

Saturation flow rate as one of the important characteristics of traffic flow plays a key role to determine the capacity and delay in signalized intersections. So far, various studies have been done to evaluate the saturation flow rate at nearside legs of intersections which is fit to geometrical dimensions, traffic flow characteristics and the behaviour of the drivers. However, despite the deference between the above specifications, no study have been conducted on the saturation flow rate at far-side legs and considering the difference between the saturation flow rate at nearside and far-side legs in case of reducing the number of lanes, lane width and other effective factors, it seems to be necessary to determine the saturation flow rate at far-side legs. In the present study, using field data collection at five signalized intersections in Rasht city, the saturation flow rate is estimated and analysed by macroscopic and microscopic methods, considering the existing lane width at nearside and far-side legs of the intersections. The results indicate that the values of saturation flow rate at far-side legs using the microscopic method are higher than the similar values in nearside legs. Also there is a primarily linear relationship ($R^2=0.957$) between the lane width and saturation flow rate at far-side legs using the macroscopic method. There is an exponential non-linear relationship at far-side legs ($R^2=0.859$) and a logarithmic non-linear relationship at nearside legs ($R^2=0.105$) between the lane width and saturation flow rate using the microscopic method. In regard to far-side leg's R^2 , it seems that the main criterion in determining the saturation flow rate is the lane width, while at nearside leg more effective parameters need to be used to determine the values of saturation flow rate.

Key words: Signalized intersection; saturation flow rate; far-side leg; nearside leg; macroscopic method; microscopic method.

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Human pathways analysed with finite-element-method

Adam Ungvarai *1, Lajos Kisgyörgy 2

1 University of Debrecen, Department of Civil Engineering, H-4028 Debrecen, Ótetető str. 2-4, Hungary
 2 Budapest University of Technology and Economics, Department of Highway and Railway Engineering, H-1111
 Budapest, Műegyetem rkp.3., Hungary

ABSTRACT

Traffic facilities are always an answer to existing traffic demand of the society. However, traffic demand is deeply anchored in human nature. Its easy implementation by any kind of traffic facility is a crucial part of comfort in our everyday life. In certain cases – when traffic demand is blocked – one can feel the necessity of missing links. Sometimes traffic also makes visible effects in our environment. Impressive examples are the so-called desire paths, also known as human pathways or pedestrian trails, which are ways as a consequence of erosion on open unpaved places caused e.g. by pedestrians. This phenomenon allows us to study some particular attributes of traffic demand and therefore also gain better comprehension of how human nature works. To make usage of this phenomenon is not completely new: in the so-called Scandinavian sidewalk building method the pedestrians set out the best routes themselves – by desire lines. In previous papers we already showed an established investigation method based on an analogy between such visible trails and local stresses in shell structures caused by static load. Investigations were made about basic procedures and parameters for the finite element programs, which showed amazing similarities. Case studies showed that this examination method is possible and of great promise, however additional research and tests are necessary. With this method forces, which drives human traffic participants can be visualised, with the global goal to arrange our environment more human friendly and do road designs more economical with less redundantly built paved space. The general aim is to establish a tool which can determine where pathways in a city are most human-friendly and close to nature – that means to be able to forecast the Scandinavian sidewalk building method. In this paper we present the mathematical theory behind the idea, as well as the overview of the yet established work, with a brief previous case study.

Key words: Human pathways; traffic demand; FEM.

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Public transport travel demand and cross-border effect – a meta-analysis

Mitja Klemenčič *

University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture, 2000 Maribor, Slovenia

ABSTRACT

Cross-border Public Transport travel demand is influenced by many internal and external factors. While the external factors are focusing on forecasting core City/Region or Country Characteristics on income, fuel price or population; internal factors are dealing with Public Transport offer (Level of Service, accessibility, Infrastructure, Information, and Fares). As cross-border Public Transport demand depends on policy situation between two neighbouring countries, multinational corridors and local circumstances, the integrated forecasts are rare, complex and normally combined with other models. Additionally the border represents the main obstacle to prevent people to travel or to slow down the Public Transport, due to technical or organizational reasons. A meta-analysis was performed to study the relationship between main factors and variables on 34 studies, where induced Cross Border Public Transport demand was reported, due to improvements of rail service. The meta-analysis reflects also the drawbacks and benefits of different methods (models) used to identify induced Public Transport demand on cross-border connections.

Key words: Public transport; cross-border effect; meta-analysis; induced demand; rail service.

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Investigation of transportation means and traffic loads along Antalya coastal area

Altan Yilmaz *

Mehmet Akif Ersoy University, Civil Engineering Department, Burdur, Turkey

ABSTRACT

Since 1950's, transportation policy all over Turkey has devoted on highway transportation. The lack of investments on railways and inefficient progression on maritime lines has caused too much traffic load on highways. Nowadays, 95 percent of the total transportation in Turkey is being done through highways. The ratio is even higher in the field of passenger transportation. In fact, using highways for all transportation activities is expensive and economically inconvenient. Antalya is one of the most important areas for tourism in Turkey. Almost all of the passenger and freight transportation is being done through highways due to lack of railways and ineffective usage of maritime lines. In 1990's, with the increasing tourism potential in Turkey, density of the vehicle traffic in Antalya region also increased because most of tourist centres and tourism investments are located in this region. Consequently, the number of traffic accidents has increased due to the increase in the local traffic density. In this study, 250 km state road (D-400) which is located on the shoreline of Antalya is investigated by considering different criteria; Pavement defects, traffic accidents, circulation and transportation and the recent situation of road is stated, the factors which generate inefficiency on roads are determined and various possible measures are examined. D400 state highway which has administration office in Antalya, has 2 parts. 114 km of this road is located in the western part of the city and 136 km of the road is on the eastern side (Finike - Antalya - Alanya). The important criteria considered in choosing these parts of the road are; the location which connects important tourism centres with each other and high AADT (Annual Average Daily Traffic) values. Another characteristic of this road is its usage for dense tourism transportation and heavy vehicle traffic. The study could determine the present condition of the coastal roads. Also, the study showed that if the tourism sector keeps on recent development rate, population growth will accelerate and the necessity of the usage of different transportation systems will come out. Moreover, the study investigated the visible alternative transportation systems that should be followed in a general framework.

Key words: Coastal roads; transportation; traffic modes, tourism facilities.

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Use of dynamic cone penetrometers in pavement design and construction

Altan Yılmaz *¹, Nihat Dipova ²

¹ Mehmet Akif Ersoy University, Civil Engineering Department, Burdur, Turkey

² Akdeniz University, Civil Engineering Department, Antalya, Turkey

ABSTRACT

Road rehabilitation very often calls for testing of conditions pertaining to existing road structure, starting with load bearing courses, down to subgrade and subsoil. Opening of trial pits and sampling for laboratory testing, as well as field investigations of load bearing capacity and compactness provide for a clear view of pavement structure. The dynamic cone penetrometer (DCP) is the most versatile rapid, in situ pavement evaluation device currently available. The DCP was initially developed in South Africa for in-situ evaluation of pavements. Afterwards, it has been used in South Africa, The United Kingdom, Australia, New Zealand and several states in the US for site characterization of pavement layers and subgrades. Correlations to CBR, unconfined compressive strength, resilient modulus, and shear strengths, and its use in performance evaluation of pavement layers make it an attractive alternative to more expensive and time consuming procedures. Many useful correlations between the DCP penetration index and other material properties have been determined. Other possible applications of DCP such as its use in the quality control of compaction of fill. Many researchers have suggested non-destructive testing of pavement and subgrade soils using the DCP to provide additional data for reliable pavement evaluation procedures. Adaptation of in situ pavement performance evaluation test devices such as DCP to quality control specifications of pavement associations. It will make possible to provide more information about the mechanical properties of the granular pavement layers for the pavement construction and design purposes.

Key words: Dynamic cone penetrometer; pavement design; quality control.

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Energy-saving with lightless rotary traffic junction design

Melis Bilgic *¹, Vedat Karaman ²

¹ Kırklareli University, Faculty of Architecture, Department of Architecture, Kırklareli

² Istanbul Gelisim University, Engineering Faculty, Department of Automotive Engineering, Istanbul

ABSTRACT

Day by day energy consumption in parallel to the human population is increasing in growing and crowded cities. Vehicles used to transport by people have a significant share of this energy consumption. This study examined that the junction have traffic jam, and dwell time of vehicles at a red light is determined. Calculate the energy used by the vehicle during the dwell time. Consequently the total energy loss is determined based on the average number of vehicles per day standing at the crossroads. As a result, a solution is lightless intersection design that prevents the energy loss is presented.

Key words: Road junction; energy; sketchup; lightless intersection; traffic jam; transportation.

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Development of Transportation Asset Management and Data Collection System (TAMS) using mobile applications

Ghazan Khan *, Andreas Bueff, Ivan Mihov, Nati Tessema, Javier Garrido, Chris Russel, Arash Parnia

California State University Sacramento, Department of Civil Engineering, 6000 J St. Sacramento, CA 95825 USA

ABSTRACT

Collecting, managing, and updating transportation asset data can be a cumbersome, complex, and expensive proposition for transportation professionals. The advent and proliferation of mobile devices including mobile phones and tablets with GPS sensors, accelerometers and cameras, presents an opportunity to leverage these devices to help address this issue in an efficient and cost-effective manner. The objective of this research was to develop a comprehensive system of mobile-based applications and associated back-end system, called TAMS, for transportation asset management and data collection. TAMS is a multi-platform asset management software, designed to collect and manage the location and attributes of transportation and associated geographical features, e.g. road signs, bridges, location of horizontal curves, etc. in the field. TAMS mobile apps for android and iOS have been built to function independently and without the requirement of a remote server. The app interface presents the user with a screen with Google Maps in the background to provide information on where the user is located or provide ease of navigation to specific locations in the field. Users can identify transportation asset features in the field and choose to classify them as points, lines, or polygons, e.g. users can choose to collect the location of bridges on roads as a point or a line feature. The mobile app can also collect additional information in the field such as location information (GPS coordinates), descriptive attributes, e.g. pictures, voice and typed notes, etc. The back-end system of TAMS consists of the web app which has been developed to work directly with the remote server that is hosted on a personal computer. Multiple users can collect data using the apps in the field and synchronize the data using the web app with the remote server. The back-end system allows for a manager to create and manage multiple user accounts to ensure security and tracking of data collection efforts. Most importantly, the manager can also upload existing transportation asset dataset to the server for editing and updating in the field. The back-end system can be used to export data into multiple formats (KML, shapefiles, XML, JSON, Excel, CSV, TXT) to be used outside of TAMS. Data collected with TAMS can be readily used in a Geographical Information System (GIS) environment to leverage location and attribute information. In addition to new data collection, the app can also be used in conjunction with existing transportation asset data which can be pre-loaded to the app and edited or updated in the field providing ease of management and cost-effective solutions. The back-end system allows for a secure method of managing and tracking data collection efforts which is critical to maintaining the quality and accuracy of data collection.

Key words: Mobile application; Transportation Asset Management; data collection; GIS; field data collection.

* **Corresponding Author**

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Evaluation of a potential wildlife crossing in the city of Burdur (Turkey)

Latif Gurkan Kaya, Cengiz Yuicedag *

University of Mehmet Akif Ersoy, Department of Landscape Architecture, Burdur-Turkey

ABSTRACT

Especially highways and expressways affect populations in numerous ways, from habitat loss and fragmentation, to barriers to animal movement, and wildlife mortality. Hence, the effects of roads on wildlife populations have been the focus of many studies in the last decade and increasing concern for transportation and natural resource management agencies. For this reason, wildlife crossing has been established on the roads to protect the wild animals and them to breed, feed and to meet water needs in recent years. Wildlife crossing is a habitat combining wildlife populations fragmented especially by highways. Namely, it has facilitated the living of wild animals by providing a connection between two fragmented areas. In this study, a wildlife crossing is designed for two fragmented areas (Mehmet Akif Ersoy Urban Forest and 607th Burdur Forest Compartment) located in the City of Burdur (Turkey). For this purpose, computer software has been used to maintain a map that has been supported with photographs. This wildlife crossing is supported by samples established in the developed countries. The research team also reviewed studies that assess the efficacy of crossings and in doing so, learned what was working well. It has been thought that such a crossing is essential for the living in these areas. Moreover, this kind of crossing should be established in the whole fragmented areas in Turkey. Therefore, they will positively contribute to fauna diversity by increasing permeability and habitat connectivity across roads. In addition, they are intended reduce wildlife-vehicle collisions to avoid possible deaths and injuries. On the other hand, the sitting of wildlife crossing structures is equally as important as their design. Identifying the proper location of crossing structures is critical for designing effective mitigation of the barrier effect caused by roads. To better identify potential mitigation measures for wildlife along transportation corridors, it is necessary to identify not only collision-prone zones, but also areas where landscape permeability can be addressed for suites of species.

Key words: Fragmentation; protection; roads; wildlife crossing; Burdur; Turkey.

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Analysis of geometric design impacts on vehicle operating speed on two-lane rural roads

A.M. Boroujerdian *, E. Seyedabrishami, Hamed Akbarpour

Tarbiat Modares University, Tehran, Iran

ABSTRACT

The rural road level of service quality has highly related to the vehicles operating speed. The vehicle operating speed has been generally influenced by geometric design characteristics. Previous studies have constructed various analytical models to measure the effect of miscellaneous geometric design variables on vehicle operating speed. This study investigates the main effect of road slopes and its interaction with other variables in Two-Lane rural roads. The vehicles operating speed in 42 sections of Two-Lane rural roads in north of Iran, a recreation area, has been recorded by video. The obtained films are analysed by image processing and operating speeds are measured by an appropriate software with acceptable precision. The distribution of vehicle speed along tangent sections was analysed and it was found speed had normal distribution. So it had two parameters: mean and variance. The relation between these two parameters and geometric characteristics of tangent sections was studied. The results show that the interaction between vehicle classification (passenger car or heavy vehicle) with slope has been significant parameter. Moreover the initial speed of vehicle at start of tangent section is a significant parameter. This result demonstrates the effect of previous geometric section on vehicle speed. The proposed models are validated by the standard error of estimate and observation versus estimation graph. The models will help road designer to estimate the average operating speed of vehicles along tangent sections and useful for policy makers to enact policies to control vehicles operating speed. The estimated speed can be helpful for analysis the safety of road concepts such as design consistency.

Key words: Geometric design; tangen section; slopes; operating speed; vehicle classification.

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The simulation of road traffic flow in the impact zone of bus stops used by varied operators

Justyna Stępień *

Kielce University of Technology, 25-314 Kielce, Al. Tysiąclecia P.P. 7, Poland

ABSTRACT

As a result of increased motorization and de-monopolisation of public transport, bus stops are being increasingly more intensively used by numerous private operators specialising mainly in interurban and suburban routes. With the substantial share of interurban communication vehicles standing at the bus stops, there are some disruptions in the fluency of public transport. Bus stop may be treated as a service system. With the increase of the time spent by buses at a stand, the probability of a bus having to wait before driving at the bus stop rises because of a stand being blocked by the previous bus. That leads to lowering public transport speed as well as waste of time incurred by public transport buses, passengers or sometimes also other users of the system. A significant diversification of the character of services among various operators at the shared bus stops causes deterioration of public transport traffic conditions. That can also affect other vehicles. Due to the high interurban transport vehicles, taxi and other non-authorized vehicles intensity, the bus stops are blocked, especially those located near the signalized intersections. The aim of this paper is to analyse the basic parameters of traffic flow with the use of computer simulation techniques for the urban street segments with localized bus stops. The traffic and passenger service processes will be the subject of research for bus stops used by various operators and users with neighbouring street segments. The analyse of the time lost at the bus stops used by various operators as a result of the following: standing in the queues, buses joining the traffic and buses waiting for the passengers to reach the vehicles of interurban carriers will be include in this paper. It is vital to define and point out those factors that affect the amount and probability of the time lost, in order to set the guidelines on location and sizes of bus stops for various operators, including quality criteria. Theory of probability and mathematical statistics in combination with correlation and regression analysis were used for the sake of this research. This paper presents the simulation of passengers boarding and alighting process at urban bus stops used by varied operators, basing on measurements in the area of urban bus stops in the city of Kielce and Cracow. There have been analyses carried out, concerning changes in the average time lost by the urban and interurban transport buses and minibuses, depending on: possibility of bypassing other buses standing at the bus stop; and the possible number of servicing canals for different variants of bus stop utilisation (service regulations) for the registered vehicle traffic and passengers exchange time. There have been proportions defined of buses' time lost caused by other transport system users such as taxis and remaining non-authorized vehicles, depending on their intensity and bus stop location.

Key words: Public transportation; bus stop; traffic engineering; computer simulation.

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Handling heavier loads in construction

Miguel Flórez de la Colina *

Universidad Politécnica de Madrid, Department of Civil Engineering, Madrid, Spain

ABSTRACT

Heavy lifting and exceptional transport equipment has been developed in an amazing way in the last two decades. We could not even dream some years ago with the weights and sizes that we are capable to transport and lift nowadays. Big cranes used to lift few hundred tons but now we are talking about thousand tons and at very important working radius, alternative heavy lift systems such as gantries, jacks, etc. are used for special jobs and, regarding transportation, Self Propelled Modular Transporters (SPMT) have been developing, increasing in number, and over 14.000 tons platforms have been moved on wheels. Shipping is also adapting fast to this scenario with higher capacity geared vessels and other type of multimodal ships. This capacity increase is being used in civil and industrial construction, (occasionally even in building construction) by developing prefabrication and modularization since it opens the possibility to handle bigger and heavier pieces. The advantages for construction are very important: better safety because it avoids to work on heights, better quality because of working in a more controlled environment (prefabrication yards, factories, etc.), improving the schedules by working on several parts simultaneously, price reductions by optimizing construction methods, global sequence and locations. The purpose of this research is to analyse the positive impacts of this higher lifting and transport capacity for prefabrication and modularization in construction and to find objective criteria and requirements that will need to be considered for planning or adapting infrastructures such as ports, roads, railways, towns, etc. Selected case studies are chosen in which those criteria can be examined. Results about load bearing capacity and clearances are indicated as well as some general recommendations for the design of the mentioned infrastructures in order to make possible the operations with this special type of equipment. Main conclusion obtained is that preparation of civil infrastructures is necessary and, because of the planning and maintenance required, special attention from Authorities or other infrastructure's owners is crucial. In order to make this planning realistic, it is suggested from this study to create "Exceptional Transport Corridors" in which it would be possible to concentrate the efforts of having accesses that allow good development of industry and power plants. Coordination and good planning regarding these special transports mean important cost reductions in projects as well as the other mentioned advantages, which ends up in significant benefits for society.

Key words: Transport; construction management, regional planning.

* **Corresponding Author**

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Diver risk assessment model considering trip characteristics using insurance data system

Majid Soltani * Seyedehsan Seyedabrishami, Amirreza Mamdoohi, Vadood Aliyari

Tarbiat Modares University, Transportation Planning, Department of Civil and Environmental Engineering, Tehran, Iran

ABSTRACT

Risky drivers impose a lot of damages to insurance companies, thus insurance providers usually may offer high-risk drivers coverage with higher prices. High-risk drivers are identified in terms of violations and accidents history. This paper investigates the impact of drivers' trip characteristics in addition to personal and socio-economic characteristics on drivers' riskiness. In case of non-accessibility to the history of drivers' violations or accidents, the impact model can be helpful for insurance providers to measure drivers' risk-taking attitudes. Then, high-risk driver coverage will be more expensive than the standard coverage. Insurance data from ASIA, the largest auto insurance company in Iran, for 506 drivers randomly selected are obtained using ASIA data system and interviewing with drivers at ASIA insurance claim centres. An ordered logit model has been utilized as driver risk assessment model. The dependent variables were the number of accidents on insurance records and traffic ticket. The results show that drivers often use private vehicles for non-mandatory purposes are more risky than mandatory purposes. Furthermore, drivers usually traveling on rural roads are high-risk driver compare to urban roads. The findings show that insurance providers may suggest expensive coverage to rural road drivers with non-mandatory purposes.

Key words: Risks of drivers; purpose of travel; ordered logit.

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Analysis of family structure influence on trip mode choice for different trip purposes

Arash Rasaizadi ¹, Moein Askari ², Seyedehsan Seyedabrishami ^{*3}

¹ Sharif University of Technology, Transportation Planning and Engineering, Tehran, Iran

² K. N. Toosi University of Technology, Tehran, Iran

³ Tarbiat Modares University, Faculty of Civil and Environmental Engineering, Tehran, Iran

ABSTRACT

The travel demand models are very influential on transportation future planning. Different variables including individual, family and zonal characteristics use to construct appropriate travel demand forecasting models. This paper focuses on trip mode choice as a part of travel demand model, to investigate how family structure variables such as household size, family members' jobs, ages and etc. will influence on trip mode choice. In previous studies researchers use household size, number of children and number of employees in their models. These variables may not properly discriminate between different families with different structure so it seems that other variables should be utilized. This paper uses life cycle concept to describe family structure better and more accurate. By using this concept, some dummy variables will be defined that can be effective in model estimation process to depict family effects on mode choice model. For family structure, five types of families that are different in terms of their children ages are considered. A Multinomial Logit model with three different calibration algorithms including: Simulated Annealing algorithm, Nelder Mead algorithm and Broyden-Fletcher-Goldfarb-Shanno algorithm has been developed. The appropriate mode choice model has been developed using trip dairy real data in one of the populated city in Iran for different trip purposes. Some of the most important results that achieved was more important role of family structure (life cycle) in mode choice than house hold size in work, school, personal, and social- recreational trip purposes.

Key words: Life cycle; mode choice; multinomial logit; family structure.

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Analysis of age effects on shopping activity duration: case study of Qazvin City (Iran)

Siamak Hosseini, Navid Hosseini Taleghani *, Amirreza Mamdoohi

Modares University, Department of Civil & Environmental Engineering, No. 7, Jalal Al Ahmad, Tehran, Iran

ABSTRACT

Activity duration is an important component of the activity participation behaviour of an individual, and therefore, one of the crucial determinant factors of individual's travel behaviour. By developing activity-based models, predicting the activities and their durations have found significant importance in modelling and management policies of travel demand. So that the degree of success of an activity-based prediction system strongly depends on its behavioural models, whose purpose is predicting and reconstructing individual's daily activities? Recent studies on the elderly behaviour have brought into the light that shopping-related activities form more than 30 percent of their out-of-home activities. Since among shopper population, the elderly people are growing fast in terms of number, this paper aims, by taking advantage of the duration model approach, to study the duration of shopping activity for the elderly and non-elderly and to recognize its affecting factors. The case study of this research is the shopping trips data obtained from an inquiry in a group of citizens in Qazvin city, Iran, comprising personal and household information, characteristics of transport networks and features of suitable location for performing activity. The results indicate that regarding the measure of goodness of fit, distributions of shopping activity duration variable has a log-logistic distribution and the hazard curve has a non-monotonic inverted U-shape form. In addition, the elderly people allocate more time for shopping compared with the non-elderly and variables such as traveller's characteristics (gender, occupation and education) as well as land use and trip characteristics (distance, trip mode, time-of-day) have significant effect on shopping activity duration.

Key words: Activity duration; activity-based model; duration model; elderly people; log-logistic distribution.

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Effect of HDPE based wastes on the performance of modifies asphalt mixtures

Sevil Kofteci *

Akdeniz University, Department of Civil Engineering, 07058, Antalya, Turkey

ABSTRACT

Flexible asphalt pavement construction is an expensive investment. Nowadays, many methods are being investigated to improve the performance of asphalt mixtures. For this reason, bitumen is usually used with modified form in hot mix asphalt (HMA) in practice. The use of recycled waste materials as modifier additives on bitumen could have several economic and environmental benefits. The main aim of this research was to investigate the effect of HDPE based plastic pipe wastes on the performance of asphalt mixtures. For this purpose, HDPE based plastic pipes were added to bitumen as modifier in to amount of 0.05%, 0.1%, 0.15%, 0.20%, then asphalt mixtures formed by the modified bitumen were tested for the determine their performances. The performance of specimens were firstly measured by stability, flow values. Then, susceptibility characteristics of the HMA to water damage were determined by using İndirect Tensile Test (ITT) method described in AASHTO T283 with classically compacted specimens. The results showed that stability values increased continuously by mixtures with a content %0.20. In addition, resistance to water damage were observed only on the specimens modified with 0.05% and 0.15%.

Key words: Hot mix asphalt; HDPE wastes; modified bitumen; water susceptibility.

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A model of driver behaviour in response to road roughness: a case study of Yazd Arterials

Nemat Soltani ¹, Amir Reza Mamdoohi ^{*2}

¹ Tarahan Parseh Transportation Research Institute, Tehran, Iran

² Tarbiat Modares University, Department of Civil and Environmental Engineering, Tehran, Iran

ABSTRACT

The impact of pavement distresses on the comfort of road users has been extensively studied so far, while little attention has been paid to investigating their effect on road safety. Some types of distresses, such as the polished aggregates of road pavements, influence vehicle stopping distance. Some other types of distresses influence the behaviour of drivers due to the roughness they create on the road surface. In this study, a model of driver behaviour in response to road roughness is calibrated which takes into account the geometric aspects of distresses, traffic parameters and road specifications. The behaviour of drivers in response to road roughness is categorized into the two states of non-reaction and reaction (which includes either braking and crossing over distresses or deviating from the path), and is analysed using logit model. The data which were collected through personal on-site observation in Yazd city pertain to the following variables; distress location, distress area, distress length, distress width, distress type, distance from lining, average hourly traffic, the average speed of vehicles, and the number of distresses within 100 meters. These data were collected from 15 randomly-selected distress areas with arterial functionality for 450 vehicles passing them. Based on the model results, a number of factors were found to increase the likelihood of drivers' reactions when facing distress areas. These factors include distress area, distress in fast lanes, and the reduction of average hourly traffic.

Key words: Driver behavior; logit model; pavement distress; road roughness.

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Verification of methodical procedure for determining the traffic volumes using short-term traffic surveys

Ladislav Bartuška ^{1*}, Vladislav Biba ², Karel Jeřábek ³

¹ Czech Technical University in Prague, Faculty of Transportation Sciences, Department of Logistics and Management of Transport, Czech Republic

² The Institute of Technology and Businesses in Ceske Budejovice, Faculty of Technology, Department of Informatics and Natural Sciences, Czech Republic

³ The Institute of Technology and Businesses in Ceske Budejovice, Faculty of Technology, Department of Transport and Logistics, Czech Republic

ABSTRACT

The traffic volume is frequently used measure of road capacity. Traffic volumes are suitable for urban planning, construction and upgrading of roadways or land-use planning decisions, while it is necessary to plan the construction of road infrastructure in the next few decades ahead on the basis of prognosis of road traffic. This paper outlines the problems of calculating the traffic volumes in Czech Republic. Especially the authors focus on the verification of methodical procedure for the determination of resulting traffic volumes using the short-term traffic surveys. The methodology TP 189 for determining the Annual Average Daily Traffic volumes (AADT) reflects the conversion coefficients which were statistically derived from long-term measurements of traffic intensities. It can be assumed that different traffic characters exist on different types of roads, for which no coefficients are set yet. Authors of the paper use data obtained from real long-term measurements of traffic volumes on the various categories of roads and try to determine categories of roads for which current conversion coefficients to determine AADT cannot be applied.

Key words: Traffic volume; annual daily traffic volume; designing of road infrastructure; determining the traffic volumes; TP 189.

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Possibilities of using the data for planning the cycling infrastructure

Ladislav Bartuska ^{1*}, Jiri Hanzl ¹, Lenka Lizbetinova ²

¹ The Institute of Technology and Businesses in Ceske Budejovice, Faculty of Technology, Department of Transport and Logistics, Czech Republic

² The Institute of Technology and Businesses in Ceske Budejovice, Faculty of Technology, Department of Tourism and Marketing, Czech Republic

ABSTRACT

The subject of the paper is a brief description of the state of bicycle transport in the region of South Bohemia, the analysis of planning and financing its development. The aim of the paper is to outline the issue of cycling infrastructure in urban and interurban planning, especially in view of methods for determining the share of bicycle transport on modal split within the specific area. The paper includes possibilities of obtaining data about bicycle traffic and outlines the steps to perform manual bike flow counting on a specific project in the city of Ceske Budejovice.

Key words: Cycling transport survey; cycle track, cycling infrastructure planning; path for pedestrians and cyclists; bike lanes.

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Transport planning realized through the optimization methods

Jiří Čejka *

The Institute of Technology and Businesses in Ceske Budejovice, Faculty of Technology, Department of Informatics and Natural Sciences, Czech Republic

ABSTRACT

The passenger traffic is the most sensitive field in terms of the passengers' perception of the transport line layout. Every drawback will show soon and be transferred into the whole range of the provided services. The aim in the passenger traffic is to remove any obstacles that prevent the passengers from obtaining the continuous, available and high quality transport and to develop such activities to meet the requirements of the passengers as much as possible.

Key words: Operational analysis methods; solving optimization problems; public transport, assignment problem; linear programming.

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Theoretical criteria for the evaluation of the operational performance of intermodal transport terminals

Ján Ližbetin ^{1*}, Zdeněk Caha ²

¹ The Institute of Technology and Businesses in Ceske Budejovice, Faculty of Technology, Department of Transport and Logistics, Czech Republic

² The Institute of Technology and Businesses in Ceske Budejovice, Faculty of Corporate Strategy, Department of Foreign Languages, Czech Republic

ABSTRACT

This article deals with an analysis of the elements of an intermodal transport terminal from the point of view of the determination of the operational performance thereof. In the first part of the article the authors provide an insight into the general characteristics of an intermodal transport terminal and the requirements for one under the terms of the European AGTC agreement. The second part of the contribution focuses on the determination of the theoretical criteria of the individual elements of an intermodal transport terminal that influence the operational performance thereof.

Key words: Intermodal transport; intermodal transport terminal; performance; logistics.

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Macroeconomic evaluation of projects regarding the traffic constructions and equipment

Rudolf Kampf ^{1,*}, Ondrej Stopka ¹, Iveta Kubasakova ², Vladislav Zitricky ³

¹ The Institute of Technology and Business in Ceske Budejovice, Faculty of Technology, Czech Republic

² University of Žilina, Faculty of Operation and Economics of Transport and Communications, Department of Road and Urban Transport, Slovak Republic

³ University of Žilina, Faculty of Operation and Economics of Transport and Communications, Department of Railway Transport, Slovak Republic

ABSTRACT

This paper deals with the issue of macroeconomic evaluation of projects regarding the construction of traffic infrastructure and equipment. The objective of traffic infrastructure projects is to ensure the improvement of public welfare and decrease the negative impacts on the environment. Individual projects must be developed properly therefore the particular elements need to be analysed in detail. In the paper, the evaluation of projects is made on the basis of comparing the costs on construction of the traffic infrastructure with benefits which the construction will bring, i.e. the macroeconomic aspects within the decision-making process regarding the investments need to be quantified on the basis of Cost – Benefit analysis.

Key words: Macroeconomic evaluation; traffic construction; traffic equipment; methodological comparison.

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Influence of architectural solutions on building heat protection with example of historical rural houses in the northern Cassubia

Marek Chalecki *

Warsaw University of Life Sciences (SGGW), Faculty of Civil and Environmental Engineering, Warsaw, Poland

ABSTRACT

The paper is dedicated to the molding of traditional historical rural houses in the context of building heat protection. Special attention was paid on architectural elements of building, such as its shape (including the spatial form of the roof), layout of the rooms and functional connections, application of material and constructive solutions, location of the house on the plot including the planning of its surroundings. The researches concerning the existing historical buildings were carried out in freely chosen villages in the coastal northern Cassubia. This area is characterized by certain definite common features. The basic choice criterion of the researched area were its specific climate conditions, uniquely affecting the molding of functional and spatial elements of the traditional rural houses. An algorithm of choice of characteristic architectural elements affecting the building heat protection in the rural houses from 19th century was worked out. It has been stated that the folk architecture, as a result of work of numerous generations, thus characterized by skilled adaptation to the natural environment and climate conditions, should be currently the pattern and inspiration for quests of low-energy-consuming solutions during design of rural dwelling houses.

Key words: Rural detached house; building heat protection; functional and spatial architectural elements.

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Sustainable development protects sensitive cultural landscapes

Lena Mantziou, Eirini Kontopoulou *, Christos - Orestis Hatzakis

National Technical University of Athens, School of Architecture, 42, Patission, 10682, Athens, Greece

ABSTRACT

Objective of this study is to investigate the dilemma “development vs. environmental protection”. This paper argues that the environment is sustainably protected if humans live, act and learn through and within it. Main issue of this study is the question of how to achieve “conscious development under high standards of living”. This process may start with our understanding of cultural landscapes and the benefits they provide. It will gradually kick-start our ability to protect, reveal and develop landscapes in harmony with human and the environment. The following questions arise: 1. How to evaluate the environmental carrying capacity of a cultural landscape. 2. How modern architectural intervention can revive a place charged with memories, without adversely affecting or further destroying it. These potentials will be investigated in this paper through two development proposals: 1. The “natural and mythological landscape of Brauron” and 2. The “secluded lake of Mornos”. Both of which are distinct cultural landscapes, having two major characteristics in common: A strict protection legislation, as well as an obvious tendency of abandonment. These two works will show a new aspect of the relationship between humans and their environment, handling landscapes as compositions of both cultural and natural heritage: Achievement of (future) ecological balance presupposes changing mentalities that will result from a combined cultural, aesthetic, economic and ecological intervention.

Key words: Architecture; architectural design; cultural landscapes; Brauron; Lake of Mornos (Greece).

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The adaptability in the architecture of sport facilities

Martin Hudec *, Lea Rollova

Slovak University of Technology in Bratislava, Faculty of Architecture, Námetie slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

In the current period which is characterized by applying sustainability strategies, innovative architectural solutions that can respond to required changes to the building over time in line with current requirements of owners and users of the building are found. It is desirable to replace mono-functional and static objects by adaptable ones which represent the new spatial, structural and program strategies of design. In this paper, the results of the research which is aim to adaptability of sports facilities, are published. The first part of the paper is aimed at analysing expression of the concept of adaptability in architectural theory and literature. The concept is divided into categories which comprehensively describe different levels of adaptability. In this part, a studies from 20-th century which investigates the strategy development of adaptability, is also described. The main part of the paper shows results of objects with sport characteristics which have been investigated. Selected examples of buildings document a process of adaptation in a certain time frame. Analyses seek the notable aspects in context of sports activities, architecture and adaptability of these spaces. Comparison of the results of the analysis of sports facilities primarily documents the tools and components to achieve a certain degree of adaptability in this program. The final part presents the recommendations for design of adaptable sports facilities.

Key words: Adaptability; sport; architecture.

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Rejected landscapes-Recycled landscapes

Silvia Dalzero *

University of Architecture IUAV, Tolentini, Santa Croce 191, Venice, Italy

ABSTRACT

This research shows the changes of the landscape in the presence of waste, reality that invades the territory in many different surprising ways in time and space. At first the issue of garbage is faced according to language of creativity that range from literature to art, to cinema...and in a second moment on how the inevitable accumulation of garbage designs our new and unexpected astonishing landscapes... in the end, how waste becomes a place. Then, through a list of projects for more or less controlled recovery altered areas, it is explained how the present territorial dimension is inexorably besieged by garbage and consequently of how it is exposed to a substantial environmental, cultural, economic and political transformation. In this way, a sort of 'indicative atlas' takes form where, synthetically some interesting and model recovery plans are illustrated. Then a close look at Fresh Kills, in the state of New York. So the difficult task of summarizing clarifying the statistical, quantitative 'numerical' aspects concerning the production of waste in order to highlight the surprising conditions that today the modern city is presented and therefore, the reasonable need to investigate. With a careful, knowing eye we reach time before study, that is: to the critical, strategic and objective evaluation to report through a cartographic survey the present conditions and the effective distribution of plants for waste disposal and collection on the Italian territory, in particular and generally on the European one. We then single out a territorial section touched by the phenomena: the Lombardy region, and then the territorial morphology so altered and the inevitable environmental transformations. The study becomes more and more detailed, proactive and conscious of the state of needing corrections, substantial improvements and experimental developments. On the light of this, the investigation along highway A4 between Milan and Brescia and more specifically the Province of Brescia where the concentration of waste disposal becomes more and more intense, unique and absolutely extraordinary is considered. Then, through a careful study of the present territorial status conceptual, indicative and synthetic models take form of possible and potential scenarios, present and future, of altered areas of the presence of waste and collection plants. Moreover, how their distribution takes place is explained, according to logical criteria, corrected, and in line with the character of the place and even how, substantially, it takes an articulated structure of actions and reactions able to design a territorial (demonstrated on the census taken) recognizable, clear and consequently, a base for future potential planning. Finally the study of these areas, make up a unique path to observe and evaluate the modern urban structure, where presently it is clear, necessary, essential to have a correct, valid and definite location, leading to territorial changes in different ways. Nevertheless, it is always true that a critical and aware point of view cannot alone resolve the present situation, but it can contribute to giving the right measure of what is at play, therefore different territorial perspectives.

Key words: Waste; landscape; recycled.

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Mansard roof, attics and garrets and the convenience of investment in order to contain land consumption

Valentina Puglisi *, Antonio Invernale

Politecnico di Milano, Department of Architecture, Built environment and Construction engineering
Via Bonardi, 9 - 20133 Milano, Italy

ABSTRACT

The enhancement of mansard roof, attics and garrets is a prominent element in the real estate market and it is going to become increasingly important. The problem of land consumption leads to make use of building spaces that are already available such as attics and lofts; furthermore, in the main Italian cities new planning regulations offer the possibility to increase the building volume in case of energy refurbishment. The research, carried out by Politecnico di Milano, analyses innovative architectural solutions in the enhancement of mansard roof and the convenience of investment in this field compared to other real estate asset classes in order to contain land consumption. The aim is to identify: a. best practices (both new construction and refurbishment of attics), b. the intervention costs, c. the market value of the recovered space (loft or attic) in relation to other units of the building. The research is divided into the following phases: 1. Overview of the Italian attics market. This part presents the state of art of the Italian housing market in relation with the opportunity and convenience of the attics refurbishment. In particular, the market analysis (size, cost, time of sale, etc.) shows the comparison among different geographical areas (regions, provinces, city centres, suburbs). 2. Search for innovative design solutions and analysis of best practices. 3. Investment convenience in lofts and attics refurbishment compared to other types of investment in urban regeneration projects. For this purpose, about 200 designers working on the entire national territory and some major players in the Italian Real Estate market were interviewed. The data demonstrate that the attics express the highest values per square meter in the Italian residential market. Furthermore, the research shows that a family that wants to invest in an attic may realize a significant gain if they decide to refurbish and sell the property in a short time. The research tries to raise operators' awareness in order to limit the land consumption, to improve existing buildings, to revitalize cities and the historical centres.

Key words: Loft valorization; garrets; land consumption; refurbishment cost; market value; residential market.

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Issues of the revitalization of historic centres in small towns in Warmia (Poland)

Marek Zagroba *

University of Warmia and Mazury, Faculty of Geodesy, Geospatial and Civil Engineering, Institute of Building Engineering, Department of Building Engineering and Building Physics, Olsztyn, Poland

ABSTRACT

Warmia is a historical region in north-eastern Poland, which – together with the neighbouring region of Mazury – is called the Land of a Thousand Lakes. The conquest of this territory by the Teutonic Order, which took place in the 13th century, gave rise to the foundation of 12 towns in Warmia, all of which have survived until our times. Towns were founded in sites chosen for their military and topographic features (defensive walls enclosing towns, built in hardly accessible locations). The towns were planned in line with the medieval urban patterns, featuring chessboard-like layout of a grid of streets, a central marketplace with a town hall in the middle, and compact blocks of townhouses. The military origin of the Warmian towns (originally, each town lay at the foot of a castle) distinguishes these urban centres from ones located elsewhere in Poland. The problems related to the revitalization of small towns in Warmia are mostly associated with their historic centres, which manifest their identity. The complexity of elements of which such historic urban centres are composed (spatial factors, such as urbanistic and architectural ones, related to the conservation of historic buildings and structures, economic and social aspects) necessitates such transformations that will lead to a better exposure and functional revitalization of the old town in comparison to other parts of a city. It is worth mentioning that the current condition of historic centres in all Warmian towns is quite diverse. The reason can be traced back to the events occurring in the last months of World War Two, when the Red Army began a purposeful and systematic destruction of historic buildings in East Prussia. Another cause was the course of the post-war reconstruction of damaged towns, which was subordinated to the then political system of Poland. As a result, many historic town centres have lost their identity. The aim of our study has been to find out how the image and functions performed of old towns can be improved. The changes involve certain urbanistic and architectural transformations as well as economic and social revitalization. The key to success is to develop revitalization programmes for individual historic districts in the towns of Warmia. The research has enabled us to draw conclusions in regard to including numerous aspects and connections between spatial factors and functions of old towns. Revitalization efforts should focus on the elimination of sources of threat, improvement of the technical condition and aesthetic values of the space (urbanistic patterns and layouts, architecture of urban complexes) and the betterment of living standards and conditions for local residents. Having achieved this, we will re-focus on the status of historic town centres, on their essential role in the contemporary life of towns, and on the need to preserve the heritage of whole Warmia.

Key words: Architecture; urban studies; revitalization; conservation of historic buildings and structures.

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Białystok – outdoor museum from the second half of the XX century

Maciej Kłopotowski *

Białystok University of Technology, Faculty of Civil and Environmental Engineering, Department of Construction and Environmental Engineering, Landscape Architecture Teaching Team, Białystok, Poland

ABSTRACT

Białystok – XVIII-century former residence and private town of Jan Klemens Branicki is today a kind of museum of urban planning and architecture from the second half of the twentieth century. This state is due to the history of the town, which was almost completely destroyed in World War II ((this refers to both physical destruction of the town, which exceeded 80% of the construction substance, and social destruction - the number of the town's population in 1939 was 107 000 and in 1946 there were less than 46 000 inhabitants). Its subsequent reconstruction was a combination of occurring conditions: economic, political and social. On the ruins of the industrial city, which in the nineteenth century was called Manchester of the North, a new urban area has been realized over the last seventy years. In the phase immediately after the war it was socialist, in the subsequent years modernist and postmodernist. Today there are almost 300 000 inhabitants. Current post-modern spatial arrangement of the city is neither accepted by its inhabitants (largely representing immigrant population) nor by designers of the subsequent phases of its development. This state leads to moral devaluation and in its consequences spatial devaluation of housing estates, residential complexes and districts, which in other circumstances would have been considered a model of the stylistic trend of the time of their construction. The author of this publication in her research work documents and analyses the housing projects from this period. At the same time she attempt to estimates them and identify, on the basis of the carried out studies, those examples which particularly deserve attention. The author's intention is material saving the most valuable of them. The sum of indicated as valuable objects is not only a city tour, but first and foremost a lesson of architecture and urban planning history. The analysis were based on and related to the general issues, including realizations on the territory of Poland and Europe (in the years 1944-1989 in the first place to realizations from the Eastern bloc), in which prototypes of local realization were sought. Years from 1944 (liberation of the city) to 2014 (adopted date of the end of the study) were divided into eleven periods resulting from the political and economic conditions. For each of these periods the most valuable realizations are indicated. As a result of research work the following were distinguished: The 40s Workers' Housing Estate District (Osiedle Zakładu Osiedli Robotniczych) - modeled on the Warsaw Mariensztat, meeting social needs of its residents. The 50s Centrum District – modeled on socialist realist construction of Nowa Huta and MDM in Warsaw. The 60s Millennium of the Polish State District - is a local response to the search for programme spatial solutions of Structural Housing Unit. Late 60s Gallery building – which, due to its dimensions was a manifesto of technical achievements and due to its formal solutions a manifesto of its social era. Early 70s Piasta District – system realization, unified apartments organized in sections of staircases, were used to construct repetitive buildings, that composed in the colonies of four were copied throughout the district. Late 70s /Słoneczny Stok/ Sunny Hillside District– exemplification of search for a new creative path and building a new ecological residential environment modeled on the ideas of Ursynów in Warsaw. The 80s Dziesięciny District– is both a manifesto of new creative tendencies and a picture of the economic crisis, which affected at that time the quality of housing. The 90s New Town District /Nowe Miasto/ – completed in a free market economy realization, which was a kind of testing ground for future developers. Early 00s Social Housing

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Association District - realization illustrating the interpretation of the terms of new urbanism, a return to the idea of a closed, private quarter and public street, and simultaneously return to the social values in the living space. Late 00s Scattered developer buildings- mainly high (about 10 floors) was a proof the achieved material success. Early 10s New town centre – commercial, constructed with exclusive building materials realizations in the type of tenement house. Projects on the new street network, creating a new centre. Summing up the analysis the author states that only continuous public education, indicating the valuable elements in our past, can build a positive image of today's cities. This task is so complicated because the groups to be persuaded to these views, in the first place, are the decision-makers, including the city government.

Key words: Białystok; outdoor museum; XX century.

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In search of a new exhibition space - methods of use urban space

Wojtowicz - Jankowska Dorota *

Gdansk University Of Technology, Faculty Of Architecture, Department Of Sustainable Design, ul. Narutowicza 11/12,
80-233 Gdańsk, Poland

ABSTRACT

The buildings considered as raising the prestige and promoting cities are those related to culture. Their impact on urban life is undeniable, which is reflected in a continuous increase in the number of new museum buildings. Apart from places intrinsically linked with culture, which, as such, may be considered as standard - like museum, theatres or galleries - there also appear alternative places of development and promotion of cultural activities. Currently, among cultural spaces, with particular emphasis on exhibition places, it is possible to distinguish two directions of development. The first of those is a traditional one represented by museums and galleries and the other one is modified, represented by different, alternative spaces. Both directions are developing in parallel and are not mutually exclusive.

Non-traditional exhibition places are worthy of particular attention. Their emergence is related to seeking new, sometimes surprising, and methods of drawing attention to the exhibition. In the case of museums, especially in recent years, one can observe that both the museum architecture and collections presented there are equally perceived as exhibition space. It so happens, at times, that the quality of the exhibition space and its architecture is so significant that the presented exhibits pale in comparison. In the case of space initially designated for other purposes than exhibitions and currently used to that end, a unique, often surprising visual effect is achieved. Art transgressing the borders and entering alternative spaces makes exhibits interact with exhibition places and become an integral part of the exhibition itself.

Key words: Exposition; alternative exposition space; city; museum; art.

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Reconstructing architectural environment from the perspective image

Jolanta Dzwierzynska *

Rzeszow University of Technology, Department of Architectural Design and Engineering Graphics, Poznanska 2, 35-084
Rzeszow, Poland

ABSTRACT

Perspective representation of architectural objects can be used for illustrative purposes, technical documentation and research. Reconstruction of such objects on the basis of the single perspective mapping sometimes may be difficult. The aim of the study is to determine the requirements of the perspective mappings with the aim of enabling restitution of the architectural objects as well as developing the effective method of reconstruction of these objects on the basis of their perspective image. The crucial point of restitution for both linear perspective and nonlinear perspective is determination of the basic elements of perspective; main point, horizon line, ground line and distance of the picture/surface plane from the station point, which determine the method of the perspective representation. The paper presents examples for the descriptive method of restitution of architectural buildings on the basis of their perspective image. Every perspective representation is submitted to the geometrical rules and relations. Due to this fact geometrical knowledge is essential in any attempt of reconstruction. Projective relation between the represented object and its image enables development of the algorithm for retrieving missing parts of wide view perspective images with the use of computer. Due to the fact that straight lines are very common in every urban environment the algorithm enables drawing perspective image of any straight line passing two given points in the perspective image. It helps to improve or find missing building contour in the perspective image. The study shows that retrieving some information about a special structure of the architectural object from the perspective image is not always easy, although it is possible in some cases. Such information enables restitution and can be useful for inventory process and in supplementing dimensions of inaccessible parts of buildings.

Key words: Perspective | restitution; reconstruction.

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Architecture and engineering go hand in hand: Morassutti, Mangiarotti, Favini and the reconciliation of disciplines

María Belén Gómez Gómez *

Universidad Ceu San Pablo, Escuela Politécnica Superior, Spain

ABSTRACT

At the end of the 17th century, when the Académie royale d'architecture was created in France, architecture was studied for the first time from a theoretical and analytical point of view. 100 years later the École royale des ponts et chaussées was found, also in France. This division of responsibilities within the building discipline varies from country to country and within the specific historical period but, the idea of two professional branches related to architecture, remain to the present day. Through the centuries this division has been perceived as a problem or as an advantage depending on the specific event, project or construction. In the late fifties of the last century two architects, Bruno Morassutti and Angelo Mangiarotti and an engineer, Aldo Favini, worked closely in Italy building amazing and very significant works. Such as the Church of Mater Misericordiae which was constructed in Milan between the years 1956 and 1958. Taking as starting point the analysis of this work, as well of other project from the same team, and some additional collaborations between Favini and other architects, this paper intends to identify the areas where harmony between both branches can be appreciated. The following characteristics have been taken into account for the analysis: a. main structure visible, b. structure is part of the core project, c. structure defines the space, d. calculation of the structure intend to optimize the structure, e. structural assembly system coherent and effective, f. innovative structural system. One of the main conclusions is that an adequate approach in the collaborative work of architects and engineers, results in impressive and amazing works in which the combination of aesthetic qualities and structural efficiency results in a harmonious building with plenty of significance.

Key words: Architects; engineers; structures; collaborative work.

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Effects of contemporary information technologies on culture and architectural space

Ozlem Kandemir *

Anadolu University, 2 Eylul Kampusu, Mimarlik Bolumu, 26555. Tepebasi, Eskisehir, Turkey

ABSTRACT

Changes are inherent and inevitable in any living culture. We live in a fluid, changing world with increasingly blurred boundaries between local and global practices. Due to rapidly escalating technical developments in social interaction technology and communication; social contacts between people has changed. These technological developments have changed our habits and gradually our culture. The requirements and needs of the society are evolving and this can be seen on different scales. This new level of connectivity brings important concerns regarding privacy, protection and control. Like in our daily life and through living conditions etc. This in turn results in changes to spatial planning and architecture. Media and technology constantly reframe and filter our perceptions of culture as well as social and political contexts resulting in heterotrophic landscape. Technological advances and cultural changes have increasingly demanded a new definition of space. Today architectural space becomes "the space of all dimensions". This presentation aims to investigate this evolution of space on different scales and means that caused by contemporary information technology through cultural and environmental aspects. The implementations of information technology on relations and different scales of interaction based on space will be discussed on different cases, and then the change and evolution of architectural concepts on will be addressed.

Key words: Proxemics; space; architecture; information technology.

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Analysis of growth and reasons for caused by frost destruction communal roads

Wojciech Kozłowski

Opole University of Technology, Faculty of Civil Engineering and Architecture, Department of Roads and Bridges,
Katowicka 48 Street, 45 - 061 Opole, Poland

ABSTRACT

In Poland, about 90% of all roads with improved surface are the roads made in the technology of asphalt, susceptible constructed. A characteristic feature of these surfaces is that the transfer of permissible loads of heavy vehicles depends to a very large extent on the subsoil capacity. In conditions of low soil moisture construction works well, but in high humidity conditions underpinning fundamental and native soil, especially after unfreeze in spring, the surface has a reduced rigidity and bending strength. This causes damage to the surface of the light medium to heavy - cracks, heaves, breakthroughs and significant losses of the upper layers of the surface. Mistake made by road builders in designing, operating, maintaining, and repairing the disregard and skip the problems with the ground under the road surface. Skipping the issues of land and leaving them to their fate themselves and is largely the cause of the destruction of roads. The article presents the analysis of the development and causes frost destruction communal roads in certain ground conditions on the basis of field and laboratory researches.

Key words: Analysis; communal roads; subsoil; frost; filtration.

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New materiality - towards media environments

Karolina Zyczkowska ¹, Boguslawa Konarzewska ^{*2}

¹ Gdansk University of Technology, 80-233, Gdansk, Poland

² Gdansk University of Technology, 80-283, Gdansk, ul. Krolewskie Wzgorze 15/6, Poland

ABSTRACT

Article presents media solutions providing new materiality of architectural objects. Media solutions in architecture evolve in new forms. Article presents both the development of new technological solutions as well as new ways of application of media solutions in relation to architectural form. The aim of the article is to show technical aspects of new materiality - intelligent materials, allowing transmission of changeable visual content (like powerglass, GKD mediamesh, IMAGIC WEAVE, TEXLON Iexipix, ETTLIN lux, OLED technology) and interaction between a user and space, so as spatial aspects of this new materiality. The goal of the article is to stress that media solutions do not stay just in the vertical position of a media façade, but go deeper in the users' environment creating digital canopies (called in the article "media umbrellas") and complex media environments. "Media umbrellas" due to their horizontal positions make boundaries between private and public space, indoor and outdoor zones, and more fluid. Depending on context they can serve various functions. They follow pedestrians, eliminate monotony of long walkways, indicate entrance zones and cover places making them cosier and more unusual. These structures can constitute fixed elements of architectural surroundings and take part in temporary events, provoking discussions and showing new possibilities. The article presents all types of this kind of solutions to prove that intelligent materials applied in architectural structures can shorten the distance between building and human, and make the space not only more visible and more dynamic, but also more accessible and friendlier.

Key words: Intelligent materials; media façade; "media umbrellas"; media environments; interactive structures.

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Traditional values in Amman downtown heritage Suqs

Loai M. Dabbour *

AlZaytoonah University of Jordan, 11711, Amman, Jordan

ABSTRACT

The purpose of this study is to investigate the structure of the traditional Amman Suq the physical, the functional, and the conceptual and to examine the spatial morphology of the traditional Suqs of the city Amman in the light of a descriptive theory of urban space and to argue that the structure of traditional heritage Suqs present typological tendencies and morphological individualities. To achieve this purpose two specific questions are addressed. The first question is about the interplay of structure and order in the layout of the traditional Suqs, which in turn raises questions about the visual and functional properties of traditional built form. The second question investigates the issue of traditional markets groupings and the kind of relation that space has to type of trade and to social interactions. The majority of authors on the subject of traditional Arab Islamic Suq structure make certain assumptions, both of which are addressed. The first is that the traditional Suqs is an outstanding example of a fabric that has grown up organically and hence the shape and form of the urban structure is unplanned. The second assumption is that the urban structure corresponds to market and trade groupings, in that the traditional Suq is seen as a collection of natural local entities. In order to investigate these questions within the downtown city of Amman, the urban structure of the traditional city is described and characterised. It is suggested that the street pattern constructs an intelligible movement interface of the configuration of the urban structure. Changes in the interface relate to changes in social solidarity, particularly to those which are functions of the organisation of trade within the city over time. The work concludes by considering the relevance of the findings to the issue of traditional urban structuring and social interface within the Suq's context.

Key words: Islamic Suq; Islamic architecture; spatial planning.

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A research on perceptibility and readability of surface by type of building

Yeşim Alemdar, Ayşe Sağsöz *

Nuh Naci Yazgan University, Department of Interior and Environment Design, Kocasinan, Kayseri, Turkey

ABSTRACT

Because technology is constantly evolving and changing world of contemporary architecture and built up parallel to the rapid population growth, the similarities between the reduction schemes set forth by products-objects in mind, and naturally began to be difficult to detect. This rapid change, the defining elements of the building with the city to start changing the symbols formed in his brain and caused users to avoid detection difficult. In this context, the study "in the face of any object, that object similarity between the schemes in the mind grows detection easier. Similarities exist or is less difficult and what kind of perception, how? Questions will appear as "the assumption being made today through new designs, especially architects and architects aimed to test candidates on the subjects. In this context, the study aimed to different architects by laid architectural product of the functions of detectability and readability by users, facades level architects and candidate (architecture students) by querying over people who are described as to examine.

Key words: Perceptibility of surface; readability of surface; architecture; architect.

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New urban needs: health, population aging and new social groups, conditions of the city model

Pablo Valero Flores ^{*1}, Santiago Quesada-Garcia ²

¹ University of Málaga, Calle Palmeras del Limonar nº17 8º A c.p. 29016 Málaga, Spain

² University of Seville, Spain, C/ Colonia, 3, ptl 4, A. 41012 Seville, Spain

ABSTRACT

The increase in the aging population in first world societies is a reality that defines each day with more determination. To be seventy years a new life that will last at least another thirty years begins. This extension of life expectancy of humans has the challenge of maintaining the quality of life during that period. That quality of life is threatened by a disease that is being considered as the epidemic of the century, both for their exponential growth as the gradual decline in buying old. This is Alzheimer's disease. The user's desire who is suffering from Alzheimer's in living at their home, in front of his income in collective care centres can maintain their quality of life to some extent delaying disease progression as well as being a more viable and economically sustainable solution for public investments in contemporary welfare societies. The architectural design, housing adapted to the Alzheimer's patient, becomes necessary to increase the quality of life of its user space. And in the same way, any space adapted to this type of user is suitable to favour any other group with or without disease. Housing becomes germ extrapolated performances, at any scale, at any public space within the urban context, at any setting standards and benchmarks in areas such as accessibility, security, autonomy and independence, therefore also in the urban design of the city, impacting their formal configuration and organizational structure. In this sense, different countries of the European Community, such as UK and France, have already established some action on their regional planning saving housing adapted for this population sector and creating new forms of households that respond to gradual aging of the population and their quality of life. Following these experiences is evident to integrate these new social and population needs in architectural and urban structure, to keep in mind in planning numbers suitable for this population group homes, as well as the functionality to move to any other scale city, the measures taken in the context of home. The purpose of this communication is to present these European experiences in terms of planning and architectural design that aim to meet the needs of this group of users, showing different international proposals for urban projects which this demand of contemporary welfare state have acquired and assumed welfare state and in which is evident the need of having this present group in continuous growth in shaping future cities. He completed research being made so far in the relationship between users and people with Alzheimer's disease, their homes and the city where they conduct their daily activities. The communication is intended as a significant contribution to the architectural and urban design of the future city, both organisationally and structurally, considering and integrating a constantly growing in our current society. Also the ones involved in the plot and urban sociology of this century.

Key words: Urban design; architectonical design; public Space; architectural space; technologies; social care.

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What built-environment structures do communities use to define their local spaces? Developing an integrated urban model of physical and conceptual artefacts

Jamie O'Brien ^{*1}, Andy Hudson-Smith ¹, Sophia Psarra ², Tony Hunter ³, Miguel Serra ¹, Martin Zaltz-Austwick ²

¹ The Bartlett Centre for Advanced Spatial Analysis, University College London, 90 Tottenham Court Road, London, W1T 4TJ, UK

² Space Syntax Laboratory, Bartlett School of Architecture, University College London, 140 Hampstead Road, London, NW1 2BX, UK

³ UCL Computer Science, University College London, 66 Gower Street, London, WC1E 6AA, UK

ABSTRACT

In this paper we outline recent research into urban communities' definitions of their local spaces, using 'relational artefacts' as spatial markers. These artefacts comprise local physical features and conceptual 'weightings' within their structural and socio-economic contexts. Our research has shown that markers may include, but are not limited to, community foci and street-network functionalities. Furthermore, separate communities may share physical artefacts yet apply different conceptual weightings to them relating to their locally embedded perspectives. This phase of work is part of a broader project, "Visualizing Community Inequalities" (supported by the Leverhulme Trust, UK), the aim of which is to integrate an urban model of local community identities in their urban-network and geo-demographic contexts. Our approach is in contrast to a notion of local community spaces being formed around linear boundaries and binary definitions. Instead, we have studied how communities use relational artefacts as spatial markers to underpin affordances of connectivity, separation or interaction. Here we describe our unique inter-disciplinary methodology that has allowed us to study the built environment at the city scale across 'sections' of community definitions. The ultimate objective is to develop a tool for urban-planning modelling that can incorporate local definitions of community spaces. We report on methods for identifying these markers through participatory workshops with secondary school-age children, attending schools in socio-economically contrasting areas of Liverpool, UK. We also report on analytical methods for defining the composition of the markers, including their inter-relationships within the built environment. We outline some pilot work in sectioning urban data based upon markers and weightings, from which we draw comparisons of community identities in a range of structural and distributive contexts.

Key words: Urban planning; relational artefacts; local definitions; community spaces; data modelling.

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The “Ideal Home” assertion of Istanbul (Turkey)

Pinar Engincan *

Maltepe University, Department of Architecture, Marmara Egitim Koyu, 34857, Maltepe, Istanbul

ABSTRACT

As from 1980's and especially for the last decade, Istanbul seems as an huge construction site which is not a coincidence when all the policies related to construction such as housing, urbanisation, urban transformation, marketing policies and stimulation of citizens' evolution to a consumption society are taken into consideration. In this period – from 1980's to today – a wide range of products belong to the “Ideal Home” assertion are built almost everywhere of the city. Nowadays with an increasing numbers of houses as strolling instruments are for sale; but how about “home” itself? As is known, “someone's home” is not just a location and a structure with natural or/and built environment of a neighbourhood, but it is a “place” socially, psychologically and emotionally meaningful to its user/owner. At this point, it becomes reasonable to examine the relation between the “ideal home” produced and the “ideal home user/owner” in the context of appropriation, attachment and identity as home making mechanisms. The theoretical background of the research depends on the literature of architecture and urban design particularly in the field of environmental psychology that is focused on the interaction between place and human. These related literatures are re-examined in order to designate the specific behavioural components of home making. According to these components identified a case study is carried out in the residential areas produced with an assertion of ideal home in Istanbul. In-depth semi-structured interviews searching for behavioural components of home making were conducted on thirty families from six different locations in the city. Findings indicate that behavioural adaptation differs in a variety of features of the houses such as; local characteristics of the urban areas the houses are built in, existing housing design, target group of houses, relations with other users etc. Additionally it is seemed that housing modifications had commonly provided a more supportive environment in a great deal of houses but on the contrary modifications are disproving the “ideal home” assertion and in some families have adverse effects.

Key words: Home; sense of place; place attachment; appropriation; identity.

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Interactive and media architecture – from social encounters to city planning strategies

Katarzyna Urbanowicz *, Lucyna Nyka

Gdansk University of Technology, Faculty of Architecture, ul. Narutowicza 11/12, 80-233 Gdansk, Poland

ABSTRACT

The paper searches into the potential of media and interactive projects to support participation and generate social encounters in public spaces. It proposes implementation of media and interactive projects into city planning processes. On the basis of theoretical approaches, case studies and interdisciplinary surveys the paper gives insight how interactive and media architecture can engage people in activities in urban spaces on many levels. It focuses on the art installations that with support of new technologies involve people to become co-creators of the art object, both directly in particular place of the city, as well as remotely, by means of mobile devices or internet. The impact of such participation may affect not only a clearly delimited place, but can be used to create connecting paths or change the perception and identity of the whole areas. The fundamental objectives of city planning programs are closely related – the goal of many urban renewal strategies is to establish creative connections between dispersed fragments of the city and stimulate the presence of people on the streets. This convergence of goals allows to perceive new interactive and media technologies as a new architectural tool that could be incorporated into the city planning processes. Indeed, conceived as temporary 'micro-interventions' they can take a role of pilot projects to change the image of places intended for future transformation or applied for site-data analysis and collecting opinions make the whole process more creative and participatory. However, there is still a need for developing procedures allowing for more effective integration of media and interactive projects with the urban planning operational schemes.

Key words: Interactive installation; public space; social encounter; participation.

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Dilemmas of identity in contemporary cities: the city of Gdańsk as an example

Małgorzata Dymnicka *, Jakub Szczepański

Gdansk University of Technology, Department of Architecture, Gdansk, Poland

ABSTRACT

The presentation aims to answer the question how, depending on the historical heritage, collective memory and historical culture, through the politics of memory, the physical space of the city and its image were shaped. All known cultures and languages contradistinguish “self” and ‘other’, ‘us’ and ‘them’. Also the cities wish to differ in some particular way, however they can have numerous identities. Their multitude and diversity may be a source of conflicts or contradictions in a coherent image’s creation. From a sociological perspective, all identities are constructed. The real problem, however, is how, with what, by whom, and for what? While constructing an identity, materials derived from history, geography, architecture, institutions of production and reproduction, from the collective memory and personal biographies are used as building blocks. Identities are not time-proof, however in favourable circumstances, they legitimize and rationalize dominant institutions of authority and culture. The public discourse on memory and identity of the modern Gdansk is dominated by multi-paradigmatism, going beyond the authenticity of the material and cultural heritage and the state of knowledge presented by historians. Metaphoric and discursive ideas, already encoded in the language, such as: Gdańsk as the multicultural city, the city of freedom and city of solidarity are used to demonstrate the multi-paradigmatism. Analysis have proved that the identity narrations were built mainly on myth-making constructions, especially on the myth of ‘the Golden Age’. Due to the palimpsests history of Gdansk and the fact that it used to be a place of different people and cultures’ existence, many identities superimposed. The same architectural forms and pieces of art legitimized, often contradictory, thesis about German, Polish or multicultural character of Gdańsk, as well as homely locality or, on the contrary, a cosmopolitan Europeanises. Only selected symbolic figures, not the content of cultural memory, get into the communicative memory. Nowadays, the selections of architectural forms, used as a base for the Gdańsk’s identities, have been extending about buildings from the Polish People’s Republic (1945-1989) period. Their aesthetic and historic values was, until recently, almost completely negated. It was an unwanted heritage. The attempts to build local identities in some of Gdańsk’s districts and to search their architectural distinctiveness have been taking place which resulting in disconnecting from a hard, essential meaning. Dilemmas of identity affects therefore an attempt to portray the identity, not necessarily as immutable and often contrasted with dominant categorizations. The vision of identity thus has become a product of discourse, something that both potential and entangled in possibilities and limitations.

Key words: Social memory; identity; myth-creating structures; heritage; space identity; Gdańsk.

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Tools for social housing implementation in built environment

Angela Silvia Pavesi ^{*1}, Matteo Borghi ², Giordana Ferri ³

¹ Politecnico di Milano, Dipartimento di Architettura, Ingegneria delle Costruzioni e Ambiente Costruito, Milano, Italy

² InvestiRE SGR, Milan, Italy

³ Fondazione Housing Sociale, Milan, Italy

ABSTRACT

The “Real Estate Fund Ca’ Granda” was born in Milan in 2014 with the objective of financing the construction of the new headquarters of the Ospedale Maggiore Policlinico of Milan, through the ethic enhancement of the real estate assets owned by the Fondazione IRCCS Ca’ Granda Ospedale Maggiore Policlinico. The financial instrument for the development is a social housing contribution fund. The Real Estate Foundation IRCCS Ca’ Granda Ospedale Maggiore Policlinico in Milan consists of 1,390 residential units in 65 buildings, including 44 entirely owned, for a total of over 110,000 square meters, of which 53% were built between 1870 and 1900; 29% between 1901 and 1940; 18% after 1940. The construction of a new hospital pavilion through the establishment of a larger project of spread “social housing” in the city of Milan, provides an important connotation of social and ethical purpose of the project as a whole. Implementing the plan of valorisation of the heritage requires the management of a mobility plan of the tenants, who currently occupy the property for various reasons, that could lead to redeployment, so as to be able to offer a housing service for those who cannot find an adequate response in the market, while enhancing a significant real estate heritage through the sale of some existing buildings. Specifically, the paper describes the case relating to the creation and the management of the Real Estate Fund Ca’ Granda Hospital, with particular reference to the definition of a project for the operation of the mobility plan, the implementation of which is a necessary condition for the development of the real estate owned by the Fund. The study presents the construction of a synthetic index of characterization of the tenants, with the aim of providing, through a preliminary evaluation of the situation of each household, a useful tool to identify cases of social fragility, for the implementation of an experimental project of spread social housing, ever made in Italy.

Key words: Social housing; social management; social manager; social cohesion; inclusive growth; economic-financial sustainability.

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Environmental simulations and their role in the research of human responses to environmental stimuli

Veronika Kotradyová, Igor Salcer *

Slovak University of Technology in Bratislava, Faculty of Architecture, Námetie Slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

The paper aims at the problematics of environmental simulations like one of the efficient methods of behavioural research for exploring the reactions of respondents to certain environmental settings. It explores contemporary situation in development of simulations of different levels of environment serving for visualisations of designed spaces, for games and simulation /testing of subjective and objective responses to different environmental stimuli. In our long-term research at BCDlab we are focused on the body conscious design, which means exploring of relation: body/nervous system and environment with an aim to design human friendly solutions by spatial design. To reach own experiences with environmental simulations and their impacts there was developed in year 2015 at Faculty of Architecture, BCDlab an interactive application BCD-APP working at web interface and in virtual reality too. App serves not only for simulation of certain environmental settings in one room from two viewpoints (choice of materials, colours, surface finishing) by user, but also for evaluation of his/her preferences and level of potential environmental stress from this setting whereas the evaluation is still in the optimisation phase. The app has potential to serve to broad public to get feedback about their choices by furnishing the residential space but also for the research purposes. The paper presents also its development and further possible extensions. The paper presents process of setting research methods and results of the first pilot tests of BCDapp as research tool with controlled small group of respondents. They were confronted with pre-selected settings of materials, colours and surface finishing and with the setting of their own choice and the subjective and objective physiological reactions were measured. This confrontation is done by the web-environment at the regular computer screen and will be extended to virtual reality through Oculus rift tool and in the future we want to add the respondent's reactions to the simulation of real physical environment in the research lab BCDlab. The aim is to define the differences in responses to different levels and projecting tools of environmental simulations and the facilitated user experience. Another focus is put on the topic of simulation of natural materials- if the responses to the texture and colour of wood has same impact by the graphic of the web application as by the high resolution photos or real material sample. As the representative natural material was used wood which is the most used material by built-in elements and furnishing objects. There are used 3 different colour groups of wood materials by floors, wall panelling and furnishing objects – light, medium and dark, whereas they were categorized by measuring the parameter lightness (L) The paper presents the differences of subjective and objective responses of the respondents.

Key words: Environmental stress; interactive application; simulation; materials; behavioural research.

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Social participation in residential architecture as an instrument for transforming both the architecture and the relation between the people who participate in it

Katarzyna Kosk *

Warsaw University of Technology, Faculty of Architecture, Koszykowa 55, 00-659 Warsaw, Poland

ABSTRACT

This paper is an attempt to draw attention to social needs in residential architecture and to bring the idea of participatory design. The notion of participatory design that uses, during the different phases of the design process, the knowledge of the potential users, takes place in this article due to the need of depicting the social interaction and their identification with the environment. The author presents hypothesis, that, social participation in designing of residential architecture has a positive influence on both the architecture and the relation between the people who participate in it. On the one hand, the involvement of future users in the design process has a positive influence on the expression of residential architecture and contributes to the formation of its individual character. On the other hand participatory design helps in creating well-functioning neighbourhoods and communities whose residents get involved. It also helps people to have a sense of identity with and to take responsibility for place where they live. Proving the thesis takes place through the presentation and the comparison of three examples of polish co-housing projects, which were created in Wrocław, Gdynia and Białystok. Author defines nine qualities of space, which promote social contact, based on the analysis of literature, mainly: Ch. Alexander: "A Pattern Language: Towns, Buildings, Construction" (1977/2012) and J. Gehl: "Life Between Buildings" (1977/2013). They concern: optimal size of the neighbourhood, spatial structure of housing estate, height of the building, concentration of people, relation of the building with the environment, method of forming the common spaces. These qualities are used as an evaluation criteria in this article. Analysis shows that two of the three examples of analysed projects have all of the considered qualities. It is predicted, so that these projects have a better chance of creating architecture, which will be able to form social contacts. The last one of the analysed projects meets only three evaluation criteria. The reason for the lack of other considered features, is seen in a poorly conducted the process of participation, namely - architect's negligible activity in this process. This example shows how important is the architect's role in the process of design. Thanks to his knowledge and skills depends the final result of designing. Architect's task is to arranging individual elements in a way that allows us to see new aesthetic links, thereby forming a harmony. The paper proves also that, if it is more design guidelines for both the existing context and needs of residents, the project will become more interesting, has its own individual character. If we want to have a many sided -architecture, many people must be involved in making it. Individualism of architecture is the results of individual needs of residents.

Key words: Participatory design; residential architecture, identity, neighbourhood.

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Spatial boundaries in public space: Urban Games

Gulhis Duygun *

Kocaeli University, Faculty of Architecture and Design, Department of Architecture, Kocaeli, Turkey

ABSTRACT

Since their early ages, individuals have to adopt the city by accepting its accepted rules. With insufficient public spaces and all attitudes aimed to be the absolute power, the awareness is defeated by the routines of the city. The constrained any type of public space returns into a simulation and this takes the right to say any word about the place he/she lives as a citizen. As an example to the constrained space the “game” places in the city can be given and in these places it can be seen that the attitude types are well defined with the sharp borders of the gaming place and finally we face with the “game” type that cannot go beyond the toy compartments in the Malls. This constraint does not only show itself for the space but also for the potential of the game to be shared by everybody. Inside these borders, deprivation caused by the deficiency of the public spaces, new searches begin in the metropolitan but, the destroyed public spaces as a result of the daily life practices developing around the capitalist relationships are now being tried to be “produced” by the constructed environment. But these “produced” spaces are just simulations of a constrained public life. In its real sense a public place or space is a space open to everyone, accessible to everyone and places being meaningful with sharing the diversities. Because of this reason, public space must exist as platforms on which all the barriers are overcome and shared by anyone from all ages. These gaming places in the cities are becoming the most important places that these sharing can occur. The child who is a part of the city Until 20. Century is started to be attracted to the special spaces that are designed especially for him/her and public gaming places are started to decrease in number, spatial and in quality. On the other hand, some special situations reform the relationship between the game and the individual. This situation can also be seen in the 2013 “gezi park”/Istanbul protests and in similar environments. This is the invention of the citizen of his/her “public space”. Over the concept of “game”, this can be defined as the instinct of the human being to produce his/her own space and game. In similar environments and /or after emergency situations (like disasters) people try to rehabilitate and motivate themselves with parallel “gaming” in these temporary living places. Moving from this point, it can be said that the potential of the city places to become a gaming place for all the actors of the city and the potential of this to overcome all the barriers with combining daily life and game is an important point. The article aim is to answer the question of how individuals from at all ages can invent these spaces how they can join.

Key words: Urban games; public space; spatial experience; body-space relation; spatial boundaries.

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Modern adaptation of the palace - the recovered charm and spirit of the monument

Joanna Gil-Mastalerczyk *¹, Regina Gil ²

¹ Kielce University of Technology, Faculty of Civil Engineering and Architecture , Department of Architecture and Town Planning , al. Tysiąclecia Państwa Polskiego 7 , 25-314 Kielce, Poland

² Andrzej Frycz Modrzewski Krakow University in Krakow, ul. Herlinga Grudzińskiego 1, 30-705 Krakow, Poland

ABSTRACT

The modernization and the conversion of the historic palace in Cianowicach near Cracow (Lesser Poland, Poland) is a confirmation, that regardless of grade preservation monument through appropriate interference with the use of modern and introduction new substances in the new feature (in any manner that emphasizes value and historical object), it became possible to restore the important significance of the object and place. Restored function, has become a tool for so that monument to function effectively and interact with the environment, the community - in the era of progressive in the world rapid development civilization, carrying a behind dangers leading to degradation of the cultural landscape, including the historic assumptions manor park. Military activities, ad hoc repairs, lack of appropriate concepts and ideas for development and for many years' shortage financial resources in Poland, led to the destruction the magnificent palace. Modern adaptation the old palace made it possible to rediscover the precious historical heritage. The recovered charm and the spirit monument is a living history of architecture court on Polish land. Irrespective of the grade preservation monument it remains an important cultural heritage of the age in which was built. It makes a significant contribution to the achievements and development of national culture. It presents the historical, scientific, artistic and natural values, constituting the inherent element of the landscape of the village.

Key words: Architecture; modern modernization; monument; palace; Cianowice.

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Traditional Turkish city public places and staff formation effect of historical building in Erzurum city example

Ayşe Sağsöz ^{1*}, Süleyman Özgen ², Füsün Kocatürk ¹

¹ Nuh Naci Yazgan University, Department of Interior and Environment Design, Kocasinan, Kayseri, Turkey

² Karadeniz Teknik University, 610808, Trabzon, Turkey

ABSTRACT

The elements constituting the historic public spaces in traditional Turkish cities, as they limit this area, this contemporary urban spaces and the recognition of the environment as they are, they are also effective in learning and perceptibility. The study of the historical city centres and public spaces and therefore effective in the formation of religious buildings, markets etc. the area where the elements were based on the assumption that better protected than in the general town. In this context, the areas covered in the survey because of the election as the Three Tombs and the environment, Erzurum is one of the oldest residential areas of the city, intense collection in the field of traditional urban elements, they can represent the characteristics of the cities of these elements in the best way and to require protection in the environmental scale of the field It described as consisting of a large area. In this study, the elements defining the area; Traditional houses, streets and monumental historic buildings; tomb, tombs, mausoleums, mosques and fountains under three groups and identified as necessary by checking the zoning plan, more detailed site plan map already benefiting from the information obtained from space has been created. Working with representative feature and contains a total of 12 traditional houses that continue to use today. Houses need to plan (in terms of spatial organization) and both views (front elements) were analysed in terms of typology and performing, it was made to the review. 2. In stage three-dimensional modelling of selected performing these areas close to the actual date of structures and elements, while the body was placed in some other existing structure modelling. The information obtained is transferred to a computer analysis matrix was created. Brought from information obtained from this matrix composed mainly by obtaining statements and typologies, Erzurum city of Three Tombs of these elements has been demonstrated in and around the impact on the formation of public space. History and traditional environments, climatic, cultural and social factors with the resulting architectural forms, from generation to generation with very little change is caused by the transfer. These formats are used, and unchanged for a long time, are a source of important information that directs the formatting efficiency of designers in architecture. In this context, it is expected to generate data in the region in terms of new constructions and analysis of the results obtained. Investigation of historical monuments in outside residential areas, religious / monumental structures are the most important results as determined by generally better preservation of this area of the city due to the weight. Unlike traditional Turkish city, modernist structures provide independent spaces. However, we have dealt with in the various layers and components of the traditional urban fabric of urban space; they are places of urban life and have demonstrated a great influence on the formation of the city's image. It may be many factors that give a visual identity to the streets; scale, proportion, rhythm ... and so on. These factors are used in the design of these spaces in various formats.

Key words: Traditional Turkish city, street and houses; historic structures & components; public spaces.

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Bridges in urban planning and architectural culture

Marek Salamak *, Klaudiusz Fross

Silesian University of Technology, ul. Akademicka 5, 44-100 Gliwice, Poland

ABSTRACT

Bridges serve several functions and the main function is obviously to cross an obstacle and get to the other side. With time, the overcoming of longer distances became possible due to technical capabilities and more innovative designs. Therefore, bridges are often treated as an indicator of progress and engineering skills as well as a symbol of the economic potential of a city, a region or a country. This is why many urban bridges have become the most important structures in the cities. They sometimes attract tourists and even are the characteristic elements of the urban landscape (icons), by which cities are being recognized. In addition to this, a typical urban bridge, in the contrary to a highway bridge, serves pedestrians and this is why it must satisfy safety and comfort conditions. There are four main functions of an urban bridge: 1) transport link separated by an urban area, 2) creation of place's image, 3) demonstration of modern technical capabilities, 4) construction of human-friendly structure. Apart from this, a bridge has also a metaphoric meaning. It is a structure that links two different or distant from each other persons or communities. This paper discusses several examples of bridges that have a significant impact on the perception of the city or even the change of terrain configuration. There are also bridges which, due to being on the cultural or ethnic borders, more often served a role of a symbolic link. These examples, according to the author, will confirm the above-mentioned thesis about the multi-functionality of urban bridges. The first and most important function of the bridge is deliberately discussed at the end to show an unattractiveness of structures that serve only this one role.

Key words: Bridges; urban; urban planning; architectural culture.

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Concrete properties in selected Auschwitz II - Birkenau Former Death Camp Buildings

Teresa Stryszewska *¹, Stanisław Kańka ¹, Stanisław Karczmarczyk ²

¹ Cracow University of Technology, Faculty of Civil Engineering, Warszawska 24 st, 31-155 Cracow, Poland

² Cracow University of Technology, Faculty of Architecture, Warszawska 24 st, 31-155 Cracow, Poland

ABSTRACT

The article presents the results of research on some selected physicochemical properties of concrete taken from the foundations, walls and ceilings of the infrastructure facilities in the Auschwitz II-Birkenau former death camp. The research was conducted as part of a broad program aimed at the diagnosis and documentation of the condition of the camp buildings, as material historical objects associated with martyrdom. Due to the nature of the buildings, a research program has been developed in consultation with conservatory services, to minimize the effects of damage associated with sampling. The research was carried out on core samples taken from parts of the camp buildings' structures. The research program included tests compressive strength, density, determination the salt content by spectrophotometric method and observations microstructure by scanning electron microscope with EDS analysis. Results and analysis made it possible to estimate compression strength and concrete degradation and to develop a method to strengthen concrete. The resulting information on the strength properties were used for computational analyses determining the level of safety of the facilities concerned.

Key words: Research materials; concretes; Auschwitz-Birkenau camp.

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Using Te' genne bali in Bola Ugi (South Sulawesi Indonesia)

Andi Abidah *

State University of Makassar, Indonesia
Vienna University of Technology, Kalbungasse 4/1 Wien Austria

ABSTRACT

Bola ugi is name of bugis house in South Sulawesi Indonesia shape of bugis house are house on stilts and rectangular form with extended rear. Meaning te'genne bali are te' is no and genne bali is even so meaning te'genne bali on bugis house is house do not use even number or exactly using odd number in certainly elements. The aims at this study are to fine elements house use te'genne bali (odd number). This study used survey method with taking some sample housing in district Soppeng South Sulawesi, Indonesia and also done interview local community. Building Bugis house consists from three parts namely lego-lego, watangpola and jokke. Currently some house is found still using tamping in Watang pola (main house) usually this type is old Bugis house or it is called bola genne and modern Bugis house do not use tamping it is called bola eppa-eppa. Both the type house is still using te'genne bali (odd number) their house. The application tegennebali can be found in watang pola (main house) elements such as roof, window, space, lander and floor. Using Te'genne bali number on stepladder is seven, nine, eleven and thirteen while using of te'gennebali roof can be seen of number saddle layer roof (timpalaja) which is; one, three and five and also seven on king house. Beside that Te'genne bali in bugis house is one of signal rank social of society. Using te'genne bali (odd numbers) adjusted by person's noble rank. They believe that application te'genne bali of their house will make its owner long life, lucky on future life. Using te'genne bali of house is not only of old Bugis house but also modern Bugis house.

Key words: Bola ugi; te'gennebali; element Bugis house.

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The knights hospitallers in Central Europe during the Modern Age

Valentina Burgassi *

Paris Sorbonne, Ecole Pratique des Hautes Etudes Paris Sorbonne, 41 Rue Dauphine, Paris, France

ABSTRACT

This proposal deals with the study of the architecture of the Order of Malta in Prague and it wants to structure a project of knowledge for a territorial and cultural heritage. The scientific approach is based on the comparison of documents (conserved in central archives both in Rome and La Valletta) and architecture already existing, with particular attention to the detailed analysis of the work of art. Attention is given to the purposes of knowledge, management and conservation of the heritage. This project finds its place in a research of history and documentation of architectural heritage and environment. History and a multi-disciplinary research method are also the foundation of all forms of protection and enhancement. A cognitive-critical action is needed in the analysis of historic and artistic context: some historians deal with the heritage of Malta, but often with different specific approaches without an overall look. A history of the Hospitaller architecture in Prague is still to be studied in its typologies. Complementary visions may open new points of view on research and find the innovative perspective with a multidisciplinary method: theory and practice converge in representations of the architecture of the Order, in a milieu quite different from the historical context of the Sixteenth Century. Analysis of the early history of the Grand Prior of Bohemia has only appeared very recently. A model for the creation of Hospitaller houses could be postulated only through an examination of local conditions and even the evolution of provincial hierarchies could be studied. The penetration of Eastern European society by the Crusade ideology has to be examined as a necessary background to the reassessment of the early activity of military orders.

Key words: Knights of Saint John; hospitallers; architecture; Prague; prototypes.

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The Ebb Tide in Conserving Nusantara Architecture

Yusfan Adeputera Yusran *

Brawijaya University, Department of Architecture, Indonesia
Institute of History of Art, Building Archaeology and Restoration, Technische Universität Wien, Austria

ABSTRACT

Nusantara architecture has become master in its own house. Attempt to realign the understanding of traditional architecture into the Nusantara architecture proven effective disseminating the virus in preserving traditional houses. Preserving Nusantara Architecture is not about maintained the tradition, but also the value. One of them is gotong royong (mutual cooperation), the motor in reviving community architecture. Amid the insistence of modernity, Nusantara style gradually eroded, despite the fact of abundance value in it as reference for modern architecture. Wisdom of indigenous peoples in building their houses becomes a reference for scientists to seek the principles, for example earthquake resistant buildings today. Moreover, economically, added value for the region with establishing ecotourism. This paper proposes recent review about conservation on Nusantara Architecture in Indonesia, with describing currently conservation efforts which being intensively carried out in various regions in Indonesia in order to revive vanished traditional architecture. Some examples described taken from Waerebo, Ratenggaro, Ngata Toro, and the exploration of vanished Tolaki architecture. Overall, the process of participatory in planning and implementation is the key factors of these programs today. Academia also involved, with students involved helping the community. Thus, the real learning process and transfer of knowledge at the same time sustaining at once. On the other hand, ex-situ conservation efforts also taken into consideration when attempt to push the equalization of protecting effort race against time. Conservation a la Europe becomes important once seeing the vast spread of custom/traditional houses in Indonesia and lacking attention from the government to drive faster. While, the occupants were unable to keep maintenance and the clamor of modern life. Open-air museum might be the only solution.

Key words: Nusantara Architecture; ex-situ conservation; Open-air museum.

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How to teach architecture? – Remarks on the edge of Polish transformation processes after 1989

Justyna Borucka, Bartosz Macikowski *

Gdansk University of Technology, Faculty of Architecture, Narutowicza 11/12, 80-233Gdansk, Poland

ABSTRACT

The political changes in Poland after 1989 have resulted in a whole range of dynamic processes including the transformations of space. Until that time established institutional framework for spatial, urban and architectural planning policy were based on uniform provisions of the so called: planned economy. The same applied to the training of architects which was based on a unified profile of education provided at the state's technical universities. The effects of the political system change are reaching far beyond the political and economic arenas. The existing urban planning tools lost their value because of factors such as liberalization of regulations and scale of investments. Poland witnessed the phenomena of suburbanization and uncontrolled transformation of space. The tool which can improve this situation, in addition to legislative action, especially in the field of spatial development- is education. The article discusses the education in the field of architecture as an important tool which could improve the existing state of uncontrolled transformation of landscape and spatial disorder in the built environment. The analysis is based on examples of different fields where architectural education takes place and the effects for the future form of the build environment. The article asks question about architectural education: what are the hopes placed in it, what are the already visible effects, and the expectations for long term effects. This analysis focuses on a number of aspects of architectural education: the fields of education in both: educating future architects (within the framework of different types of universities, different profiles and circular, additional exchange programs e.g. Erasmus, changes of the profile of studies - Bologna system) and long life learning of architects already active in the market. There is also need to mention the importance of architectural education of future recipients of architecture, namely children and young people within the different actions on the national and local level.

Key words: Architecture; architectural education; pedagogy; spatial planning, urban planning tool.

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The assessment of remote sensing methods for detection of architectural mediaeval details

Ireneusz Ewiak, Agnieszka Jenerowicz *, Paulina Lulkowska, Malgorzata Woroszkiewicz, Izabela Usiadek

Military University of Technology, Faculty of Civil Engineering and Geodesy, Geodesy Institute, Department of Remote Sensing and Photogrammetry, gen. S. Kaliskiego 2, 00-908 Warsaw, Poland

ABSTRACT

Architectural objects are not only relics of the past but also an artistic vision and an expression of civilization and culture. Therefore, analysis and protection of cultural heritage are very important nowadays. Monitoring and study of all architectural monuments are basis of their maintenance and preservation, thus, analysis of the structure and the condition of architectural objects should be continuous and maximally simplified. Moreover, in many cases, due to a bad condition of the architectural heritage, the duration of conducted analyses should be as short as possible. Methods of architectural object analysis used so far are based on a direct investigation of the structures of objects and materials. These are invasive methods of investigation and due to their nature can be long-term, time- and labour-consuming, and require a thorough knowledge about the examined object. An alternative for this approach would be the application of remote sensing methods that can be considered as a non-invasive method of investigation. A group of investigators from the Department of Remote Sensing and Photogrammetry from the Military University of Technology, Warsaw, Poland, along with specialists from the Institute of History of Art from the University of Wroclaw conducted an investigation in one of the cities of the region of Lower Silesia - Zabkowice Slaskie, using non-invasive methods. As the test objects, several buildings in the old town and old monastery were chosen. The investigators used both passive and active sensors, i.e. a multispectral camera, a thermal camera and a laser scanner, inside and outside of the analysed objects to detect remotely elements of buildings that differed from the rest of the construction, and therefore, could be considered as objects that should be investigated with classic invasive restoration methods. The synergy of different types of data showed parts of buildings in the old town that were rebuilt during centuries, i.e. new building stories, cornices, etc. All obtained results were compared with the architectural documentation that confirmed the accuracy of used techniques. Furthermore, the integration of the data of the old monastery allowed to detect mediaeval elements that were hidden under the plaster, which was followed by the restoration work in the monastery. The conducted research showed that a synergy of different remote sensing data has a great potential of non-invasive methods, especially remote sensing methods in the conservatory works, particularly in its first stages, or when some parts of the documentation of an investigated object is missing.

Key words: Building restauration; architectural objects; history of art; remote sensing; data synergy; mediaeval details.

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Ruins of memory: a sustainable conservation for the material and immaterial values of the closed Mental Institutions in Italy

Emanuela Sorbo *

Università IUAV di Venezia, DACC, Department of Architecture, Construction and Conservation, Dorsoduro 2206, Terese, 30135 Venezia, Italy

ABSTRACT

In 1865 in Italy a national law was enacted by which the Provinces were obliged to maintain the poor that were regarded mentally insane (legge Comunale e Provinciale n° 2248 del 20 marzo del 1865) and to restore existing public mental institutions or build new ones. In 1978 with a new law (n. 180), based on a proposal and a cultural movement promoted by the psychiatrist Franco Basaglia, these structures were closed and only in some exceptional cases (such as for instance San Giovanni Hospital in Treviso or San Servolo in Venice) were reused and converted to other functions. Most lie abandoned on national territory in spite they have a very large urban extension and are very close the center of the cities. They were built with a strong relationship between cultural and social idea of the significance of mental illness and specific architectural form, because it was intended to play an important therapeutic role. The Italian mental institutions were planned with a small-village type inspired by the British "open-door" and "no-restraint" model. They were organized with a strict separation between patients (male from female, and according to typological mental conditions) and the possibility to walk in an open space, imitating a countryside experience but with an administrative centre to control and manage the pavilions. They were built with advanced technique solutions for construction and systems (such as heating, cooling, ventilation, water and sewage) but were all intended to answer a therapy method such as idrotherapy, electrotherapy and so on. Because of this link between material and immaterial memories that they reveal, sustainable conservation strategies involve extensive categories of issues (from technical to cultural point of view). They are places of memory where are condensed all the expressions of architecture as a narrative source: the heritage memory of the pavilions, gardens, green; the cultural memories of the furnishings, beds, typewriters and medical equipment; the documentary memories as medical records, exam results, badges with the names of the patients and the invisible memories, the experience behind the walls, the untold of human experience. As a consequence is difficult find a methodology for a conservation project able to maintain their whole identity as cities-fragments, architectural models and places of memory. But this layering of memories reveal in itself an immaterial value which open the possibilities to multiple forms of conservation and possible reuse. The transmission of material and immaterial architecture values could be revealed starting from thinking the project (and the architecture in itself) as a memorial not only or exclusively as a monument: a place in which a widespread cultivation/conservation of memories (through experimental design exercises that testify a story of memories) is linked with new functions. A new interpretation of the place in a social meaning. Through this way strategies of reuse might become/reveal a social memory exercise to avoid the collective amnesia and the architectural isolation.

Key words: Cultural heritage; architectural ruins; mental institutions; cultural identities and memories; conservation and restoration.

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Mellah al-Jadid, the Jewish Quarter of Tetuan, Morocco: An identifiable architecture?

Julio Calvo-Serrano *, Fabián García-Carrillo, Juan M. Santiago-Zaragoza

University of Granada, Higher Technical School of Building Engineering, Campus of Fuentenueva. 18071. Granada, Spain

ABSTRACT

Architecture and Islamic urbanism have been the subject of intense academic interest for decades, however, the Jewish neighbourhoods, which were a vital component of cities with a Muslim majority in the Maghreb, have been ignored, or have been scarcely studied. Few researches related tend to approach the study of these minority neighbourhoods as isolated units, from the point of view of exclusion and singularity, considered exceptions to the "ideal" Islamic city, without taking into account the multiple connections between the Mellah and the rest of the Medina. But Jewish communities were settled in North Africa long before the Arab extension and the advent of Islam to the Maghreb; therefore its history, as a social group, cannot be considered apart from the history of Moroccan Muslims, since all the events in the country influenced and affected both groups, although in different ways. In the case of Tetuan, the presence of Jews is parallel to the foundation of the city by the Grenadian al-Mandri, in the late fifteenth century. Coming from the Iberian Peninsula, the Tetuan Jews grew their number after the Reconquest and the general expulsion of Iberia-Sefarad; as times passed, they became more than 10% of its population. Based on the demographic weight and economic and intellectual dynamism of Jewish-Sephardic community, Tetuan became known as "Little Jerusalem." Jews settled northwest of the district al-Blad, the oldest of the city, without physical separation from Muslim neighborhoods, adopting the system of organization "qêhalîm" according to their place of peninsular origin. According to testimonies of European travelers of the eighteenth century, in the Mellah al-Bali, neither the streets of their neighborhood were different from the rest of the Medina, nor was there a specifically Jewish housing type. Jewish houses were, in their internal spatial configuration and construction identical to those of the same social sectors Muslims lived with. But in 1807, by order of Sultan Moulay Sulayman, the Tetuaní Jewish community was forced to leave Mellah al-Bali, sell their homes to move to a walled space and build their new homes, within six months. So a city was formalized within a city developing its complex existence of minority within the Muslim city. In this paper an approach to the domestic architecture of the new district arises, Mellah al-Jedid, through typological analysis. We try to clarify the following issues: A community of 2000 years old roots has not been able to define a place and condition the space to the point of getting an identifiable one; can we speak of a distinctive Jewish Mellah Moroccan architecture?

Key words: Judeo-Moroccan identity; Mellah; Jewish Quarter; Islamic city; Medina; Morocco.

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Torre de los Jerónimos de Casanueva (Granada, Spain): Identity of a village

Francisco Javier Lafuente-Bolivar *, Gabriel J. Fernández-Adarve, Juan M. Santiago-Zaragoza

University of Granada, Higher Technical School of Building Engineering, Campus of Fuentenueva. 18071. Granada, Spain

ABSTRACT

Casanueva is a small village in the North limit of the Vega of Granada, a wide, flat, and fertile agricultural shire in the middle of Andalucía that keeps getting water thanks to its millenary network of irrigating channels, which take the water from rivers that are born more than 3.000 meters high in Sierra Nevada.

Also centuries are counted as the time that keeps the object building of this project, until now a silent container of the asleep memory of the place to which it gave the name: The Farmhouse of Casanueva, known by its neighbours as "Tower of the Jerónimos". The presence of the building in Casanueva does not go unnoticed, so much that its neighbours have it as the symbol of their village. However, almost anybody knew of its origins and its evolution. Time was blurring its history and its shape. But the firm will of its neighbours to secure the identity of their roots, gave the Group of Investigation, Patrimony and Environment of the Superior School of Building Engineering belonging to the University of Granada (PMA-ETSIE) the opportunity of studying, analysing and rediscovering the great building that was there hidden. Doing research, the TOPONIMIA of the place transported us through time: from an agricultural, monkish exploitation from the XVI century to an Islamic medieval farmhouse and from it to a Roman villa, but always with the Vega as a resource. The typological constructive analysis done by the Research Group confirmed the data of the historical documentation: it's in fact a foundation of Hieronymite monks from the end of XVI and beginning of XVII century that uses Mudejar constructive solutions. It is a planned and cultured architecture, originally isolated as the centre of an agricultural exploitation that today highlights in the popular architecture that surrounds it. The cadastral tangle in which it is still placed hides a beautiful building mistreated by its recent history. Once it was discovered in its wide extension and nobility, it could be identified as the great property constructed around a peristyled yard that appeared in historical maps and descriptions. Ever since it was able to establish lines of work for the reutilization, serving in this way as docent exercise for students and professors who do research and are interested in the rehabilitation of the historical patrimony. We were with no doubt in front of the germen of what centuries after generated the born of Casanueva as the core of the population. The teaching and research process have achieved the objective proposed: to maximize the feeling of identity of a village to the most important element of its patrimony, initiating with it the process for rehabilitation and preparation for future use. As a result of the research process the municipal administration to start the process for the old monastery of Casanueva to be recognised for its historical and archaeological values as a Cultural Interest Building in the category of monument, the greatest grade of protection that the Spanish legislation for the historical patrimony gives.

Key words: Identity; Heritage; Rural Architecture; Rehabilitation; Cataloging.

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Morphological and constructive analysis of Gothic walls within a selection of Renaissance facades in the world heritage city of Caceres

Pablo Alejandro Cruz Franco ^{*1}, Adela Rueda Márquez de la Plata ², Susana Mora Alonso Muñoz ³

¹ University of Madrid, Madrid, Spain

² University of Extremadura, Cáceres, Spain

³ Polytechnic University of Madrid, Madrid, Spain

ABSTRACT

The aim of the research is the documentation and analysis of the old gothic city of Caceres through constructive study of the existing facades. This city is World Heritage Site as one of the urban ensembles of the Middle Ages and the Renaissance most comprehensive in the world and is known for its monumental palaces that have maintained their appearance from the sixteenth century to the present day. But how were the Gothic facades of these palaces before the sixteenth century? Thanks to a controversial decision made during the twentieth century to remove all the plaster and layers of sacrifice of the historic buildings were brought to light the bare stone exposing corrections in the facades, where you can appreciate mullioned windows, monumental gates, holes filled with recycled masonry, pieces of stairs, granite columns, etc. The developed methodology is at first the discovery and inventory of these "hidden" facades and then analyse these changes in the physiognomy comparing them with the plants of the palaces and the urban fabric. After having clear what palaces and what facades have these corrections, we proceed to the photogrammetric survey to know exactly what pieces make up the façade being the stepping stone to a study of constructive strata and to draw conclusions from age and composition of the original elements and how are you changes have affected the operation of the building and are the result of modifications in how to use and understand the city through the centuries. Specifically this work covers different cases: the House Aldana, the palace of Ovando, the palace Generala and the episcopal palace, which are all a clear example of buildings whose appearance has varied through the centuries and they have unique elements that demonstrate how the ancient Gothic buildings are inside of those that have reached us.

Key words: Architectural heritage; Gothic city; Lost Fachade.

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From mortuary landscape to contemporary villages – live and death on Luxor West Bank (Egypt)

Zsolt Vasáros *

Budapest University of Technology and Economics, Faculty of Architecture, H-1111 Budapest, Hungary

ABSTRACT

Thebes is presumably the largest archaeological site in Egypt. But wider aspects of the necropolis and the temples, particularly those of periods other than the New Kingdom, or the question of the reused structures in later times and their architecture are still often not in focus of the research. With this in mind, it was the main idea to assemble all the relevant data of the contemporary architecture since time of habitation on the West Bank. While the heyday of Thebes was from the Middle Kingdom to the Third Intermediate Period, the modern history and the contemporary status of the necropolis has never been architecturally interpreted using a multi-layered model in space and time. Our first site project in March 2015 – after 20 years of fieldwork on excavations - concentrate on aspects of vernacular architecture at the site. This research adopt an anthropological perspective of the Theban landscape and Hassan Fathy's work in Upper Egypt, where ongoing human understanding and engagement with the physical and mental surroundings produce outcomes that are never final. The inhabited area is continually being shaped and reshaped, while it seems to be eternal. As a cultural landscape, the Luxor West Bank villages nowadays are informal settlements in an overheated social reality as much as it one of the most important archaeological sites in the world. The archaeological heritage of the almost 250000 years human being, the 3500 years of Pharaonic and Roman Imperial Period and the Islamic culture are dominant features. Until the recent demolition of the colourful mud-brick buildings of Qurna village, situated among the Noble Tombs, were home to a vibrant community. In a famous series of lectures given by Hassan Fathy at al-Azhar University in 1967, almost exactly twenty years after work on New Gurna had stopped, Fathy spoke about the dangers inherent in changing urban patterns, and the huge responsibility that architects assume when they undertake to create a town from the very beginning. His work is an appeal for a new attitude to rural rehabilitation. The standard of living and culture among the world's poor peasants can be raised through cooperative building, which involve a new approach to rural mass housing. His works in New Gurna and in Baris/Kharga Oasis are appeals for a new attitude to rural rehabilitation. The standard of living and culture among the world's poor peasants can be raised through cooperative building, which involve a new approach to rural mass housing. New Gurna was stopped, the realized parts were never fully settled. The buildings are almost destroyed, or rebuilt. The Baris centre was built until 1967 also never finished. Fathy's role as a catalytic force in the continuity of traditional architecture will be presented in this research, redefining him as part of traditionalist, modernist and partly as utopist agendas as well. The research based on a departmental site project at the BME Faculty of Architecture.

Key words: Cultural landscape; Egypt; Hassan Fathy; vernacular architecture; historical structure; islamic architecture.

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The role of a street is the immaterial role

Luis Pinto *¹, Paulo Carvalho ¹, Luís Pais ¹, Giedrius Vilkuotis ³

¹ Beira Interior University, Covilhã, Portugal

² Vilnius Gediminas Technical University, Lithuania

ABSTRACT

With this study, we intend to clarify the meaning of the immaterial value of the street. Architects are now using a different methodology to conceiving projects. They work between atmospheres and emotions. Art meaning, is not a conscious perception, but addresses the intuitive apprehension. We could say, that perception leads to the expression, and the expression is essential for the perception. One “sees” and “it interprets”, the other “represents”. In this research paper, we address the issue about the immaterial value of the street, that it is a visual experience that subconsciously affects individual’s functions and emotions. We are talking about shape, colour, light and shadow. For some people, the colour assumes a prominent role, balancing, signal, interpretive emotion associated to the shape and texture. For other takes on the role of exaggeration, excess, so its absence or colour uniformity are assumed as principal than the form, and that it is the immaterial role of the street. It is the way how he feels happy or sad, when we walk on the street. We define, in this research, the aesthetic experience of the street as the moment in which the subject establishes a relation with the object/buildings, this relation being one in which the body and all senses are connected. The experience is aesthetic and unique, which is original, particular, of a sole individual, constitutes a moment of a relation. That means the immaterial value of the street. One of the most serious perception problems of the street, are the historical centres and its aging. To contradict this process, it is necessary to inject new cells so that the urban tissue might regenerate. It is essential for the city to gain its youth and become more attractive, more modern and more competitive. This renewing is our responsibility; we may contribute by bringing financial ecological and cultural advantages. For example, a building like a theatre when it must be renovated, we must think of it as a public space with life quality, with identity references and at human scale. Concluding it must represent the roots of cultural immaterial sustainable city.

Key words: Immaterial value; street; happy street; colour; architecture; emotion.

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Real estate value of a heritage building

Luis Pinto *, Paulo Carvalho, Luís Pais

Beira Interior University, Covilhã, Portugal

ABSTRACT

Over the years, the street has been understood as a place where buildings just line up, with shopping centres and various businesses taking place. It is also known that a city has streets where dusty, dirty and dilapidated buildings are lined both sides of the street in the city centre. However, there are measures that have been developed by government administrators to improve the condition of the street that have helped improve the condition of various cities. The built heritage, has dimension values, which in many cases is easily measurable, but in other cases, it becomes almost impossible to evaluate them and puts them in relation to mathematical formulas and statistics, slandering a real value, what is being evaluated. These factors are so culturally, emotional, which in some cases are considered as an appreciation and in other cases as depreciation, to add to the calculation formula used, systematized and accepted. We can imagine many scenarios or enriching cultural factors diminishing, or proximity elements in ruins, to find such a subjective value to set, or which is implied in any business or transaction sheet. That's why we think this theme, still at the beginning of a significant discussion, will raise doubts, which later will be transformed into rules, facilitating the interpretation of an assessment, both to people who, as to whom it is given. We will address the subject about Silent Numbers. Silent numbers could be called or classified as "Cultural Factors" relating to emotion. The subjective factors are considered, for the most part, both in more complex evaluations, as in most common assessments. Our final objective, it will be to draw a calculation formula, for the determination of the standard market value of any building in the Real State world.

Key words: Real estate value; heritage; building; architecture; city; culture.

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Cast iron staircase in Aleksandrów Kujawski (Poland): history, construction, architectural form

Michał Kwasek *, Aleksander Piwek

Gdansk University of Technology, Faculty of Architecture, ul. Narutowicza 11/12, 80-233 Gdańsk, Poland

ABSTRACT

The purpose of the article is presentation of monuments' destruction problem. Interim protection often allows to use vintage buildings, but despite that many of valuable objects are still deteriorating. The text presents historic cast iron staircase, which is situated inside the railway station building in Aleksandrów Kujawski. Since the moment of creation in the 19th century for a long time that station, located at the border of Prussia and Russia, was an important transit point. Due to the geopolitical changes after The World War II nowadays it is situated in the central of Poland. At the same time it lost its significance. The cast iron stairs were created in 1870's. Despite many plans of recovery they are still deteriorating whereas other rooms in the same building are being restored. The staircase was built as a result of an extension of the railway station building because of the planned visit of rulers of two neighbouring countries. Due to that reason stairs have extremely prestigious design. Huge significance has also the construction of it. This emperor's staircase consists of repeatable elements casted in iron. This has provided easy mounting and interesting, rare artistic form. The staircase in Aleksandrów Kujawski was broadly analysed. In the article modular, openwork, prefabricated structure is presented. Photographs, architectural stocktaking drawings and 3D models of extraordinary construction nodes reveal that unique functional architectural object, which combines functionality and high aesthetic qualities. Stratigraphy examination of paint coats shows, that the stairs were renovated many times. Presented implemented remedial actions indicate negative results of incorrect, unthinking approach to monuments. This unique in Poland cast iron staircase is a glaring example of monument, which despite of compelling reasons of creation, remains neglected nowadays. It became an impulse to discussion on the fate of the cultural heritage which is the element of building's equipment. Often on grounds of service-based nature of it they are not fully appreciated, thus adequately protected.

Key words: Cast iron; emperor's staircase; destruction of monuments; prefabricated elements; historical buildings; 19th century architecture.

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Natural materials and transparent structures in the function of protection and rehabilitation of Bosnian-Herzegovinian medieval fortifications

Amir Čaušević *, Amira Salihbegović, Neriman Rustempašić

University in Sarajevo, Faculty of Architecture, Patriotske lige 30, 71000 Sarajevo, Bosnia and Herzegovina

ABSTRACT

A great number of medieval fortifications in Bosnia-Herzegovina is in a state of deterioration, lacking ceiling and roof structures (usually made of wood). Their components usually make part of other structures in open areas covered with weed and stand as useless rubble or are neglected due to there being legal restrictions on owners of the land to participate in their reconstruction. Numerous fortifications have disappeared, while some still hold remnants of the times past in their stone and mortar. The detritus blocks the access to the structures whose importance is thus also neglected. One of the first tension resistant materials used in construction was wood. Wood is an extremely anisotropic material. The tensile strength of wood fibres is suitable for dimensioning. From an economic point of view, it is disputable whether the ruined wooden structures should be reinforced. Since wood is rather light and easy to incorporate and manipulate with, it seems that the most convenient procedure would be the replacement of the structures as they are relatively easy to unload. The most common in building construction is the need for repair or strengthening of the existing roof structure elements. The means, materials and methods for strengthening such structures may be quite different - ranging from rolled profiles, steel fixing strips, and reinforced concrete blocks, to specially designed elements of reinforced steel, the so-called "bars" made of latticed steel and suitable for mass production. Contemporary methods are usually based on applying transparent structures as well, while contrast between the new and the old is further emphasized. These structures protect ruins and fortifications from further deterioration, regardless of whether they partially or fully cover the area below, i.e. as "light" eaves which may also be removed if necessary. The examples in the present paper, which do not refer to Bosnian-Herzegovinian medieval fortifications only, are given as to illustrate means and methods of active protection while taking into account their existence as a whole and in the context of their historical value. By applying contemporary methods, technical and aesthetic characteristics of the materials, it is possible to track their functional and historical endurance while expressing the value of the times in which they were constructed but at the same time, reveal a vision for the future.

Key words: Medieval fortification; castles; masonry; wooden and transparent structures; heritage; interventions.

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Modern Lithuanian architecture in Soviet time: self-reflections by architects

Dalia Dijokiene ¹, Egle Navickiene ^{*2}, Edita Riaubiene ³

¹ Vilnius Gediminas Technical University, Faculty of Architecture, Department of Urban Design, Pylimo g. 26/1, Vilnius, LT-01132, Lithuania

² Vilnius Gediminas Technical University, Faculty of Architecture, Department of Architecture, Pylimo g. 26/1, Vilnius, LT-01132, Lithuania

³ Vilnius Gediminas Technical University, Faculty of Architecture, Department of Architectural Fundamentals and Theory, Pylimo g. 26/1, Vilnius, LT-01132, Lithuania

ABSTRACT

Modern architecture in soviet Lithuania (1944-1990) is unique and outstanding in the context of former Soviet Union. It is distinguished for its contextual approach, link with the local tradition and regard to the natural environment. Modern architecture in after war Lithuania was created not by the newcomers, but by the first generation of architects educated in Lithuania. The purpose of research presented in the paper is to determine the premises under which modern architecture in Lithuania was founded after the World War II. Architectural objects designed by the first generation of architects educated in Lithuania initiated the distinctive development of local modern architecture. Current rapid unconsidered changes, as well as insufficient knowledge and evaluation of origins of Lithuanian architecture threaten its nivelation and loss. The paper reveals: 1) how the architects active at that time understand the phenomenon of architecture; 2) the basic principles of architectural design; and 3) the position of an architect as a professional in the society. Lithuanian architecture of soviet time attracts considerable attention of researchers these days. Architectural legacy is analysed mostly; the object of research are buildings. Political, ideological, social, economic contexts are explored as well; however the investigation is little based on authentic witness. This study is based on semi-structured interviews with the most influential architects, who represent the first generation of architects educated in Lithuania, available nowadays. Architects, who were active in fields of design, education and research in soviet time, were interviewed. The object of investigation is the conditions, preconceptions and attitudes that played the major role for their architectural practice, but not the architectural design and the artefact by itself. The principal results uncover the attitudes at soviet time towards architecture that set the basis for peculiarities of Lithuanian modern architecture. The outlook of personalities is rather solid despite of their diverse activities and experience. The first generation of architects educated in Lithuania see architecture as a very broad, miscellaneous phenomenon. They unanimously emphasize the artistic aspect as the keystone in architectural design. The attribution of importance and manifestation of architecture varies; nevertheless, the concept of architecture integrates and interweaves artistic, ethical, social, political aspects and initiating aspects. The architectural design of contemporary architects is founded on deep understanding and following the development of architecture: historical, pre-war modernism and also vernacular one; the tradition revealed by architectural shapes, building materials and way of life; and the respect for natural (relief, water, greenery) and historic environment. The buildings featuring the harmonious integration into urban and natural environment were considered of the highest value. Under certain soviet conditions like slant political ideology, state-owned property, planned urban transformation and mass construction architect gained a specific status. He was a powerful player, supervisor, responsible for the overall design and building processes, with set priorities for

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artistic creation, restricted by political ideological propaganda and limited resources but not by the private interests.

Key words: Lithuanian architecture; modern architecture; Soviet Period; architects' interviews; attitudes towards architecture.

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A complex assessment of roof structures

Ioan Andreescu ^{*1}, Alexandra Keller ², Marius Mosoarca ¹

¹ Politechnic University of Timișoara, Faculty of Architecture and Urbanism, Traian Lalescu str, nr. 2/A, 300223, Timișoara, Romania

² Politechnic University of Timișoara, Faculty of Civil Engineering, Traian Lalescu str, nr. 2/A, 300223, Timișoara, Romania

ABSTRACT

The structural analysis of a complex roofing system – the early XXth century Stock Exchange in Timisoara – has brought forward a paradoxical situation: this early modern building displayed an amazing collage of various traditional typologies of timber roofing, connected in order to produce a spectacular aesthetic effect of roof line. Further studies of XVIIIth, XIXth and early XXth century roofing structures presented an interesting evolution: until mid XIXth century the roofs were produced by craft guilds, influenced not only by their practical knowledge but also by symbolic and traditional knowledge manifested in the choice of peculiar geometric traces (sacred geometries) not unlike the famous Chinese roofing principles, described in “Yingzao Fashi” manual. Starting with the end of the XIXth century, the guild system vanished along with the symbolic and traditional meanings, leaving the practical knowledge completely independent – ready to be used for spectacular and aesthetic purposes (as in Art Nouveau and Secession buildings). Well into the XXth century, even that knowledge vanished, leaving a simplified, standardized and efficient form of roof framing. Paradoxically, well into the mid XXth century, an unconventional thinker, Buckminster Fuller, was able to generate a new kind of “roofing system”, the “geodesic dome” and the space frame structure, taking inspiration from the same kind of holistic and universal approach which animated the old craftsmen. Our investigations highlighted the overwhelming importance of a holistic and symbolic world view (“weltanschauung”) in the making of such specialised structures as the roofing frames, at least until the mid XIXth century. A complex assessment of such structures must take into consideration these elements in order to fully understand and properly conserve and restore them for the benefit of further generations.

Key words: Historic roof structures; guild; craftsmen; symbolic knowledge; sacred geometry.

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Fictive subject & house relationship without the 'local'

Elif Yeşim Özgen Kösten *, Hazal Öztürk

Kocaeli University, Faculty of Architecture and Design, Anitpark Campus, 41300 Izmit, Kocaeli, Turkey

ABSTRACT

The design of the house as one of the standardized commodities of the modern society brought an important shift in the status quo. This shift entails a wide spectrum of elements including the segregation of 'settlement' from 'city' on a macro scale and the segregation of 'house' and 'dwelling' on a micro scale. 'Settlement' became a notion separate from the 'place' settled and became a system designed independent from a 'place'. As the user of these idealized settlements of the 20th Century and the units designed within is unclear, even the 'subject' that would transform the unit to 'house' became an object of design. However, the notion of 'place' is composed of many layers such as historical, economical, political, societal, intellectual, perceptual, experiential, visual etc. and the city textures exist for centuries as subjective values that include these layers. Even a city's relation with the topography it settled on is capable of forming its identity; like a hilltop city, a valley city, or a coastal city and this relationship is also the most important source of the formation of all spatial elements within a city. But today, cities transformed into fragmented 'urban plots' which are designed without regard to the 'place' with every movements of their occupants and utilizing of living spaces scripted. These cities became mere 'place's in which constant construction happens to enable efficient production and faster house consumption, instead of a place for social and cultural interaction. In this study, the transformation of Kocaeli, a coastal city, and the reasons of this transformation will be revealed through the examination of the relationship between building regulations and architectural texture. Therefore, in this era in which the construction industry, that is itself a product of the 20th Century, forms its own market disregarding the relationship between subject-house, this study will contribute to formulate strategies and policies in order to define new regulations that upholds the identities of the 'local' and 'locational'.

Key words: Architectural culture; local; place; subject; house; urban housing; codes & regulations.

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Characteristics of gothic cathedrals in France and their structural elements

Terezie Vondrackova ^{1*}, Vladimír Nývlt ¹, František Němec ²

¹ VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Civil Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Informatics and Natural Sciences, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

Cathedrals represent some of the finest examples of interconnections architectural, aesthetic, functional, but also the structural design of the building. Their main motivation for the actual construction has been from its beginnings celebration of God, interconnections him with and gathering of believers. The emphasis placed on the aesthetics of the whole building was so crucial. But not always architectural elements were in accordance with the statics of the building. Gothic architecture, based on the earlier Romanesque buildings, points to the development of structural elements. They allow for further development, particularly in terms of building height but also the width of the wall. The aesthetic aspect which has been emphasized, however, was unaffected. Conversely, there has been the emergence of new non-standard architectural solved part of the cathedrals. The dominant design features was the use of external supporting systems, cross vaults and arches as well, which allowed for Gothic buildings to reach huge heights. Due to the fact that the beginnings of Gothic architecture are associated with France, the publication includes analysis of Gothic cathedrals with significant influence of this component, but also historical significance to the future development of this style. It is the cathedral of Notre-Dame in Paris, cathedral in Reims and cathedral in Chartres.

Key words: Gothic style; support system; Gothic arch; cathedral.

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The significance of Baroque Gothic Architecture in the Czech Republic

Terezie Vondrackova *, Vladimír Nývlt^a, Jan Plachý

VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Civil Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

The publication analyses selected works of one of the most important representatives of Baroque Gothic. Jan Blazej Santini Aischl represents an important personality in the world of architecture from the early 18th century. Architect Jan Blazej Santini Aischl got to the reconstruction now very prized buildings due to their devastation during the war period and the turbulent political situation. Publications so analyses the reconstruction of two monasteries, recognized as one of the most important and belong to the largest in the Czech Republic. This is a reconstruction of the Cistercian monastery church of the Assumption of the Virgin Mary in Sedlec near Kutna Hora, and the reconstruction of a Benedictine monastery church in Kladruby. Jan Blazej Santini Aichel allowed to return and fame already surpassed the simplicity of its specific Gothic architectural style. It was also a kind of demonstration of religious orders, whose wishes fulfilled. Their compromise so created structures that combine elements of Baroque with Gothic elements. This combination, which Santini applied to the reconstructed construction, then used also in the construction of completely new buildings. An example is presented in the publication Church of St John Nepomuk at Zelena hora. It was originally a place of pilgrimage with world standards that represents sample construction, demonstrating the unique architectural style of Jan Blazej Santini Aischl.

Key words: Baroque Gothic; Jan Blazej Santini Aichel; monastery; architectural style.

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Architectural education in Silesia - changes in the study curriculum

Joanna Serdyńska *

Wydział Architektury, Politechnika Śląska, ul. Akademicka 7, 44-100 Gliwice, Poland

ABSTRACT

Architecture, like law, medicine and not so many others belongs to the group of regulated professions. This means that the government is given the right to define the guidelines to streamline the processes of architects' education. Nevertheless, there is room within these guidelines - if not for freedom and individuality, then definitely for a wise compromise between state rules and local tradition. This allows us to talk of specific schools of architecture. Academic architectural education in Silesia dates back to the year 1949, when the newly established Silesian University of Technology started courses for architects within the faculty of Engineering and Building. In 1977, the independent Faculty of Architecture was established and for almost thirty years it was the only institution in the region that provided architectural training. At the turn of the Century some new schools of architecture emerged: the faculty of Architecture and Civil Engineering at the Opole Technical University and two faculties at the state higher vocational schools in Nysa and Racibórz. A significant number employed in the three new schools were previously either educated or employed at the Faculty of Architecture Silesian University of Technology. Today, four schools shape the image of state architectural education in Silesia. The education of architects in the silesian region, however, has origins that can be traced back to the Lviv Technical University. Following the shifting of borders that took place after the Second World War, the teaching staff was repatriated to a number of Polish cities. Former Lviv professors and students who came to Gliwice almost immediately became engaged in establishing the Silesian University of Technology. For this reason it is not difficult to find a sense of continuity in the study curriculum and teaching patterns of Lviv and Gliwice and consequently Opole, Nysa and Racibórz. The paper deals with the architectural academic education in the region of Upper Silesia. It investigates the study curriculum over the period of almost a century. The research commences with the Lviv origins of the Silesian study programme, continues throughout the post-war period, looking firstly at the study curriculum applied at the Faculty of Architecture, SUT, and ends with the multi-school teaching environment of today. The purpose of the research is to trace back and indicate the changes in the study curriculum. The questions concern study modules and their share in the programme. The research reveals that while the main modules of study curriculum remain broadly the same, the amount of contact/teaching hours has been significantly declining. The conclusions sum up the changes and formulate questions about the future shape of architectural education.

Key words: Architectural education; Silesia; changes of study curriculum.

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Influence of architectural solutions on building heat protection with example of historical rural houses in the northern Cassubia

Mirosława Górecka *, Marek Chalecki

Warsaw University of Life Sciences (SGGW), Faculty of Civil and Environmental Engineering, Warsaw, Poland

ABSTRACT

The paper is dedicated to the molding of traditional historical rural houses in the context of building heat protection. Special attention was paid on architectural elements of building, such as its shape (including the spatial form of the roof), layout of the rooms and functional connections, application of material and constructive solutions, location of the house on the plot including the planning of its surroundings. The researches concerning the existing historical buildings were carried out in freely chosen villages in the coastal northern Cassubia. This area is characterized by certain definite common features. The basic choice criterion of the researched area were its specific climate conditions, uniquely affecting the molding of functional and spatial elements of the traditional rural houses. An algorithm of choice of characteristic architectural elements affecting the building heat protection in the rural houses from 19th century was worked out. It has been stated that the folk architecture, as a result of work of numerous generations, thus characterized by skilled adaptation to the natural environment and climate conditions, should be currently the pattern and inspiration for quests of low-energy-consuming solutions during design of rural dwelling houses.

Key words: Rural detached house; building heat protection; functional and spatial architectural elements.

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Glass as a component of curvilinear architecture in 21th century

Krystyna Januszkiewicz, Marta Banachowicz *

West Pomeranian University of Technology in Szczecin, Architecture and Urbanism, Szczecin, Poland

ABSTRACT

Architects today digitally create and manipulate NURBS surfaces, producing building skins that results not only in new expressive and aesthetic qualities, but also in new tectonic and geometric complexities. The exterior surface of building – its skin – becomes necessarily emphasized due to the logics of shape conception inherent in the NURBS-based software. The explorations in constructability of geometrically complex envelopes in project of the digital avant-garde have led to a rethinking of surface tectonics. Buildings with curvilinear geometry force relationships between geometry and material which are different than before. The emergence of architecture freeform surfaces with a high degree of complexity poses a big challenge for designers and constructors for the production of such structures. Architects are waiting for new building materials suitable for non-linear shaped envelops. Glass panels was found at the centre of interest of the architects specializing in the design non-linear shaped buildings. However most of the works focused on the problem of the use flat panels. This form does not allow to achieve the desired shape or satisfactory solution sufficiently complex geometry. Bent Glass Panles, gives infinite possibilities of forming the design, thanks to which, we have a chance to get rid of unnecessary frame construction. What is important is the material opens up new possibilities in the development of the new surface tectonics of free surface buildings. The paper is focusing on Glass Panels, used as a component of nonlinear shaping of envelop in architecture. It is presented how Wave Glass Panels is used in the so-called mono-layer structural envelops of forms with complex geometry, which is easy to obtain using the NURBS-based digital design tools. Excellent examples are, among others, objects such as The Gherkin in London (2004), De Admirant Entrance Building in Eindhoven (2010), Park House in London (2012), RMJM Zhuhai Observation Tower project, Pathé Foundation in Paris (2014), and 134 Spencer Street by Elenberg Fraser project will be presented. The opposite of these solutions will be presented experimental curvilinear forms (their manufacturing) made of a new material 3d glass panels and explains the benefits arising from their use.

Key words: Architectural geometry; skin; freeform surface; wave glass, glass panels.

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Ways of successfully integrating traditional concepts into the present

Oana Andreea Bănescu *, Alma-Dia Hapenciuc , Roxana Carjan

Politechnic University Timisoara, Department of Architecture and Urban Planning, Traian Lalescu no.2, Timisoara, Romania

ABSTRACT

The purpose of this paper is to explore how tradition can be looked upon and integrated in the present tool set of an architect, collective conscience, individual, by using modern technology. In modern Romania, the rural areas have not only been disregarded, but heavily destroyed at a hallucinating rhythm (10 years almost equal a century in the European Union), because of immature collective mentality, imported models from other cultures without applying any filters, the assimilation by nearby cities and the destruction of identity, the aging of the population, the constant seek for comfort, industrialisation, ignorance of a minimum set of regulations, artificial land speculations etc. - all of which made us jump from one extreme to the other. Today, even the most pessimistic scenarios have been overcome by reality: an aggressive, diverse and decontextualized type of living. These new housing trends give us more fragile buildings, that consume more energy, have over-dimensioned spaces, are badly oriented and don't create a positive environment. The elegance of building has now been replaced by spying on each other's well-being. Despite these mutations, Romania still keeps important fragments of rural living. Only in the Banat area (one of the best preserved), there still are hundreds of rural settlements with intact or very little modified structures, which are worth taking into consideration for their past virtues, but also for recuperating some cultural, historical, aesthetical and behavioural components. A mapping of these building typologies would be very welcome in order to extract and adapt new concepts to modernity. A new way of building should successfully coexist with the surroundings, underline the vernacular, promote sustainability and stand the test of time and place. This subject is almost a mystery nowadays because of the lack of information, studies, interest and even architects have problems when going back to a certain "model", mostly because models aren't defined yet. No one knows what our local character is and how to handle it. The materialization of the study is made through a set of rules, applied on emerging projects. Although local tradition is mostly denied in Eastern Europe, there still is hope for regaining and integrating the natural way of building into the present. Unfortunately, the present is complicated, not complex, and has a chaotic building dynamic; tradition, on the other hand, as long as it's contoured in a correct and simple manner, has strong components, being thus capable of becoming an alternative or even infiltrate in the contemporary phenomenon and define new concepts.

Key words: Tradition; integration; building; concept.

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Outside and inside the canon: a Hungarian architect's oeuvre as an essence of the possibilities of the region's architecture in the last decades

Levente Szabo *

Budapest University of Technology and Economics, Faculty of Architecture, Dept. of Public Building Design, Műegyetem rkp. 3-11., 1111, Budapest, Hungary

ABSTRACT

The architectural work of Ferenc Bán occupies a special place in Hungarian architecture of the last half a century. His works are autonomous, but at the same time they carry the influences that were typical at the time of the design and which, however, do not or only rarely fit the national mainstream tendencies. The oeuvre of Ferenc Bán can be seen as part of the all-time canon of contemporary Hungarian architecture, but at the same time his creative attitude was typical of some outsider, lonely behaviour in almost all his creative periods – and often also the resulting perplexity was typical of his oeuvre's reception. The speciality of his architecture is the ability of association that allows free transitions even within one single work between lean structures, archetypal or geometric form adaptations, or even organic, natural analogies. His oeuvre presents an exciting and unique cross-section of the changes in contemporary Hungarian architectural thinking, basically from late 60s to the present day. In my paper I would like to try to reconstruct and interpret the main steps of an architectural oeuvre lasting from the late 60s to present day. I hope that comparing this lifetime work with the last decades of the Hungarian and international results may also help the better understanding of past and ongoing architectural trends of not only the Hungarian architecture, but the architectural tendencies of the post-socialist region. I wrote a book about Ferenc Bán's architecture, which was published at the end of 2015, focusing on the most important influences and connections to international architectural results. My aim is to present the most important thesis of my book about his architecture and about the possibilities of the architectural achievements in our ex-socialist and post-socialist region in the last decades.

Key words: Experimental architecture; post-socialist region; outside and inside of the canon.

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Flexible shaping of architectural forms with the use of reciprocal structures

Maciej Piekarski ¹, Szymon Filipowski ^{*2}

¹ Rzeszow University of Technology, al. Powstancow Warszawy 12, 35-959 Rzeszow, Poland

² Cracow University of Technology, ul. Warszawska 24, 31-155 Krakow, Poland

ABSTRACT

The paper presents the reciprocal systems of structural components as a tool for shaping architectural forms of twisted multi-storey buildings and modular shell roofs. The authors base their understanding of the reciprocal structure on the definition according to which it is the structure composed of elements joined together in such a way that each element is supported and also supports all other elements of the structure (Popovic-Larsen 2008). In authors' opinion the usefulness of reciprocity of structural components results mainly in potentiality of combining sets of the same elements into a various geometric configurations, with the use of the same principle of combining. It is possible because the elements can be joined and supported at points spaced differently along their lengths. These assumptions have been applied in parametric design. The first application concerns multi-storey buildings of twisted forms, in which the only vertical structural elements are the columns. The structures of floor slabs, designed as the systems of reciprocal beams, can be rotated in the whole to one another, due to displacements and simultaneous rotations of the beams relative to the columns. It is possible to create in this way architectural forms of twisted buildings, in which the dimensions and the angles of rotation of particular floors can be created completely freely. There has been developed a computer programme in the Grasshopper language, which can be a useful tool for architects for creation the forms of the twisted buildings and for finding the relations between dimensions of the structure and the external envelope. The second application is related to modular shell roofs, which can be constructed with the use of two types of structural components: beams and arches forming a framework supporting a shell covering. The beams and the arches are able to be combined in different ways, as well as the positions of joints are also changeable along the lengths of the elements. Thereby it is possible to obtain a wide assortment of roofs, which vary in architectural forms. Analogously as for the twisted buildings, a special computer programme has been written in the Grasshopper language as a help for architects to give them a possibility of flexible design of a suitable roof. The results presented in the paper concentrate around architectural design. The flexibility, which characterizes the construction of structural systems from reciprocal components seems to be beneficial also from static point of view. More exact investigation of presented structures from such a perspective is intended by authors in the future.

Key words: Reciprocal structures; twisted buildings; shell roofs; Rhinoceros; Grasshopper.

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Optimisation of functional layout of small apartments in dense city centre housing areas

Anna Szczegielniak *, Dariusz Fabianowski

Opole University of Technology, Faculty of Civil Engineering and Architecture, Department of Civil Engineering and Architecture, Prószkowska 48, 45-061 Opole, Poland

ABSTRACT

This paper presents a mathematical model of process optimisation for the architectural design of small apartments layout in the multi-family buildings in city centre areas. It is difficult localisation which requires from a designer to resolve issues resulting from the plot size and problems with access of the daylight. The model was used to analyse and select an optimal version of the functional and spatial layout from 6 chosen solutions which are frequently used in the modern residential buildings: distributed (T1), open space (T2), enfilade (T3), circulation (T4) and two mixed T5(T2+T4) and T6(T1+T2). The used algorithm allowed a comprehensive approach, evaluating the group of criteria, ranking the variants qualitatively and selecting the optimal solution. The ergonomics of special solutions (criterion D) was recognized as the most important one. Whereas the technical criterion - the assessment of construction and materials solutions has turned out to be the least important. Its low significance is a result of the assurance of fundamental security, resulting from the initial assumptions adequate for typical buildings. T1 variant was scored the highest, mainly as a result of high score in the D criterion (ergonomics). Next was T2 highly scored in terms of the economy B criterion. Both highly scored variants represent contradictory options of designing residential space: T1 – distributed, T2 – open-space. Whereas variant T6 was positioned lower in the hierarchy, which might seem surprising given that it is a common choice in modern buildings. It, however, can easily be adapted to T1. The obtained results confirm a designer's assumptions, focusing mainly on creating comfortable and ergonomic residential environment for the user and economic in the entire life of the building. To solve the issue, the modified Chang's multicriteria comparative analysis (EA FAHP - Extent Analysis Fuzzy Analytic Hierarchy Process) was used. The advantages of this method are: decomposition of the decision-making process into the multi-level hierarchic structure with clear levels of assessment; use of comparison in pairs between the criteria of the same level and the criterion of the higher level; possibility to verify the accuracy of the assessment (consistency of comparison matrices) using the consistency ratio for the modal values of fuzzy numbers. Main disadvantage of the method is the possibility to obtain zero partial values of the weight vectors occurring in the case of significant differences in scores. The occurrence of zero values leads to incorrect results. In the following paper the modification of the EA FAHP method proposed by Wang and Elhag was used. The modified method introduce a different way of calculating the synthetic measure index of the scores, eliminating occurrence of zero values. Despite popularity of FAHP methods and number of papers in the field of architecture and construction, the authors do not see their broader implementation. Such type of algorithms, are helpful on the conceptual design stage, however, they are lacking from the specialist literature, and are also not applied commercially. The discussed model presents a new approach which was so far lacking in the literature.

Key words: FGDM (Fuzzy Group Decision Making); EA FAHP (Extent Analysis Fuzzy Analytic Hierarchy Process); decision analysis; optimization; architectural design; functional layout.

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Barriers of implementing integrated façade design and delivery in a traditional project context in China: a case study

Li Shan *

City University of Hong Kong, Architecture and Civil Engineering Department, B6502, Tat Chee Avenue, Kowloon, Hong Kong

ABSTRACT

China promotes prefabrication technology in façade industry, which encourages the utilization of prefabricated curtain wall. Prefabricated façade delivery needs more integration, which can be achieved through reorganizing the delivery process. Though principles are available for process reorganization, Chinese façade subcontractors face barriers in implementations, considering current delivery practice and project context. The purpose of this paper is to present a case study on the attempt to reorganize façade delivery process to enjoy the benefits of integration in a traditional Design-Bid-Built (DBB) commercial building project, in China. The scope of the paper covers: i) the current façade delivery process, and the problems faced by façade subcontractors, ii) the suggestive façade delivery process inspired by some integrated project delivery principles, and iii) the barriers in implementing new delivery process. It was found that the benefits of the integrated delivery process may not be completely realized on façade subcontractor side due to some task-related barriers, contract-related barriers, and people-related barriers. Suggestions for those who are working or will work in Chinese façade industry are provided.

Key words: Barriers; integrated façade design; industry; China.

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Digital tectonic design as a fresh approach to architectural design methodology

Krystyna Januszkiewicz, Grzegorz Baliński *

West Pomeranian University of Technology Szczecin, Faculty of Civil Engineering and Architecture, Piastów Ave. 17,
70-311 Szczecin, Poland

ABSTRACT

In the 21st Century the Digital Tectonics focuses on the role and application of materials and technology in the creation of contemporary architecture. The rapid development of digital 3D modelling tools led designers in this new geometrical forms in architecture, that become part of an experimental exploration of Topological and computational geometry. The form-finding processes of transparent organic forms entice the new generations of young architects with the freedom of design. Computer linked fabrication techniques of many kinds have become an integral part of the design process, while new digital tools are allowing engineers and architects to understand in far more detail the behaviour of load carrying surfaces, and to generate new architectural forms. Digital and computer-linked design techniques is one of the hottest topics in architecture and in an ever-expanding world of digital technology this article tackles the theoretical elements of the field. Tectonics describes the architecture of the building with a clear composition and structural arrangement logic shaping the body, flowing from the direction of flowing forces and gives the impression of stability. In time with the birth of digital design methods appeared digital tectonics that have become an integral part of the design process, where new digital tools are allowing engineers and architects to understand in far more detail the of load carrying surfaces, and to generate new architectural forms. Concepts and methods of design employing fabrication technologies extend the scale of materialization methods performing as a unified set of design processes. Material conditions and assembly logic are now integrated and described as the basis for digital materiality. A few examples will be presented: Zaha Hadid Architects, Nordpark Cable Railway, Austria, 2007; Fernando Romero, Museo Soumaya, Mexico, 2011; UN Studio, Arnhem Central Transfer Terminal, Netherlands, 2015. Lust for creating buildings that look like renders causes that often does not reflect the whole picture of problems of creating complicated structures, and not Linearity structures increases several times the difficulty of the construction process. The consequence of this problem is the need for high quality fabrication processes and execution. Unfortunately, it is not yet at such a high level at which one would require. Buildings designed using modern tools have shortcomings or botch that affect the worse reception and derogation from digital images of the proposed building. This work is to compare projects with non-linear structure and their subsequent implementation for complex digital tectonic that will help identify the weakest points of the whole construction process and try to identify the tools that are needed to counteract this situation. This paper deal with also grid shells (Edward Cullinan, Buro Happold,Downland Gridshell, Singleton, UK , 2002) and woven surfaces (Shigeru Ban, Pompidou Centre in Metz, France, 2010), which comprise a bridge between the traditional and the contemporary design. The article present current possibilities of use of different materials in constructing structural envelopes in architecture.

Key words: Digital technology; digital tectonics; structure; nonlinear shaping envelope; new challenges.

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The use of the language of mathematics as an inspiration for contemporary architectural design

Anna Czech, Justyna Borucka *

Gdansk University of Technology, Faculty of Architecture, Narutowicza 11/12, 80-233Gdansk, Poland

ABSTRACT

The purpose of the article is to present the evolution of the use of mathematical language as an inspiration for creating spatial, three-dimensional forms in art and architecture. The article focuses on the possibilities for art and architectural design ideas gained by contemporary mathematics, algorithms and computational parametric approach. The analysis of various examples of how mathematical achievements inspire and inform architecture represents the relationships between the composition of spatial forms and the rules of mathematics, and is evident in different time frames, different styles and different approaches to thinking about and creating architecture. The starting point for this analysis is the symbolic Vitruvian golden ratio and its impact on the principles of spatial forms composition, since the Vitruvian formula is still present in contemporary logos and graphic design. Next, using the study of the geometric art of folding and cutting paper to create three-dimensional spaces, elements of applied art or even furniture or clothing, the article reaches to the mathematical issue of fractals, as the most accurate illustration of the aims of the parameterization in contemporary architecture. Fractals are a part of nature and are represented by mathematical algorithms and serve as inspiration for nontrivial geometry. Fractals as an interesting spatial form: by its simple recursive definition and its self-similarity direct us to the idea of optimization and – what may come with it - the issue of sustainable development. Parametric architecture, as a way of thinking about building as a set of numerically coded aspects, demonstrates the possibilities of using mathematical resources to improve functioning of the building by using optimization algorithms. The article shows a wide range of advantages and possibilities of such uses of mathematics in generating spatial forms which surrounds humanity. Further, this analysis asks about the possible risks and disadvantages of such an approach, wondering if the correct definition of architecture is possible to achieve simply by using language of mathematics without all the other immeasurable aspects.

Key words: Architecture; art; mathematics; fractals; parametric architecture.

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Genetic algorithms for optimization structure geometry of free-form roofing

Konrad Zaremba *

West Pomeranian University of Technology, al. Żołnierska 50, 70-310 Szczecin, Poland

ABSTRACT

This paper will present case study of ongoing research over freeform courtyard roofing. It will describe strategy of rationalization of load-bearing structure based on optimization using Genetic Algorithms. It will discuss benefits and limitation of application GA in design process. Most of all it will describe and discuss change in design methodology. Rising demand for complexity and efficiency of architectural structures is challenging for designers and manufacturers. It has motivated wide range of research on applying computational techniques in to design process in order to efficiently design freeform structures. One direction is application of Genetic Algorithms for geometry optimizations. This search algorithms allows to generate numerous solutions and validate them in order to look optimal solution for design problem. This techniques have been proven successful for isolated problems such as geometry, structure or environmental efficiency. In most cases one objective algorithms are used. This means that program works to achieve best solution for one parameter. However nature of architectural design in much more complex. Wide range of decision during process gives much more goals to optimize. Therefore multi-objective algorithms are very promising to be applied in to design process. This approach allows to optimize for number of goals, more importantly it is possible to optimize of contradictory goals. This corresponds to nature of many design problems where optimal solutions is impossible to achieve. Research is based on going design of freeform roofing clad with double curved glass panels. One of the challenges is design of loadbearing structure form freeform nurbs surface. The structure is going to be manufactured from bended metal tubes. Technology of production allows to bend pipes in circular shapes of certain radius. Therefore initial freeform nurbs curve is hard to transfer in buildable load bearing structure due to its complex geometry. For fabrication purposes linear elements needs to be simplified to arcs in order to achieve profiles for bending. To solve this problem we have applied GA for arc fitting in to initial curves. Algorithm tiers to fit geometry in such way to minimize deviation from initial curve and maximize continuity between arcs (equal tangents). Base set up can be modified due to other parameters such as length or number of elements etc. Method aims is to achieve full freedom of design for architect but also to reassure possibility of construction. This process of rationalization will be used to construct medium sized glass pavilion for exhibitions. Case study concludes and compares experiments over different approaches of applying GA in architectural design.

Key words: Genetic Algorithms; optimalization; geometry.

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Industrialized architecture in a globalized world

Matías Caballero Cortés *

Universidad Politécnica de Cartagena, C/ Rosalía de Castro, 40 1ºD. 30177 Murcia (Guadalupe), Spain

ABSTRACT

At present, in a global world, for a large number of citizens around the world, the housing is a constitutional right that is not yet accessible due to the high cost. For that reason, the architecture must give an answer to this demand of the current society promoting the investigation in industrialized housing. Opposite to the speculative madness of past, present and future housing bubbles, the industrialized architecture guarantees the stability of the construction sector, improves the safety, increases the quality, reduces the cost and the raw materials, and produces a high level of energy efficiency and a low environmental impact. The average single family home has been the laboratory chosen by many architects in order to experiment their ideas of prefabrication and industrialization. During the Modern Movement, due to the urgent need for a lot of affordable housing, this question is intensely treated, getting prototypes of a high architectural quality. The analysis of the works of the Masters gives us a series of tools and methods of project to help us develop homes that combine energy efficiency, sustainability and architectural quality. Industrialized construction does not involve a reduction of the architectural quality of housing. The use of systems and industrial processes did not take away the creativity of the architects of the Modern Movement, standardization and technology must be flexible and be at the service of architecture, not vice versa. At that time the ideas were often one step ahead of the industry, which unfortunately could not provide the necessary technological solutions. However, today, the industry and technology are themselves in a position to realize the ideas of architects, who remain the key to change, the first step. This will not be enough if the rest of the sector (urbanists, manufacturers, distributors, developers and builders) remains on the sidelines. It is up to us to continue taking steps in the field of industrialization, to give all citizens the best possible housing with a fair cost.

Key words: Industrialization, housing, project, energy efficiency, sustainability, modern movement.

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Constructive and graphic study of the influence of new engineering techniques in the method, theory and design of architecture between 1840 and 1872

Adela Rueda Márquez de la Plata ^{*1}, Pablo Alejandro Cruz Franco ², Jesús Anaya Díaz ²

¹ University of Extremadura, Cáceres, Spain

² Polytechnic University of Madrid, Spain

ABSTRACT

In 1840 the first railway line was opened between two European cities, Basel and Strasbourg. With this fact closes what has been called the first stage of the industrial revolution. Two years later theoretical architectural journals, such as "The Builder" and "Revue Generale de l'architecture et des Travaux Publics", demands a radical change in the conception of architecture to deal definitively with the architecture of the "neos-" and "-isms" that until now simply seeking to adapt, unsuccessfully, to the obvious technical and technological advances. These isolated facts are just one example of how the emergence of engineering, as a technical specialization, influences on the methods, theory and design of new architecture. From that point on, the fast and significant advances in engineering developed over the years means a real way of change. As a result of these changes, the architectural design methods begin to be based on constructive models applied exclusively in buildings for new uses. A characterization of these models is raised, it is not easy to distinguish between the logical use of an emerging technology and new architectural type. To achieve this, those works that represents the path of the conception of the new architecture that are required, are studied and analysed in graphic and constructive level. Some of these projects are: "The Pavillion des Plantes" designed by Fontaine and Rohault (1836), the Britannia Bridge planned by Stephenson (1846), the Monongahela Bridge designed by Roebling (1846), The Roger Albert Bridge by Isambard Kindom Brunel (1854) and The Chocolate Factory "Menier" planned by Victor Louis (1872). After the study and analysis of these new architectural archetypes, it demonstrated that the technique, derived from a social need, influences the demand for changing the theory of existing architecture. This theory needs a sensible flexibility to changes, which until now had never raised, and that in the classical theory did not exist. A thorough review of concepts is necessary because the technical and engineering promise new changes, and cannot depend on "create" a new architectural theory adapted to each circumstance, for that reason the lack of use of architectural treatises, as they understood until now, begins these years.

Key words: Engineering; architecture; influence; technique; 1840; 1888.

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A ten million years long story ...

Zsolt Vasáros

Budapest University of Technology and Economics, Faculty of Architecture, H-1111 Budapest, Hungary

ABSTRACT

This paper is one of the stages on the path to the realisation of a large-scale landscape design project. The research, which is based in part on work done by the Faculty of Architecture/Budapest University of Technology and Economics - Doctoral School of Architecture, deals with one of the most underdeveloped regions of Hungary, located on the north-eastern border of Borsod-Abaúj-Zemplén county. The natural landscape and cultural and historical sites of the region have considerable potential, especially if they are properly integrated into the economic and touristic life of the county. The unexploited possibilities in the character of the area are in great contrast with the current situation that can be experienced. The protection and the appreciation of the industrial past does not raise nearly as much attention as other historic buildings, therefore its subsistence is endangered. The quick demise of the heavy industry that was built in the communist era left the landscapes marred by defunct factories and the remains of mines that have long been out of use. Nonetheless, in many cases the abandoned and decaying industrial buildings that belong to the region's past bear significant architectural value. Our aim was to explore the potentials of the area, introduce visions for the future, and help provide the inspiration for new projects. In addition to the revitalization of the whole former mining area, we suggested a new site museum and visitor centre for the site where Rudapithecus was found (cca. 10 million years old), which is already realized and includes also a study trail. Over the course of the last 5 years we have obtained permissions to build and support for the implementation of our plans, and now the implementation is partly finished. We therefore suggested a possible development strategy for the region, which aims to build upon the legacy of this industrial past by letting the public explore and understand the region through a thematic route across these sites. As part of this design, and in particular in the area of interventions in the cultural field, this project presents a unique opportunity to experiment with innovative planning principles and new methodologies and to reflect on what synergy means. The project aims to raise public awareness about these values by showing visions and giving inspirations for the future primarily regarding to industrial heritage and architecture. Creators described a possible way of development that does not wipe out traditions of industrial history. They defined a thematic road to get more acquainted with the region. Certain stations on this road are already complete on architectural plans. The project includes the organization of an exhibition-roadshow that will present the abstract of the knowledge collected and also the architectural plans of stations of the "Industrial land tour" regional thematic road for the public at Ózd, Miskolc, Rudabánya and at Budapest.

Key words: Cultural landscape; Hungary; industrial past; synergy; industrial heritage; natural heritage.

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Residential project as a cause in architectural design and education

Karolina Tulkowska *

Warsaw Univeristy of Technology, Faculty of Architecture, Koszykowa 55, 00-659 Warsaw, Poland

ABSTRACT

The nature of residential architecture is defined by the conditions of its origins. Concepts of living estates and (multifamily) buildings vary in relation to, inter alia, the functional, spatial, economic, technical, formal and environmental conditions. The purpose of the research is to define a method for a design process, which would be both comprehensive and effective. Analysis of the relevant aspects of the initial conditions, influencing the project, subsequent stages of the creation/construction enterprise will be the starting point for an outline of strategies for the design process. General and concise characteristic of housing projects in present-day Poland is difficult to seize. The vast majority of the primary housing market are now apartments sold by the non-public investors (developers). It is problematic to talk about a vision for future or long-term goals. The current economic climate promote small flats sale, often without taking into account variability in the structure of the building (or complex of the buildings) as a whole. So the role of an architect is now more than to design „well” (according to the functional, technological, spatial and other requirements), but also to support the rationality of the project’s framework and assumptions. Another problems appear when we discuss the questions how to teach to design housing environments (in the school of architecture). Having in mind that students will practice mostly in the (unknown) future, when the conditions may change significantly. The substance of the research would be to examine two or more alternative paths simulating different approaches to design process. Conclusion will appear in a form of a model solution describing the method of design.

Key words: Residential; architecture; housing; design method.

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Computer programs as a tool of supporting the use of daylight in architectural design

Malgorzata Roginska-Niesluchowska *

Gdansk University of Technology, G. Narutowicza 11/12, 80-233 Gdansk, Poland

ABSTRACT

The paper deals with the design software applications supporting the use of daylight in buildings. It investigates the possibilities of using such software in architectural design, as well as current directions of their expansions. Programs that cooperate with popular applications used by architects are of the author's interest. The method of analysis and criticism of literature, as well as some observations are adopted in the methodology of research. The assumptions (criteria) of analysis concern the possibilities of using the applications in solving various design tasks, which depend on the project scale (interior lighting design, daylighting system of building, urban planning design) and also the project stage (location analysis, architectural conception, technical design, evaluation and certification). The issues of hardware requirements, ease of operation, flexibility and complexity of solving different design problems, opportunities for cooperation with other programs, as well as the possibility to exchange and update data in a multi-stage design process are also concerned. Basing on the grounds of the available applications, and the current general direction of software development, the author tries to draw conclusions about the necessity and directions of development of computer programs for daylighting analysis and simulation. The professional specialized software is usually required in later stages of a design process for detailed analysis of lighting, and it is based on the required lighting factors and other quantitative criteria. The starting point for the analysis and evaluative assessment of lighting is the realistic simulation of processes and phenomena associated with the spread of light in space. It is founded on the methods of virtual representation of light and its sources and physical properties of existing materials. Digital graphical representation based on HDR (High Dynamic Range) image technology, the image of the range of luminance comparable to the brightness perceived by man, enables visual assessment of the effects of lighting. Some restrictions in widespread and extensive use of the specialized software by architects can be related to the requirements of the knowledge of optics and informatics, e.g. programming skills. The main tendency in the current development of software for architects is to ensure cooperation between all sectors of the construction industry. This is reflected in the BIM (Building Information Modelling) software, which combines all the information about the investment in one spatial model. This also applies to the daylight issues associated with solar energy acquisition. The possibility of a comprehensive evaluation and certification of a building is the reason for joining all the tools related to the criteria of sustainable development.

Key words: Daylighting; daylight analysis software; daylight simulation software.

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Architectural engineering perspectives: towards building architecture and structures quality

Inga Garnyte-Sapranaviciene *, Josifas Parasonis

Vilnius Gediminas Technical University, Sauletekio av. 11, Vilnius, Lithuania

ABSTRACT

This study is focused on architecture and construction sustainable interaction ratio, there're analysed and structured architectural engineering development stages, and herein imprinted the building's form development perspectives. The current lack of clarity and quality in the architectural and engineering speech has been boosting the relevance of this task. As the architecture represents all the artistic qualities dictated by technical subjects' de facto context, there was chosen a unique position, in which thought and action converge through complex building architecture and structure shaping. This study on the formation of high-quality architectural ideas conveys the attempt to establish the structure, how architectural objects were perceived in different periods of changing societal outlook and what influence these perceptions give for present sustainable building design. Engineering, in this case, is perceived as a way of thinking about building construction. By analysis of engineering development it have been set specific periods which are not fully coincided with the traditional architectural styles classification. Four distinguished architectural engineering complexity perspectives arise as: P1 - traditional, based on the basic practices, P2 - modernism (engineering science), P3 - postmodernism (cyclic analogues); P4 - integral (adaptive structures). Each one holds its own thinking/judgment and creative paradigm and reveals the growing complexity, transcendent and inclusive information of the previous perspectives. Such alternative perception of architectural engineering development provides new ways of thinking and design perspectives in shaping high-quality sustainable buildings' architecture and structures.

Key words: Architectural engineering; sustainable building; design quality; perspectives.

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Moving towards competence in teaching architecture: the relationship of research and design in academy

Ksenia Piatkowska *

Gdansk University of Technology, 80-223 Gdansk, Narutowicza 11/12, Poland

ABSTRACT

Architecture is truly a profession of public trust requiring special care at all stages in academic education. European educational reforms initiated by the 1999 Bologna Process affected architecture education, and shifted the role of research. The number of doctoral programs increased, so the involvement of PhD students in teaching also expanded. This study aims to identify how these changes affect quality in architecture education. Using qualitative and quantitative approaches, different forms of architectural education offered in the European Higher Education Area, staff selection practices, requirements for PhD candidacy, and student achievements were assessed, compared and correlated. Both the apparent imbalance of theoreticians and practitioners staffed in architecture faculties, and increased didactic obligations for inexperienced PhD students with no formal qualification seem to generally undermine competence in architectural education. As a solution, the author highlights the need to revise the prerequisite for teaching in architecture faculties, and proposes the establishment of two types of faculties in this discipline: an 'architecture faculty' where the accent is on the practical aspects of the profession and its graduates will be fully prepared to competently serve in construction and a separate 'theory of architecture faculty', where architecture issues will be discussed in terms of the humanities.

Key words: Architecture education; PhD programs; architectural research; education reform; academic qualifications.

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Old and new – the complex problem of integrating new functions into old buildings

Ioan Andreescu *, Vlad Gaivoronschi, Marius Mosoarca

Politechnic University of Timișoara, Faculty of Architecture and Urbanism, Traian Lalescu str, nr. 2/A, 300223, Timișoara, Romania

ABSTRACT

The firm, “Andreescu&Gaivoronschi”, is operating since the early 1990s in Timisoara, a typical Central European town situated in the Western tip of Romania. The backbone of the urban form consists of well-defined historical districts (XVIIIth to mid XXth century), containing a large number of historical buildings which have survived long periods of neglect. Although most of them do not classify as “historical monuments”, they still maintain their character and are inseparable of the city’s identity. Around the historic districts, there are remnants of mid XXth century industrial buildings, well positioned towards the transportation networks and displaying competent structures (mostly concrete). The necessity to address, both historical and industrial buildings, in order to adapt them to new functions (office, retail, conference, cultural) produced – in time – two distinct and complementary approaches. First – the “augmentative” approach used mainly for the inner city buildings. Slight, transparent, rather spacious volumes were accommodated into the available residual and interstitial spaces, accommodating atria, conference and exhibition rooms and circulations, in order to avoid massive interventions inside the existing structures. The presence of a consistent new structure enabled us to avoid the structural upgrades for a seismic area by simply connecting the new and old structures. Scarcely visible from the public space, providing ample space, and spectacular experiences of the inner volume, these new volumes offered a reliable solution to the problem. We have several interesting examples of the “augmentative” approach: the “Savoy Hotel”, the “Orthodox-Christian Cultural” centre, the “16 Decembrie” Office Building. Second – the “enveloping” approach, used mainly for the industrial buildings, A complex 3D overlapping structure is literally “coating” the existing building, being anchored directly on its upgraded structure. The new envelope is partially “hollow”, accommodating various functions: mechanical, circulation, lighting, insulation, double glazing, etc. It is also a game changer, because it offers a new identity to the building, in coordination with the inner structure. Practically, you have a new building resting on the “bones” of the old one, the new building conserving the footprint and – more or less – the volume of the old one. It is exactly the opposite approach towards the “augmentative” one. The most important projects of this kind are: “The Regional Freight Railways Headquarters” and the shopping emporium “Galleria 1”, both in Timisoara. Both approaches are a result of the process of optimisation in opposite conditions: conserving the maximum of the original building substance and expression in the first case, and creating a new appearance and spatiality by coating the enhanced inner structure of the building.

Key words: Historic buildings, industrial buildings, new functions, new volumes, overlapping structure.

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The analysis of the function network of an articulated education building with the topologic techniques

H.Derya Arslan *, Burak Köken

Necmettin Erbakan University, Architecture Department, Meram, Konya, Turkey

ABSTRACT

The systems which enable the functional organization within the campus and determine the directions and the expansion form of the campus are used in the planning of the campus which gathers the university buildings in Turkey. The design of faculty buildings which are specialized throughout the campus are flexibly designed for the prospective expansion and the spaces are increased in the modular form. This situation is the required specification in the education buildings and also creates the risk of forming the clumsy masses which have many repeating units and in which the only function oriented solution strategy is used. Many different topologic techniques have been used by obtaining the functional structures of complicated buildings by depending on the objective data in the recent years. The main motivation of this study is to establish the analysis of the change of Selcuk University Engineering Faculty building, which has uncontrolledly expanded by articulating since 1996, by depending on the topologic techniques in the last twenty years. The engineering faculty consists of 11 separate departments and so, this situation results that the different quality buildings belonging to the departments of different disciplines are founded in the same environment. The changes which form together with each articulation in the examined structure which has become a structure having many modules by being articulated from the hexagonal module within the process are determined with the "space syntax" method which is a topologic technique. The beta index, the gamma index, the average depth values for the space and the correlativity values of each space to the system are analysed for each articulation with this method. The findings obtained from each articulation are evaluated by comparing with each other.

Key words: Education building; flexible design; topologic technique; space syntax; analysis.

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Architectural design of university schoolrooms with the link to ventilation

Mária Budiaková

Slovak University of Technology in Bratislava, Nám. slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

The paper is oriented on the architectural design of university schoolrooms with the link to ventilation. Today's architectural solution of university schoolrooms is not in accord with the possibilities of natural ventilation. In today's university schoolrooms, we can use just the natural ventilation therefore schoolrooms must be correctly ventilated by windows and doors. Correct and sufficient natural ventilation of university schoolrooms is very important because students spend majority of their time in the university in those schoolrooms. In Slovak universities, the natural ventilation is incorrectly and insufficiently provided. The biggest problem is the winter season, when the natural ventilation is provided just by opening doors into the corridor. By this way, sufficient supply of oxygen is not provided, what causes distractibility and feeling of tiredness by students. Therefore, the research was focused on the comparison and analysis of different ways of natural ventilation in university schoolrooms. Experimental measurements in university schoolroom were carried out, where the parameters of thermal comfort were measured at different systems of natural ventilation with the device Testo 480. Measurements were carrying out in two height levels, which were enabled by the change of the position of tripod, on which were mounted: temperature and humidity sensor, globe thermometer, turbulence sensor. Obtained values of air temperature, air relative humidity, air velocity, globe temperature and indexes PMV, PPD are presented in the graphs. On the basis of analysis of measured values is chosen the most suitable system of natural ventilation for university schoolrooms. Principles of architectural design for university schoolrooms are created for this optimal way of natural ventilation. It relates mainly to positional arrangement of students' desks and teacher's desk. In the future, we can assume mechanical ventilation in university schoolrooms, therefore in the conclusion of the paper is the recommendation on modern and energy efficient system of mechanical ventilation for university schoolrooms.

Key words: Architectural design; natural ventilation; university schoolrooms.

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Motivation behind designing and constructing twisted tall buildings

Sinan Bilgen *, Bekir Özer Ay

Middle East Technical University, Building Science Program, Ankara, Turkey

ABSTRACT

After decades of conventional shapes, irregular forms with complex geometries are getting more popular for form generation of tall buildings all over the world. This trend has recently brought out diverse building forms such as twisted tall buildings. This study investigates the motivation behind designing and constructing twisted tall buildings. The quest for this challenging form is discussed from the investor's, designer's and leaseholder's point of view. Since twisting a tall building give rise to additional complexities, concerns related with the design and construction of these forms have been examined. In addition to the aesthetic and functional aspects of twisted forms, structural and aerodynamic concerns are taken into consideration. Structural and aerodynamic analyses of an existing twisted tall building and its conventional counterpart were performed and the results have been compared. 1/750 scaled rigid models of prismatic and twisted forms have been used for wind tunnel tests which were conducted at the Centre for Wind Energy of Middle East Technical University (METU), Turkey. The comparisons highlighted the aerodynamic advantages of twisted tall buildings. Compared to prismatic form; twisted model is superior on reducing vortex-shedding dynamic response by disorganizing the wind vortices. Thus, twisted form shows better aerodynamic behaviours for along wind and across wind direction. Consequently, despite the difficulties arisen from inherent complexity of twisted forms, they could still be feasible and profitable for their designers/investors with their attractive images in the realm of tall buildings. Analysis results also supports the superiority of twisted tall buildings to their prismatic twins in terms aerodynamic effects.

Key words: Tall buildings; twisted forms; motivation for twisting; wind excitation; aerodynamic tests.

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Contemporary house design - parametric evaluation, lessons from practice, case studies in Poland

Tomasz Bradecki *

Silesian University of Technology, Faculty of Architecture, Akademicka 7, 44-100 Gliwice

ABSTRACT

Contemporary house design is developing in various directions. One of them is creation of extraordinary houses which provide original space. Recent realizations in Poland show that there are many interesting houses, but it is often hard to classify them. Its form, functional and architectural solutions can only be described by text and drawings. Author proposes a parametric evaluation of house design which helps to describe its originality by parameters connected with functional program and spatial arrangement. Several well recognised realizations have been discussed and described using the proposed parametric evaluation method. Also authors own design has been described as a case study. Author considers if such a method would be useful for general house evaluation purposes.

Key words: House design; parametric evaluation; contemporary house.

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Session Title:
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Experience of post-modern historicist architecture in Turkey

Rana Karasozen *

Anadolu University, Faculty of Architecture and Design, Department of Architecture, Eskisehir, Turkey

ABSTRACT

Architectural designs which based on historical forms is a fact during the evolution process of architecture since hundreds of years until today. As historicism is one of the main factors which constituted modern architecture with critics of imitating historical forms, it is also one of the main approaches of post-modern architecture with critics of the modern. Post-modern historicism is different than the historicism of pre-modern period. The mission of post-modern historicism is to recall the public memory in order to supply architecture to consumption culture in terms of identity. Post-modern architecture and its historicism started to be practiced in Turkey since early 1980s as it has found its convenient socio-economic conditions base on consumption culture and materialism after that time. Post-modern historicist practises of Turkey have specific features. It has a variety different from the Western examples of post-modern historicist architecture with addition of its own history of architecture and pre-modern and Second World War period historicist experiences. Both direct and indirect uses of historical elements can be seen in those examples. A post-modern architectural design can have historical elements either from a single or more than one historical styles. Post-modern historical elements can be used combining with different late modernist architectural approaches. Designing in historical or non-historical environment is another important determinant of post-modern aspects. Use of historical form can also differ according to the function of the building. Post-modern historicist approaches, historical resources of the building forms and elements, different uses of post-modern historicism in different types of buildings and meaning of post-modern historicist architecture in Turkey is examined in this study by means of examples.

Key words: Architectural design; post-modern historicist architecture; building; Turkey.

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Influence of historical public squares as urban public spaces on promotion of citizen's quality of social life: case study form Naghshe-Jahan Square, Isfahan, Iran

Asma Mehan ^{*1}, Farzaneh Soflaei ², Sergio Pace ³

¹ Polytechnic University of Turin, Department of Architecture and Design, Torino, Italy

² Islamic Azad University, Islamshahr Branch, Tehran, Iran

³ Polytechnic University of Turin, Department of Architecture and Design, Torino, Italy

ABSTRACT

Public Square is one of the main pillars in social life that has effects on the social quality of the urban public space, and improving the level of social interactions of the citizens. This research will focus on Iranian public squares in Safavid dynasty as the most successful cases of manifestation of social identity in the history of urbanism in Iran. Considering the effect of public space in quality of social life, in many modern cities, the public squares that have recently designed and constructed aren't responsive for social needs, improvement of communications and the social relations of citizens. This matter appears because of poor conditions of cities during modernization and lack of attention to cultural, sociological and psychological needs. It should be noted that Safavid era is the age of manifestation of culture, art, architecture and urbanism in Iran. In this period, the most beautiful and the greatest public squares were designed in various functions, with special physical and geometrical design patterns. In this research, that been developed based on descriptive procedure, the characteristics of Naghshe-Jahan Square as an active and vibrant historical public square has been examined to realize the effective factors on improving the quality of citizens' social life. The results of research indicate that public squares in Safavid dynasty paid a comprehensive attention to non-physical aspects like social beliefs, culture, traditions, religion, also physical attributes such as size, form, location, orientation, function, accessibility and visual aesthetics (human scale, golden proportion, symmetry, ornaments, etc), introspection, respect to privacy, unity, and continuity, which all have represented through design elements in Iranian historical public squares of Safavid era. Therefore, Naghshe-Jahan Square in Isfahan, served as a multifunctional historical public space for improvement the quality of social life in the Iranian urbanism history.

Key words: Iranian public square; urban public space; quality of social life; Naghshe-Jahan Square; Safavid Era.

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Construction history as a part of assessment of heritage buildings

Piotr Berkowski *¹, Marta Kosior-Kazberuk ²

¹ Wrocław University of Technology, Faculty of Civil Engineering, Wyspińskiego Blvd. 27, 50-370 Wrocław, Poland

² Białystok University of Technology, Faculty of Civil and Environmental Engineering, Wiejska 45A Str., 15-351, Białystok, Poland

ABSTRACT

Issues related to the processes of maintenance and assurance of continued and safe exploitation of heritage buildings and civil engineering structures are closely related to the processes of their diagnosis, repair and strengthening. What is more, if a building has heritage value and is on the list of monuments protected by law, various aspects related to conservatory requirements must be taken into account during renovation. One extremely important element for a proper diagnosis of the technical condition of historic buildings, and also for the adequate design of the process of their refurbishment or of the actions associated with prolonging the time of their use and the processes associated with maintenance, should be the conducting their architectural and structural historical survey. Such analysis must be related to the following aspects used during the design and construction of the object: design solutions, methods of structural analysis, methods of the dimensioning of structural components, properties of building materials and technologies of their production, and also the technology of construction, including the quality of workmanship. Such research, supported of course by the use of the full range of modern material examination techniques and computational simulations, allows a more complete understanding of analysed structures. It also provides a possibility to adopt the best technical solutions in the broadly defined actions with an aim to prolong the service life of such heritage structures. Such a program should also contain a prediction of the development of existing or new damage and degradation of the material, as well as guidelines for repair and renovation works in order to ensure its further safe operation. From the point of view of the completeness of such a program and with regards to architecture and design, its indispensable elements should be both the historical analysis of the design and the construction of this building, as well as of the entire course of its exploitation.

Key words: Heritage structures; construction history; assessment program; RC historical buildings.

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The advent of a contemporary European hospital – origins of the process of architectural development

Joanna Borowczyk *, Joanna Olenderek

Technical University of Lodz, Faculty of Civil Engineering, Architecture and Environmental Engineering, Department of Architecture and Urban-Planning, Politechniki 6, 90-924 Lodz, Poland

ABSTRACT

For centuries health care facilities had been undergoing a long, complex and unstable process of development, which during the interwar period led to the establishment of a particular standard in design, common to all hospital services within the area of influence of the European culture. In the era of modernism a universal system of building hospitals was adopted, whose spatial assumptions are being followed to this day. Tracing the origins of European hospitals design requires referring to the examples of facilities from different periods in history, which were designed according to varying expectations connected with the degree of development in medical sciences, traditions of a particular community as well as changing concepts of a human body comprising both scientific and fictitious points of reference. The main purpose of the paper is describing the origins as well as characterizing the architectural design of hospitals built in Europe before World War II. The Authors have made an attempt to point to concepts represented by common design patterns which have been positively verified over the last decades. However, most attention has been focused on facilities contributing to the general architectural landscape of contemporary urban structures. Investigation of the historic methods and tools for adjusting health care facilities to changing cultural and economic-administrative conditions allows revealing the origins of numerous factors which contribute to the organizational, technical and building structure of contemporary European hospitals. Analyses allow determining the influence of political, economic and social background as well as technological development on the formal and functional solutions in the field of architectural design of health care facilities. The Authors provide a synthetic image of the conditions in the design and construction of hospital buildings in Europe until 1930s. A broad spectrum of historic and political circumstances accompanying the formation of hospitals described in the paper has also been discussed. The study involves a presentation of a complex network of deciding factors influencing the choice of solutions concerning the functional and spatial structure of the facilities as well as symbolic significance of the analysed architectural assumptions. Adding health care facilities to the existing urban tissue of European cities allowed transforming these areas into modern cities, i.e. places which provide citizens with optimal living conditions and development opportunities. In this respect many European hospitals built throughout the history played a particularly important role. Transformations discussed in the paper resulted in the improvement of living conditions among citizens, and the architecture of medical facilities meeting the social needs has become for many years a symbol of a contemporary European city.

Key words: Architecture; urban planning; architectural design; public use architecture; hospitals' architecture; European hospital.

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The historic XIX-century barracks in contemporary spatial structure of Polish cities

Dorota Gawryluk *

Białystok University of Technology, Department of Construction and Environmental Engineering, Landscape Architecture
Teaching Team, ul. Wiejska 45A, 15-351 Białystok, Poland

ABSTRACT

Since the ancient times complexes of barrack buildings have influenced the spatial development of many cities. "Castrum romanum" constituted a matrix of many cities in Europe, i.e. Cologne, Florence, Budapest and Paris. Urban relics of ancient military complexes are legible in the structure of these cities even today. On the territory of Poland numerous historic barrack complexes are the legacy of the XIX and early XX century. At that time they were built on the initiative of the three powers: Russia, Prussia and Austria between which the area of Polish Republic was divided at the end of the eighteenth century. Over the years the powers transformed from the allies to antagonists. The effect of a change in policy between them, at the turn of the XIX and XX century, was the tripartite military reinforcement of borders between the annexations, which cross the former territory of Poland. Erected at that time complexes of military buildings, their spatial layout and architectural form, met the needs of different military armies. As a result, on the territory of contemporary Poland, we can find three main types of XIX-century barracks reflecting building types represented by each invader. Preserved former military complexes gained today in many cases a new identity. They have non-military functions. In the structure of cities they are clear architectural and urban compositions. Entered into the contemporary urban landscape, they are often regarded as attractive areas for investment due to their individual, historical character. At the turn of the twentieth and twenty-first centuries a number of barrack complexes located in Polish cities were subject to revitalization. Preservation of cultural values readability in the architectural and urban structure of these complexes underlines the individual, complex history of each of these places. They are a testament to the past, which was given as a contemporary expression by introducing a new function - the new identity of the place. The aim of the study is to demonstrate the diversity of the nineteenth century barracks. This will be achieved through the presentation of the main urban and architectural features of the historic complexes, characteristic for individual annexations. Based on the subject literature and source materials (archival maps, plans of barracks, drawings, barracks buildings, old postcards and photos) the leading features of the location and urban layout of barrack complexes were determined. The main style features of the architecture expressed in the form of buildings, building material and used detail were sorted out. A comparison of these features confirms the diversity of barrack buildings depending on the area – annexation. Discussed were the chosen, recently revitalized post-military complexes from the area of the former annexations (Kraków, Wrocław, Poznań, Elk, Gdańsk Wrzeszcz, Suwałki, Zamość). Preservation of the historic barracks legibility in the new structure of the city was evaluated as well as attractiveness and appropriateness of the process conducted for modern urban residents. Carried out analysis allowed to formulate the following conclusions: A. In many Polish cities the historic complexes of barracks built at the turn of the XIX and XX centuries were preserved. Their readability in the spatial structure of the city is different depending on individual history of the centre. Historic architecture of barracks shows features of style characteristic to individual annexations. B. Preserved nineteenth century complexes of barracks located on the territory of Poland, in many cases were subjected to revitalization, including the last two decades. C. Particularly interesting projects related to revitalization of the former military complexes are characterized by

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the attitude of honouring the historical values of architecture and at the same time inspired by them. This approach results in beneficial solutions taking into account the existing cultural values while introducing new, contemporary "added" value that affects granting the place a new, positive identity.

Key words: Historic barracks; Russian barracks; Prusian barracks; Austrian barracks.

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Restoration of high Capitulara Sala façade of Seville city hall. Restoration of its colours

Maria Dolores Robador ^{*1}, Antonio Albardonedo ², José Luis Perez-Rodríguez ³

¹ University of Seville, School of Architecture, Avda Reina Mercedes 4A, 41012 Seville, Spain

² Geography and History Faculty, C/ Doña María de Padilla, s/n. 41004 Seville, Spain

³ Materials Science Institute of Seville (CSIC-Seville University), Americo Vesputio 49, 41092 Seville, Spain

ABSTRACT

This work is included in a wide study of restoration and conservation of the building of Sevilla City Hall. The building of renaissance style is constructed entirely of stone. The stone was chosen that could be easily carved. This carved stone is highly vulnerable to the external agents that cause deterioration. The restoration of this zone of this facade has proven difficult because of the stone's alteration and the meticulous detail for stone work. The following techniques petrographic microscope, optical microscope, x-ray powder diffraction, scanning electron microscope coupled with chemical analysis by energy dispersive X-ray, differential thermal and thermogravimetric analysis, Fourier transform infrared spectroscopy were used to characterize the original materials, added synthetic materials during previous restoration and materials produced by environmental contamination. The restoration of this building was accomplished by cleaning, reinforcing and innovatively consolidate and protecting the stone using suitable mineral materials similar to those used in the original construction of the building. The petrographic study of the stone showed the presence of fine-grained carbonate rock composed primarily of bioclasts and fine sand. In some zone of the restored facade. The presence of wall paintings was detected which may have covered all the stone surface of the building. The surface of the stone was covered by a contamination layer constituted mainly by gypsum. Other materials such as mortars, gypsum, acrylic resin applied in previous restoration have been also found. On the stone, it has found many significant traces of colour, layers of white, red and salmon colours. Lime and iron mineral pigments are composed. This has allowed to know the chromatic richness that this building had in the past. The cleaning was performed using products that would not harm the stone: water and natural soap. After the stone were cleaned, they were consolidated and protected by stable mineral materials compatible with the stone and whose qualities have been known for centuries. The degraded joint mortar was removed and filled with Cumen lime mortar in a technically controlled process. The deteriorated stone was replaced by stones similar to the original. The missing carved stones were recomposed using a technically controlled mortar of lime and sand whose composition was similar to that of the original stones. The facade was protected with a thin layer of fine mortar composed of lime a coloured with the same colour of the stone. The colours have been protected and they have been left views, as evidence of chromatic history of the building.

Key words: Stone; restoration; mortars; alteration; protection; cultural heritage.

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Evolutionary study of colour in the history of the facades of Royal Ordnance Factory of Seville

Maria Dolores Robador ^{*1}, Antonio Albardonedo ², José Luis Perez-Rodríguez ³

¹ University of Seville, School of Architecture, Avda Reina Mercedes 4A, 41012 Seville, Spain

² Geography and History Faculty, C/ Doña María de Padilla, s/n. 41004 Seville, Spain

³ Materials Science Institute of Seville (CSIC-Seville University), Americo Vespucio 49, 41092 Seville, Spain

ABSTRACT

Ordnance Factory of Seville is a singular example of industrial architecture in the city over more than four years. Born around 1565 in the San Bernardo district of Seville, in the first foundry created by Juan Morel, which was the smelting of the famous Giralddillo. Over the centuries, the building spaces of great architectural value were incorporated into a long evolutionary period. Its factories maintain a wealth of colour overlap different periods. We have studied the overlapping layers of colours throughout history have been applied. This allows to discern different images of the building, through its skin. Methods used are historical and documentary study, the visual study and scientific analysis. Buildings were analysed, planimetric surveys were conducted and a historical study was done with the analysis of bibliographical sources, iconography, photography, models, etc. Scientific study was carried out in situ with colorimetric techniques, to determine the L*a*b*C*h coordinates, image analysis using the colorimetric study, compared to the pattern of barium sulphate, and analysis by comparison with NCS colour chart. Analysis was completed with sampling and analysis of physicochemical properties of the layers in laboratory: diffraction and X-ray fluorescence, infrared spectroscopy, optical microscopy and scanning electron microscopy with energy dispersive microanalysis X-ray. Particularly striking is the so-called "cathedral", built in eighteenth century, a unusual space vaults, enclosed by walls with powerful frieze and cornice, pilasters and buttresses to redirect the horizontal thrust of the arches and domes of uppermost deck. Visual and scientific analysis is deducted the overlapping chromatic treatments through time. Initially the main elements of structure, cornices and pilasters were red, and white walls, reinforcing the architectural composition of the facade. Subsequently walls were painted bright yellow, while keeping red the structural elements, cornices and pilasters. In a third stage was applied white in cornices and pilasters, and other yellow in backgrounds, this colours have endured to this day. All these stages are shown on the plans to expose chromatic changing facades, lanterns and dome. Scientific study highlights the superposition of layers of pigmented lime mixture of iron oxides and clay minerals. In other samples calcium carbonate has small grains of red colour consisting of Fe, Si and Al. In summary, this research provides the architectural, landscape and scientific study of the colours of the facades, lanterns and domes, which are mainly the pure white light and high pallet of reds and yellows. This range of colours we have come to know the causes of their choice and are identifiers of the city.

Key words: Colour; coating; lime; landscape; protection; cultural heritage.

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Bank buildings and representation phenomenon selection of the work of Michal Milan Harminc, Doyen of Slovak architecture

Jana Pohaničová *, Katarína Števlíková

Slovak University of Technology, Faculty of Architecture, Námestie Slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

From the point of view of Slovak and Central-European architectural historiography, the issue of architecture of bank buildings in the era of subsiding historicism and ascending modernism has not been researched thoroughly yet. An interesting contribution to this field of architecture is presented by the work of Michal Milan Harminc (1869 - 1864), the doyen of Slovak architecture. His life and work have been the focus of a long term biographical, archival and field research of both authors. Almost 300 architectural works, created 1887 – 1951 in the region of the former Austria-Hungary, later in Czechoslovakia and other successional states (Hungary, Serbia, Romania, Ukraine), ranked Harminc to the most productive central-European architects. Financial institutions present a significant component of his typologically as well as stylishly diverse architectural portfolio. Among his works are included main as well as branch offices of major Slovak institutions ranging from first significant establishments based entirely on Slovak capital to buildings of Tatra bank, which, before the WWII, had ambition to become a central Slovak bank promoting Slovak industry and interests of national-emancipatory movement. Bank buildings in Ružomberok (1902 – 1903), Martin (1910 – 1912), Trnava (1914), Bytča (1919) and Bratislava (1923 – 1925) represent remarkable stylistic line of subsiding, although still relevant, historicism and rising modernism. By the 1920ties, buildings rendered by excellent eclectic architect Harminc gained a monumental character. Representative and solid nature of the architecture of first Slovak bank institutions was expressed by modulation of their facades as well as solid interiors. Harminc proved himself to be a versatile author possessing the sense of adequacy of architectural forms as well as logic of disposition, whether creating in rural or in urban environment. His designs are characterized by sense of indoor detail, craftsmanship and precision, molding characteristic architectural expression of bank buildings. These features were significant for first two creative periods of Harminc's work, emerging from historicism to the position of modern official monumentality. In terms of formation of specific typology, architect's work reflects reliably the period conception of representative concept of banking palace, adapted by author for the Slovak peripheral environment. To express the character of particular financial institutions, author employs formal elements referring to classical line of historic architecture and decorative elements adherent to banking operations, such as beehives, the figure of Mercury or Cronus, the allegorical figure of industry or fruit, flower and laurel festoons. In the area of Central-Europe, this typological line is represented by bank buildings of Ignác Alpár, Otto Wagner and others. In comparison to the works of these architects, bank buildings of Harminc represent less imposing, regionally bound mode of architecture. Nevertheless, it constitutes an integral component of diversity of Slovak as well as European cultural heritage.

Key words: Architecture; bank; representation; Michal Milan Harminc; historicism; modernism.

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The advent of a contemporary European hospital – origins of the process of architectural development

Joanna Borowczyk *, Joanna Olenderek

Technical University of Lodz, The Faculty of Civil Engineering, Architecture and Environmental Engineering, Department of Architecture and Urban-Planning, Politechniki 6, 90-924 Lodz, Poland

ABSTRACT

For centuries health care facilities had been undergoing a long, complex and unstable process of development, which during the interwar period led to the establishment of a particular standard in design, common to all hospital services within the area of influence of the European culture. In the era of modernism a universal system of building hospitals was adopted, whose spatial assumptions are being followed to this day. Tracing the origins of European hospitals design requires referring to the examples of facilities from different periods in history, which were designed according to varying expectations connected with the degree of development in medical sciences, traditions of a particular community as well as changing concepts of a human body comprising both scientific and fictitious points of reference. The main purpose of the paper is describing the origins as well as characterizing the architectural design of hospitals built in Europe before World War II. The Authors have made an attempt to point to concepts represented by common design patterns which have been positively verified over the last decades. However, most attention has been focused on facilities contributing to the general architectural landscape of contemporary urban structures. Investigation of the historic methods and tools for adjusting health care facilities to changing cultural and economic-administrative conditions allows revealing the origins of numerous factors which contribute to the organizational, technical and building structure of contemporary European hospitals. Analyses allow determining the influence of political, economic and social background as well as technological development on the formal and functional solutions in the field of architectural design of health care facilities. The Authors provide a synthetic image of the conditions in the design and construction of hospital buildings in Europe until 1930s. A broad spectrum of historic and political circumstances accompanying the formation of hospitals described in the paper has also been discussed. The study involves a presentation of a complex network of deciding factors influencing the choice of solutions concerning the functional and spatial structure of the facilities as well as symbolic significance of the analysed architectural assumptions. Adding health care facilities to the existing urban tissue of European cities allowed transforming these areas into modern cities, i.e. places which provide citizens with optimal living conditions and development opportunities. In this respect many European hospitals built throughout the history played a particularly important role. Transformations discussed in the paper resulted in the improvement of living conditions among citizens, and the architecture of medical facilities meeting the social needs has become for many years a symbol of a contemporary European city.

Key words: Architecture; urban planning; architectural design; public use architecture; hospitals' architecture; European hospital.

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A multidisciplinary approach to the Portuguese Cistercian Monasteries Architecture: research and knowledge

Ana Maria Tavares Martins *

University of Beira Interior, Departamento de Engenharia Civil e Arquitectura, Edifício II das Engenharias, Calçada Fonte do Lameiro, s/n, Portugal

ABSTRACT

This paper aims to provide a debate on the multidisciplinary research achievements and knowledge concerning the Cistercian architectonic legacy, in Portugal, connecting Architecture, Civil Engineering, Heritage, and History. The Cistercian order was introduced in Portugal in the 12th century and its monasteries have been associated with the development of the nation as well as objectives of occupation and administration of the territory. The history of the Cistercian Portuguese Heritage is intertwined with the history of Portugal. The Cistercian monasteries in Portugal have become worthy examples of the European Cistercian architecture, although throughout the ages have been adapted, expanded and transformed according to the styles of the epochs. After the extinction of the Orders (1834) underwent numerous transformations and Cîteaux departed from Portugal for never to return.

Currently, Portugal is part of the 'European Charter of Cistercian Monasteries and Sites', since 2009, being represented by the monasteries of Alcobaça, Arouca, St. Cristóvão de Lafões, Salzedas and Tabosa. Consequently, the Portuguese Cistercian architectural heritage, is also part of the 'European Route of Cistercian Abbeys' to which it was assigned, in 2010, the mention of 'the Council of Europe Cultural Itinerary'. This paper brings to debate the rehabilitation and morphology of the Cistercian Monasteries layout, in Portugal, as well as the research on the Cistercian legacy conducted mainly at the Department of Civil Engineering and Architecture of the University of Beira Interior connected to two research centres Lab2PT (Landscape, Heritage and Territory Laboratory) and CIDEHUS (Interdisciplinary Centre for History, Culture and Societies). The originality of this research is the multidisciplinary study and the results achieved in the research of the Cistercian legacy in Portugal as a system: the former monasteries and its architecture are the main subject concerning morphology, architectonic rehabilitation but also acoustics, thermal comfort, or natural light. Finally the research methodology and results will be presented in the study case of the Monastery of S. Bento de Cástris and the work carried out for the FCT EXPL/EPH-PAT/2253/2013 Project also known as ORFEUS Project – The Tridentine Reform and music in the cloistral silence: the Monastery of S. Bento de Cástris – which was financed by the Foundation for Science and Technology (FCT) with community co-financing through the COMPETE program of QREN and the European Union (FEDER). The ORFEUS Project is based on a multidisciplinary approach around the Tridentine Reform reflexes in the musical Cistercian feminine matrix between the 16th and 18th centuries on Cistercian Monasteries. This research, guaranteed by historians, architects, engineers, musicologists made possible to achieve the proposed results and accomplished much more than the results previewed initially, with a significant International dimension.

Key words: Cistercian architecture; heritage; morphology; acoustics; thermal comfort; natural light.

* **Corresponding Author**

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Mellah: the Jews quarter of the medina. Uniqueness and porosity of the Moroccan Islamic city

Julio Calvo-Serrano *, Fabián García-Carrillo, Juan M. Santiago-Zaragoza

University of Granada, Higher Technical School of Building Engineering, Campus of Fuentenueva. 18071. Granada, Spain

ABSTRACT

With the name Mellah are known in Morocco the old neighbourhoods from some cities and villages extended along the territory, generally surrounded by walls where the muslim power forced the once important local Jewish minority to live. Nevertheless they maintained a lot of religious liberty and some administrative autonomy. They were the consequence of a determined way of understanding and regulating the interreligious coexistence in the pre-colonial Morocco; each dynasty, as they unstaured a new capital of the realm, they also created an exclusive neighbourhood for the Jewish dhimmi, minority tolerated according to the Islamic Law to which the sultanic power should protect, according to the Omar Agreement. They are peculiar neighbourhoods that can be distinguished in their origins and characteristics, but all of them have their isolation and closure in common, even though, internally, if not faithfully reproduced, they imitated the same urban distribution. The Mellah is a strictly Moroccan specificity, not comparable to the European ghetto. The life inside propitiated the development of a Judeo-Moroccan specific identity, accentuated by a complex net of relationships with the power and the neighbour muslim community. Nevertheless, Mellah and Medina are sceneries of the same coexistence structure, affirmations of the same, common history that affected, in different ways, to both communities. At the beginning of the XX century, the French orientalist from Argel created the concept of Islam City, and influenced by the colonial dominant spirit, they characterised it by its "urban disorder", reflection of the same social disorder; to them the Mellah was just another effect. In this simple and prejudiced approach, the space for the Jewish minority is an exception to the "ideal" muslim city. Later researchers reasoned each city in its context, even recognising the differences of the society members, but only occasionally they took care of their interaction and mutual influence. Certainly the Islam and its legal tradition influenced, even though with non-equal results, the configuration of the muslim cities, regulating both the public and private spaces and with specific dispositions for the minorities. But classify is generalize. The Mellah was a peculiar place, but at the same time shaped the Medina, where the permeability among its neighbourhoods reflected the same community relationships, as they were all spaces of relationship. In this work, although we question every exclusive focus, we make a reinterpretation of the Jewish minority space in the traditional concept of the Islamic city in the Magreb, considering this as a complex structure in constant evolution, according to the necessities and possibilities of every inhabitant that had been and are part of it.

Key words: Mellah; Jewish neighbourhood; Islamic city; Muslim urbanism, Morocco.

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Parallels and analogies in the interwar architecture in Latvia and Czechoslovakia

Renāte Čaupale *

Latvia University of Agriculture (LLU), Landscape Architecture and Planning Department, Skolas street 14, Bauska, LV3901, Latvia

ABSTRACT

The interconnections of the interactions between the art and architecture of the Latvian and Czechoslovakian nations are relatively fragmented. However, there is one large European cultural space in which both parallels and analogies can be found, as required by the communicative role of art and architecture. In the 1920s and 1930s, a European architecture that was founded on modern features could be found in the architecture of the new Latvian state. Art Deco aesthetics was one of the operative events of the interwar period. Its expression changed along with the changes occurring during this time period, retaining the decorativeness principles of Art Deco. Art Deco aesthetics encompass several distinct but related design trends, including the following: **a.** interpretation of elements of folklore – Ansis Cirulis in Latvia and Pavel Janák in Czechoslovakia authored masterfully designed interior examples. Regardless of their creative potential after the First World War, artists and architects in many new states were drawn into the stream of contemporary trends – the folkloristic style, which became one of the decisive sources of inspiration for demonstrating national self-determination, which, in turn, is typical of all cultures and civilisations and can sometimes be international. An analogous interpretation of folklore brings these processes together, which allows them to be identified as folkloristic Art Deco trends. There are moments when folkloristic Art Deco as a component of Modernism art and architecture of the 1920-30s organically foreshadows the aesthetics of pre-postmodernism; **b.** modernization of the classic form, which has been highlighted directly in the period of the leader cult common in new states. The wish to represent people's self-determination in architecture and the circumstances of this time period shaped the monumentality of the masterpieces designed by Jože Plečnik and Eišens Laube in Prague and Jūrmala, respectively, and, at the same time, also their distinct consideration for national heritage. Naturally, a cultural basis that is identical for many European countries can be identified in Latvia and Czechoslovakia, rather than art elements of incidental nature that have randomly entered the country. For this reason, the aim of the present paper is to show the ideological context of Latvian and Czechoslovakian architecture.

Key words: Architectural history; Art Deco; folkloristic art; national art; 1920s and 1930s.

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Evolutionary processes in the development of the world's oldest temples in Göbekli Tepe and Nevalı Çori, Turkey (9.100-7.500 B.C. [14C]), in the light of studies in Ontogenesis of Architecture

Marta Tobolczyk *

Warsaw University of Technology, Department of Architecture, ul. Koszykowa 55, 00-659 Warszawa, Poland

ABSTRACT

The paper is the presentation of research in Ontogenesis of Architecture¹. This new field of studies, as a part of Theory of Architecture, deals with the problems of origination and development of architecture from its earliest germs in the Stone Age, through its monumental, geomorphic forms, to the latest trends. It aims to formulate general rules and regularities, which govern evolutionary processes related to architecture. A special attention is paid to the prehistoric period in the Near East when, during so called Neolithic Revolution (10th - 8th millennium B.C.), building activity became a vast laboratory for fostering man's creativity abilities. With the growing understanding of spatial-structural problems, there appeared rudiments of planned settlements and circulation systems, as well as the archetypical forms of cult (ritual) enclosures and temple structures. As explained by studies in Ontogenesis of Architecture, the origins of Neolithic cult buildings usually reflect the complex evolution based on two sources. The final form of a cult building generally echoed the shape of a simple archaic hut, which was monumentalized, as well as it was descendant of nomadic cult enclosures which were arranged in open landscape. The purpose of the presented research is to demonstrate the evidence of such a double channelled development of the world's oldest roofed temple in Nevalı Çori located on Euphrates near Şanlı Urfa in south-eastern Turkey (sanctuaries: 13 A, 13 B, 13 C, dated to 9th millennium B.C. excavated in successive layers by Harald Hauptmann from Heidelberg Institute of Archaeology) in years 1990., and linked with cult enclosures in Göbekli Tepe (10th -8th millennium), uncovered by Klaus Schmidt during excavations carried out from 1995-2012. The principal result is to make clear that if we compare some layouts of open cult enclosures and the oldest "temples" discovered in the area of middle and upper Euphrates, it is possible to reveal the succeeding stages of a transition from ritual centers in open landscape to roofed cult buildings. Major conclusion or rather supposition is that this archetypical form of Neolithic "temple" signifies the transition from society of hunting-gatherers' to agriculture based community that happened in the investigated area around 9.000 B.C. Starting from that moment numbers related to calendar became important elements of architectural canon. The paradigm, based on measuring time in a circuit of seasons and astro-symbolism elaborated in open lied foundations of the earliest recognized canon of architecture built for ritual, as well as community gathering purposes.

Key words: Ontogenesis of architecture; Neolithic canon of architecture; archetypical form; cult building; cult enclosure.

* **Corresponding Author**

General foundations of this field of studies, introduced by the author, are presented in the book: Tobolczyk, M.,2008, "The Birth of Architecture. Introduction to the Ontogenesis of Architecture", Urban International Press, New Castle,in press; and in Tobolczyk, M.,2000, "Narodziny Architektury. Wstęp do Ontogenezy Architektury", PWN, Warszawa.

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Sustainable historic structures as socio-economic development accelerator in historic cities – case study “Old Herold”, Trenčín (Slovakia)

Vladimír Ondrejčka *1, Silvia Ondrejčková 2

1 Slovak University of Technology in Bratislava, SPECTRA Centre of excellence EU, Vazovova 5, 812 43 Bratislava, Slovakia

2 Slovak University of Technology in Bratislava, Institute of management, Vazovova 5, 812 43 Bratislava

ABSTRACT

Empty and underused historic production areas are common phenomenon of Slovak cities, as results of the restructuralisation processes in industry in the second half of the last century. These areas, usually defined as brownfields, are perceived as “the scars” in the picture of the cities, but in many cases, they represent specific local potential for future socio-economic development, especially of those located in the centre of historic city. The aim of the paper is to present innovative approach to sustainable brownfield revitalisation of historic production areas in historic cities with special focus on possible impact on socio-economic development and quality of life of inhabitants. This approach is demonstrated on case study of “Old Herold” area in city Trenčín, localized in the touch with historical centre of the city on the river Váh riversid.

Key words: Brownfield revitalisation; socio-economic development; public participatory; historic city.

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Mountain architecture in Sierra Nevada, Spain; San Francisco Shelter, an unique heritage in danger

Fabián García-Carrillo *, J. Carlos Peñas-Alcántara

University of Granada, Higher Technical School of Building Engineering, Campus of Fuentenueva, 18071, Granada, Spain

ABSTRACT

The purpose of this work is the first establishment catered to leisure and sports of the Sierra Nevada mountain range, home to the highest peaks of the Iberian Peninsula; an emblematic but also unknown building, built over a hundred years ago by some "visionaries", when there was not even a road to access. Located at 2200 m altitude, San Francisco Shelter has had an eventful history marked by the Spanish Civil War, 1936-1939. From the original building, with great formal uniqueness and constructive ingenuity, now only a section stands still preserved, majestic and lonely. The Shelter was a refuge for mountaineers, and the starting point and base of the first tracks and ski lift of Sierra Nevada in the first quarter of the nineteenth century, later relocated elsewhere around the current Prado Llano station, the southernmost of Europe. The interest and opportunity of this work is justified by the objective value and the preoccupying state of conservation of the building, maintained with more will than skill, which on December 15, 2015 celebrated its centenary. Through painstaking research and extensive work in the field and cabinet, it has been possible to achieve a great objective knowledge of a rather forgotten reality, and of the special and complex historical development of a building, certainly not monumental, but with great symbolism, both historical and cultural value, and therefore Heritage. We base the work on the use of graphic documents as support for research and knowledge, as well as a vehicle for the preservation and dissemination of heritage architecture. Following a methodology and a systematic procedure based on the principle of "know to understand, understand to evaluate, and evaluate to act", has been able to achieve a broad understanding of the architecture of the building, its history, and evolution. There was a lack of baseline data, so they will stand out as original contribution of this research, the documentation prepared specifically and with the most current and reliable means so both the current state of the building, as well as the original Shelter that disappeared, and the hypothetical "virtual building" that could have been, if completed the initial idea of its promoters. For now, we also know the possible initial project, never built. Similarly, and supported by laboratory work, we have proceeded to the analysis and characterization of materials and constructive solutions, and to detect and assess the conditions of the existing building. And finally, the research serves to support a simple, but thoughtful and coherent proposal for virtual intervention, facing the restoration and rehabilitation of a new San Francisco Shelter, raised from the maximum respect for the heritage value of the subject matter, its present and past, but without sacrificing the future. It will be a starting point for a debate on the necessary recovery of this unique heritage, now in danger.

Key words: Sierra Nevada, Granada; mountain architecture; historical and cultural heritage; restoration and rehabilitation; infographic documentation.

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Church with leaning arches - origin of form, typology, and diffusion on the Balkan Peninsula

Milijana Okilj *

Vase Pelagića 34 C, Banja Luka 78 000, Republika Srpska, Bosnia&Herzegovina

ABSTRACT

A large number of Christian religious objects had been emerging in a very long period of time, conditioned by different cultural influences in the area of the Balkan Peninsula. Monumental religious architecture in the Balkans was researched well and systematically, especially the most important churches and monasteries built in the Middle Ages. Adequate and comprehensive study of the typology of religious buildings of modest size or artistic value was left out from the scope of the research. Churches with leaning arches, which are not of monumental proportions, however, are extremely important in the development of religious architecture from the early Byzantine and Preromanesque period, and later in the Ottoman period, until the late nineteenth century. The main object of the research is, therefore, origin, typology, and origin of shape and diffusion of this distinctive type of churches in the Balkans. A characteristic of this type are pilasters linked by arches which are placed along the side walls in the interior and have constructive and decorative role. These arches are called leaning arches. The constructive purpose is reducing the range of walls and facilitating the construction of the vault. In order to get the comprehensive insight into the value of churches with leaning arches research covers a large territory and a large number of particular examples. The aim is to form a comprehensive knowledge of the churches with leaning arches, to determine development trends, reciprocal links and influences. The study entailed a complex overlapping of historical, political, cultural, spatial and other aspects. The research has proved that the medieval churches which are not distinctly monumental have unjustified modest representation in history of architecture. Before the research the general opinion was that the number of churches with leaning arches in the Balkans is relatively small and concentrated on a smaller area to the west. It was determined that this type was widespread throughout the region, and the number of preserved examples is significantly higher than so far assumed. When it comes to determining the occurrence of churches with leaning arches, it was found that it was closely associated with the interplay of cultural and architectural circles of the East and the West, where the term East includes diverse influences coming from different provinces of Asia Minor, Transcaucasia, Mesopotamia and the Aegean coast, who penetrated to the west starting from the VI century. There was a significant improvement in the vault system during the early Christian period as a result of a series of experiments in the formation of various forms of arches. Undoubtedly, the use of leaning arches to stabilize the construction of church buildings must had been also tested in some variant forms. It is estimated that this is a very important conclusion because it confirms that the origin of the various arch and vault solutions, including the leaning arches in the framework of structural set of church buildings, is in relation to the area where the tradition of building the arch structure is very long and dates back to the ancient history.

Key words: Church; leaning arch; Balkan; typology; origin of form.

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Architecture for the New Man in the 60`s in Romania, first glimpse of communism build environment after Nichita Hruscirov discourse, a project, an architect, two buildings

Dan Idiceanu-Mathe *, Roxana Carjan

Politechnic University of Timisoara, Department of Architecture and Urban Planning, Traian Lalescu no.2, Timisoara, Romania

ABSTRACT

After the Second World War and after the 1947, a communist regime with the support of Moscow starts to build the new order, the environment for the New MAN and WOMEN. After a few projects with Moscow approval in the line of Stalin-ism architecture, the New Town try to find a way. Political context has no direction for the moment in constructions, till Nichita Hruscirov discourse in 1954. The City of Hunedoara – the biggest heavy industry area in the 50`s and the city of Bucharest – the capital of Romania. The communism starts to build the neighborhood of tomorrow in the beginning of the 50`s. A new young architect Nicolae Porumbescu starts to work. One of his project is to design a building with cultural function, a theatre – the main object for big square: – in Bucharest – „Piata Infratirii intre popoare” -engl/” The Fraternization nations Square” and in Hunedoara – the main Square of the city. His Inspiration for the subject is the „Balsoi Teatr”- Moscow. The same project is built in two places – Hunedoara and Bucharest, but in different scale and relation with the surrounding of block of flats for the new man, the communist one. The Communist rulers are in the search for a new identity of the communist city. The House of the New man for the 950`s is a pastiche of composite style, inspired by classical values, where in the flamboyant decoration of a hypostyle classical hall, the red star in five corners rules. Why the history repeats also in architecture, why the only way is „Hellenistic” one, with the idea of dominating the crowds? He tried to work against the stalin-istic style, with the decoration, with space, with the urban composition, which will be impaled a few years later in 60`s as a „style without utility”. Why always the classical option is the path for a new ideology of image? Why the classical is the target as image for having something that impose over? What N. Hruscirov did to the new way? It`s an answer to have.

Key words: Communism architecture; the `60`s; modern architecture; architecture in Romania; Eastern Europe.

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Architecture of the Tatra Bank and historicism in the work of Michal Milan Harminc

Jana Pohaničová *, Katarína Števlíková

Slovak University of Technology, Faculty of Architecture, Námestie Slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

Since the last two decades of the 19th century, national-emancipatory efforts of Slovaks were associated with aspirations to establish a central Slovak banking institution supporting smaller institutions based on Slovak capital and promoting Slovak industry and economy. After several failed attempts and many compromises, this institution came to be the Tatra Bank. It fitted into the variety of Austro-Hungarian banking system and later became the flagship institution of Slovak financial engineering in newly arisen Czechoslovakia. A fundamental part of constituting the institution's identity was the issue of architectural expression of the buildings of the Tatra Bank. The choice of the architect was essential. In the territory of today's Slovakia, obvious choice was Michal Milan Harminc (1869 - 1964), exceptional for his pro-national orientation and wide creative portfolio. By the time of the competition for the Tatra headquarters he already realised several buildings of important Slovak institutions, such as substantial local banks, church in Černová or Slovak National Museum in Martin. As an author of designs for the Tatra Bank since its beginnings until its subsequent expansion, Harminc proved himself to be the right decision. During 1912 – 1925 he created two headquarters buildings for the Tatra Bank – in Martin and later in Bratislava. In accordance with the creative credo of the pragmatic eclectic, the style of buildings develops motives and principles of historic architecture, which he absorbed during his first creative period, so called Budapest period. This style, in which the headquarters in Martin was created, outlasts in a specific form within the period of official monumentality. During latter period, Harminc created his finest works – the Tatra Bank (1922 – 1925), the Museum of Agriculture (1925 – 1928) and the Hotel Carlton-Savoy (1927 – 1928) all in Bratislava and the Palace Sanatorium of Dr. Szontágh in Nový Smokovec (1917 – 1926). Designs for the Tatra Bank buildings in Martin and Bratislava represent a type of an urban banking palace. The architecture of the branch office in Bytča (1920 – 1921) with its accordingly moderate historicist form presents an excellent adaptation for the local environment. Harminc evinced himself as a creator of bank buildings sensitively combining the demand for the adequacy of representative forms with the pragmatic layout. At the close of the 19th and the beginning of the 20th century, in the Central-European region, similar principles were used by Ignác Alpár, Ödön Lechner, Otto Wagner or Josef Gočár. In this context, works of the doyen of Slovak architecture demonstrate the solidity and reputability of the institution which played a significant role in formation of the Slovak financial sector. At the same time, Harminc's banks reflect up-to-date Central-European architectural trends as well as actual social, political, economic and national-emancipatory issues during the first decades of the 20th century. Taking into consideration all matters stated above, it is important to see historicism as a valid and permanent inspiration of architecture coexisting with the arising modernism.

Key words: Architecture; Tatra Bank; Michal Milan Harminc; historicism; Austria-Hungary; Czechoslovakia.

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Historical structures of vernacular architecture: ICT used for heritage conservation

Ana Virtudes *, Filipa Almeida

University of Beira Interior, Department of Civil Engineering and Architecture, Calçada Fonte do Lameiro Ed.II das Engenharías, 6201-001 Covilhã, Portugal

ABSTRACT

Good examples of preservation of vernacular architecture buildings are still an exception, whether as iconic and picturesque evocation, translated in a historic revival for tourist attraction, or in museums, neighbourhoods or fishing villages. There are the cases of Norway, preserving the rorbu, a temporary shelter for fishermen with its roots in the 12th century; France, preserving the tchanquée in Arcachon river banks or the carrelets in the Gironde estuary; Scotland, preserving the crannog, a circular enclosure surrounded by piles, including The Scottish Crannog Centre. But, in the majority of the cases, the vernacular architecture of river banks have been subjected to a rapid and significant disappearance, with the irreversible loss of a unique cultural, architectural and environmental legacy, weakening the sense of place, the identity of local communities with their territories and the cultural heritage of the countries. This problem is not an exception in Portugal, where the forgotten heritage comprises historical structures corresponding to wooden stilt-houses, represented in some villages along the Tagus river banks. This legacy has its roots in a migratory movement of a fishing community called the Avieiros, started in the 1860s, coming from the central west coast of the Atlantic to along Tagus River. However, the decline of fishing activities, the search for new sources of income, initially in the crops along the fertile region, and later in cities, the vulnerability of wooden buildings, and the absence of spatial planning policies or building preservation guidelines, has led to a decay in their transformation processes with the disappearance or abandonment of almost all these villages and their buildings. Nowadays, there are only five remaining Avieiras villages dotted in five municipalities, which totals less than 90 buildings and about 300 inhabitants so far. They are the only existing examples of river bank vernacular architecture in this country at the scale of urban settlements. Therefore this article aims to present an analysis about the survey of the vernacular architecture of river banks in Portugal, in order to highlight strategies of their preservation and enhancement, using an ICT tool. A computer program application called Smart-plan was design on purposes for the evaluation of two aspects of vernacular buildings: their proximity of the architectural matrix features and their status os conservation. The results show that more damaged the building are, closer they are from the vernacular architectural matrix and more preserved they are more faraway they are from the architectural matrix features. These results show that in both cases they need a strong action of preservation in order to recover their vernacular features or their good condition.

Key words: Historical structures; vernacular architecture; ICT method; heritage conservation.

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Stilt-house villages in Portugal: What does the future hold?

Ana Virtudes *, Filipa Almeida

University of Beira Interior, Department of Civil Engineering and Architecture, Calçada Fonte do Lameiro Ed.II das Engenharias, 6201-001 Covilhã, Portugal

ABSTRACT

The vernacular architecture of stilt-houses is represented in Portugal by the wooden stilt-houses of the villages, called 'Avieiras', situated along the margins of the Tagus River between the rising hills of the city of Abrantes and the land approaching of the city of Lisbon. These stilt-houses built by the waterside are one of the most ancient typologies of vernacular architecture in Portugal. Connected with the rivers, they reflect a common building strategy, with common materials and methods perfectly matched with nature. Therefore, the identity of these villages is inseparable from the river. Since the end of the 19th century that the fishing tradition marks these settlements bears witness to their locality, construction methods, the material and techniques used for the building, the architecture and urban morphology. Nowadays, these stilt-houses are one of rare legacies of vernacular architecture linked with the rivers landscapes in Europe. However, there are several challenges for the stilt-houses of the 'Avieiras' villages given their vulnerability in face of the degradation process. Many of these buildings are now long gone or in a continuous process of changing in terms of architecture, construction materials or morphology of the urban settlements. These changes are caused by the contemporary requirements in terms of comfort and habitability conditions. In this sense, this article aims to reflect on the territory of Tagus stilt-house villages' legacy, about their state of conservation and the opportunity to define spatial planning strategies at the time of the river environment preservation, with the goal of placing a value upon this unique heritage.

Key words: Stilt-houses; Tagus river villages; spatial planning strategies; river ecosystem.

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Monuments of the Czech Republic on the UNESCO world heritage site list and their significance for geotourism

Miloš Duraj ¹, Marian Marschalko ¹, Dominik Niemiec ^{1*}, Isik Yilmaz ²

¹ VŠB-Technical University of Ostrava, Faculty of Mining and Geology, 17 listopadu 15, 708 33, Ostrava, Czech Republic

² Cumhuriyet University, Faculty of Engineering - Department of Geological Engineering - 58140 Sivas, Turkey

ABSTRACT

The article presents the monuments from the Czech Republic enlisted on the UNESCO World Heritage Site List. Each country tries to choose representative sites and monuments that document the structural and architectural development in a given region. Therefore, the Czech Republic carried out an analysis of their monuments. As the Czech Republic has a very rich and expressive history in the very centre of Europe, its history has significantly affected its civil engineering and architecture. It is also a country with a varied geological structure and geomorphology. Today's untraditional forms of tourism, among which we also find geotourism, may thus build on such knowledge and expand the current offer of destinations. Learning about the geological structure is also important in terms of future renovation and reconstruction work. The current list of UNESCO cultural sites will be expanded by further unique sites and buildings. For this reason, it is important to combine knowledge from more specialised disciplines, such as geology and mining science.

Key words: UNESCO cultural and natural heritage, architectural styles, monuments, geology, geotourism.

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Churches influenced by underground mining in the Karviná Region used for the purposes of geotourism

Marian Marschalko ¹, Miloš Duraj ¹, Dominik Niemiec ^{1*}, Isik Yilmaz ²

¹ VŠB-Technical University of Ostrava, Faculty of Mining and Geology, 17 listopadu 15, 708 33, Ostrava, Czech Republic

² Cumhuriyet University - Faculty of Engineering - Department of Geological Engineering - 58140 Sivas, Turkey

ABSTRACT

The article aims to point out the mutual relations between underground mining and its manifestations on the ground surface. For the purpose, churches in the Karviná Region were selected. The buildings have been affected by over 200-year long extraction of hard coal. Some of the buildings have been influenced from the start of the mining activities, others later on. Thanks to the combined effects of the historical significance of the monuments and their diversion from the vertical axis, the buildings have become even more interesting. Moreover, they clearly document how the anthropogenic mining activities influence the built-up area. Some of the buildings have been preserved to date, some had to be demolished, unfortunately. Nowadays, the monuments are becoming significant sites of geotourism interest.

Key words: Underground mining; coal; churches; conservation of monuments; geotourism; Karviná Region; Czech Republic.

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Disorders of the building and its remediation - Hagia Sophia, Turkey the most the Byzantine building

Jan Plachy ^{1*}, Josef Musílek ¹, Luboš Podolka ¹, Monika Karková ²

¹ VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Civil Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

² ^bVŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, The Department of Mechanical Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

The aim of the publication was to bring information about violations of building Byzantine Hagia Sophia in Istanbul. Hagia Sophia is the most important Byzantine church built in the 6th century, which became a model for all the former architecture. Until now it is one of the largest churches in the world. He became an inspiration and role model for all generations of builders and architects. The study provides information about the violation of the building and its causes. It also describes the remediation, which were made in its history. The issue of building violations is mainly due to plate tectonics activity in the territory of Turkey. This caused a series of damage to individual parts of the building. Unsuitable construction solutions, the issue of external influences in the vicinity of the structure but also the influence of religion throughout history has completely changed the concept of the building, especially the exterior.

Key words: Hagia Sophia; disorders; remediation elements; Byzantine Empire.

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The unique construction of the church of Hagia Irene in Istanbul for the teaching of Byzantine architecture

Josef Musilek ^{1*}, Luboš Podolka ¹, Monika Karková ²

¹ VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Civil Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty of Technology, Department of Mechanical Engineering, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

The aim of the publication is to highlight the construction design of the church of Hagia Irene in Istanbul. It is a unique building structure, which was created in the 4th century. This is even before the construction of Hagia Sophia which is the most important Byzantine buildings. At the same time is located in its vicinity. Given that Hagia Sophia is surface-covered with plaster from the inside and for the most part from the outside, is not visible building material and construction. This means that in the case of Hagia Irene we can well observe the nature of structures, materials, and also to understand the construction sequence. Hagia Irene becomes a great example for teaching architecture in Byzantine style. Such an approach, however, can also be used for other architectural styles of churches, if the structure is visible from the outside and inside.

Key words: Hagia Irene; Byzantine architecture; building material; dome.

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Conservation of selected churches in the Most Region and Karviná Region and their significance for geotourism

Dominik Niemiec ^{1*}, Miloš Duraj ¹, Marian Marschalko ¹, Isik Yilmaz ²

¹ VŠB-Technical University of Ostrava, Faculty of Mining and Geology, 17 listopadu 15, 708 33, Ostrava, Czech Republic

² Cumhuriyet University - Faculty of Engineering - Department of Geological Engineering - 58140 Sivas, Turkey

ABSTRACT

Coal mining in the Czech Republic has left significant marks on the geomorphology of the regions. Simultaneously, it has also affected the lives of people who have lived there for centuries. This article selects two areas, where the consequences of mining are pronounced. It compares the open cast mining in the brown coal deposit in Most and the underground mining of hard coal in the Karviná Region. Only few monuments have survived out of the original buildings. Certain landmarks are the churches that appear in both of the localities. In Most the original church was relocated by almost one kilometre to another place. The Karviná Region has several churches that have tilted due to mining subsidence. The buildings are the witnesses of the original settlements and suitable destinations for tourists. Overall, the areas have high potentials for the development of non-traditional forms of tourism, especially geo-mountane tourism.

Key words: Coal mining; open cast mining; underground mining; churches; geotourism; conservation of monuments; Most; Karviná; Czech Republic.

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Effects of architectural competitions on urban space in post 1980 period – a case study of Eskisehir (Turkey)

Guler Koca *, Rana Karasozen

Anadolu University, Department of Architecture, Eskisehir, Turkey

ABSTRACT

Urban and architectural scale competitions held in Turkey from 1930's has started opening for Eskisehir in 1946. The periods when the competitions were opened for the city concentrate into two periods, 1946-60 and post-1980. While the first period of competitions were held by the central government, it is noteworthy that the post-1980 competitions were held by local organizations. There were a total of fourteen projects, with the earlier projects taking place in the city centre, and latter projects moving outward as the city developed. The competitions reflected the trending architectural touches, both in the country and the world, they also contributed significantly in development of modern urban identity and space of Eskisehir. In this study, competition projects from post-1980's will be reviewed for their contribution into development of Eskisehir's modern urban space, and they will be compared with the competition projects from 1946-60 era in context of their relationship established with the architectural style and the city.

Key words: Architecture; competition; urban; Eskisehir (Turkey); urban identity.

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How to design buildings, housing estates and towns so that their impact on the environment will be acceptable?

Beata Majerska-Palubicka *

Silesian University of Technology, Faculty of Architecture, Akademicka 7, 44-100 Gliwice, Poland

ABSTRACT

Currently, there is a tendency in architecture to search for solutions implementing the assumptions of the sustainable development paradigm. A number of them are components of architecture, which in the future will certainly affect urban planning and architecture to a much greater extent. On the one hand, an issue of great significance is the need to integrate sustainable system elements with the spatial structure of environmentally friendly architectural facilities and complexes and to determine their influence on design solutions as well as the implementation, operation and recycling, while on the other hand, it is very important to solve the problem of how to design buildings, housing estates and towns so that their impact on the environment will be acceptable, i.e. will not exceed the possibilities of natural environment regeneration and, how to cooperate in interdisciplinary design teams to reach an agreement and acceptance so as to achieve harmony between the built and natural environment, which is a basis of sustainable development. In this broad interdisciplinary context an increasing importance is being attached to design strategies, systems of evaluating designs and buildings as well as tools to support integrated activities in the field of architectural design. The above topics are the subject of research presented in this paper. The basic research aim of the paper is: to develop a current method of solving design tasks within the framework of Integrated Design Process (IDP) using modern design tools and technical possibilities, in the context of sustainable development imperative, including, the optimisation of IDP design strategies regarding the assumptions of conscious creation of sustainable built environment, adjusted to Polish conditions.

Key words: Sustainable development; architectural design strategies; Integrated Design Process.

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Contaminant management in the built environs as sustainable and economical practices for urban societies

John Sansalone *

University of Florida, Environmental Engineering Sciences, Gainesville, Florida, USA

ABSTRACT

Particulate matter (PM), associated chemical and microbiological loadings from human activities, urban infrastructure and lack of maintenance activities represent a chronic health impact to urban societies around the world. Current sustainability and maintenance operations for resource recovery from urban infrastructure systems such as sewers, drainage, unit operations and pavements are economically viable and benefit human health even in difficult economic conditions for our urban-based societies around the world. Such operations are simple and economical in all societies and can significantly reduce PM, chemical and microbiological loadings (including vectors transmitting the Zika virus, now in Florida) that along with wastewater discharges contribute to impairment of urban waters. Quantifying the load recovery and economics thereof is beneficial for all citizens. Furthermore, chemicals such as phosphorus is a limited resource and the world's supply (largely in areas of armed conflict), is being depleted as a raw commodity. These operations recover detritus, PM and associated chemicals/vectors from the urban inventory; inventory that is transported through, stored in, and on urban infrastructure systems. This PM is the primary source and sink of chemicals and microbiological contaminants that result from the interaction and imposition of anthropogenic/biogenic activities and urban infrastructure design practices/materials on the hydrologic cycle. Quantifiable knowledge of sustainability operations with several years of data collection across 14 cities in the State of Florida is demonstrated to provide a defensible foundation to build the allocation of load reduction credits. The economics and nutrient load reduction of primary sustainability operations (pavement and urban infrastructure appurtenance material recovery practices) are compared to conventional unit operations and best management practices (BMPs). Results are quantified from these data collection efforts across Florida and are categorized in terms of hydrologic functional units (HFU) and land use in cities. Florida is the leading state in the USA for wastewater reuse, with over three thousand cubic meters per day that is reclaimed after advanced wastewater treatment. In this study, a Florida-based metric for a kg of urban PM recovered is converted to mg of chemical recovered by a sustainability operation or BMP. Results indicate that both sustainability operations are significantly more economical than current BMPs. Such systems incorporate modern tools such as continuous simulation (as with the Storm Water Management Model, SWMM) and computational fluid dynamics (CFD). Study results have been codified in Florida regulations, has become very successful across Florida and expanding to other states in the USA. On an annual basis in Florida, thousands of metric tons of nutrients have been recovered by the sustainably practices in Florida smart cities.

Key words: Sustainability; pollutant load credits; economics; nutrients; pathogens; urban toxics; particulate matter.

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Assessment model for greenhouse gas emissions for the transportation of waste concrete in demolition and disposal phase

Taehoon Hong, Kwangbok Jeong *, Minhyun Lee, Jimin Kim

Yonsei University, Department of Architectural Engineering, Seoul, 03722, Republic of Korea

ABSTRACT

In 2015, South Korea government set up its 37% carbon emission reduction target (CERT) compared with business-as-usual (BAU) by 2030. The construction industry consumes more than 40% of the world resources and energy, and greenhouse gas (GHG) emission reduction potential is huge. This study was conducted to develop the assessment model for GHG emissions for the transportation of waste concrete in demolition and disposal phase. This study was conducted in follow three steps: (i) definition of the variables associated with the GHG emissions for the transportation of waste concrete; (ii) analysis of the interaction of each variable; (iii) development of the assessment model for GHG emissions for the transportation of waste concrete using system dynamics. The analysis results are summarized as follows. First, the total GHG emissions below BAU in 2030 was estimated to be 304,000 ton CO₂-eq when the recycling ratio is 100%. Second, the total GHG emissions were found to decrease 23.14% when the recycling ratio is 100% in comparison with the case where the recycling ratio is 70%. It is because the additional energy was consumed for transportation to landfill from intermediate treatment. For future work, the followings can be considered. First, GHG emissions can be analysed by considering the waste concrete as well as other wastes such as metal, steel, and mixed waste. Second, not only the transportation for waste concrete in demolition and disposal phase but also other equipment (e.g., backhoe, giant breaker, etc.) can be taken into account.

Key words: Greenhous gas emissions; demolition and disposal phase; transportation; waste concrete; system dynamics.

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Testing pilot model of resilient technology strategies against climate change

Rolando-Arturo Cubillos-González *, Francisco-Javier Novegil-González

Catholic University of Colombia, Dig. 46a, no 15b - 10 Piso 6 Bloque "O" - Bogotá Colombia, Colombia

ABSTRACT

The rainy season of 2010-2011 was an important trigger to make to Colombian government put the issue and risk of climate change on the agenda. Consequently, the government institutions seeks to respond to the potentially adverse impacts caused by climate change. Thus the Colombian government has already begun to create sustainable policies. However, it is not clear what kind of tools would use it to give an efficiently answer to climate impacts over the urban areas by the Colombian government. The purpose of this research is to describe the concepts of technology strategy and resilience applied in urban areas in Colombia. The research will test the following question: are there possible technological strategies that respond to climate change efficiently? The hypothesis is to develop the ability of habitable areas to adapt to climate change in urban areas. This hypothesis links the independent, variable Climate Change, with the dependent variable, resilience in defined urban environments. This study was exploratory in nature and consisted of the technique for the construction of the proposed model: factor analysis technique. The result was the development of a testing pilot model which addresses, in the most effective manner, the problems of resilient technology strategies present today when building processes in the Colombian cities. The product of this research was a basic concept model to enable the evaluation of technological processes in urban suburbs against climate change. In conclusion, this new basic model is expected would be a tool to design an algorithm which enables the implementation of a software model and the creation of resilient technology strategies for the construction or renovation of urban areas in Colombia.

Key words: Environment impacts; resilient cities; sustainable urbanism; sustainable technology; simulation; urban habitat.

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Temporal patterns in fine particulate matter time series in Beijing: a calendar view

Jianzheng Liu *

The University of Hong Kong, Room 841A, Knowles Building, HKU, Pokfulam Road, Hong Kong

ABSTRACT

Extremely high fine particulate matter (PM_{2.5}) concentration has become synonymous to Beijing, the capital of China, posing critical challenges to its sustainable development and leading to major public health concerns. In order to formulate mitigation measures and policies, knowledge on PM_{2.5} variation patterns should be obtained. While previous studies are limited either because of availability of data, or because of problematic a priori assumptions that PM_{2.5} concentration follows subjective seasonal, monthly, or weekly patterns, our study aims to let data show themselves on a daily basis through visualization rather than imposing subjective periodic patterns upon the data. To achieve this, we conduct a time-series cluster analysis on full-year PM_{2.5} data in Beijing in 2014, and provide an innovative calendar visualization of PM_{2.5} measurements throughout the year. Intuitive insights from the analysis on temporal variation of PM_{2.5} concentration show that there are three diurnal patterns and no weekly patterns; seasonal patterns exist but they do not follow a strict temporal division. These findings advance current understanding on temporal patterns in PM_{2.5} data and offer a different perspective which can help with policy formulation on PM_{2.5} mitigation.

Key words: Temporal patterns; extremely high fine particulate matter; time series; Beijing.

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Antidepressant architecture enveloping cities under rapid development

Krystyna Januszkiewicz, Sylwia Gudaczewska *, Piotr Orłowski

West Pomeranian University of Technology, Piastow 17 Avenue, 70-310 Szczecin, Poland

ABSTRACT

Architecture is powerful field that has an impact on human life. Advanced urbanization brings a lot of advantages to society, but also far-reaching side consequences. Big, noisy and polluted metropolises with high concentration of people, contribute to the deepening of depressive state of civilization. The first parts of the paper define the existing problems influencing depression, which are: lack of nature and sunlight, noise and pollution in big cities. It then goes on to attempt to solve the problem through experimental architectural design, which involves latest technology. Buildings located in unfriendly urban environment could be designed as a living structure that collects inputs - negative and positive one - from environment and processed them. Positive one as sunlight and rainwater could be collected and reused and negative one as noise and pollution could be neutralized or processed into positives, creating friendly urban habitat for users. Modern technology is at high level, there is no problem with collecting water or solar energy so why do not make one step forward and collect energy that people produce everyday such noise or smell. Proposed solution is experimental design of structure that collected odours from environment and neutralized it for future processing like creating antidepressant fragrance, and collecting sound of the city and manipulate it to create human friendly sounds. Those factors combined with sunlight and indoor plants could create antidepressant microclimate in the building. Solution like this would contribute to an improvement the quality of human life, especially in the cities under rapid development. This study highlights social problem, such as depression, resulting from rapid industrialization and urbanization, and serves as useful background to further research on the possibilities of re-define sustainable and human friendly design..

Key words: Antidepressant architecture; sunlight; nature; noise; pollution; processing.

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Attempt to improve indoor air quality in nursery school

Marek Telejko *

Kielce University of Technology, Tysiąclecia Państwa Polskiego 7; 25-314 Kielce, Poland

ABSTRACT

Most nursery school buildings in Poland rely on natural ventilation. This fact is attributed to the age of these buildings constructed more than dozen or even several tens of years ago. Few of them were fitted with a mechanical ventilation system allowing for the adjustment of microclimate parameters. The national requirements for gravity ventilation provide general guidelines, specifying strict description only for the airtightness of windows and balcony doors and the minimum airflow to be supplied to the rooms. The minimum airflow supplied is independent of the number of occupants and purpose of the room. Low indoor air quality (IAQ) can impact occupants' health and lead to poor productivity or low academic performance. Therefore the provision of good IAQ in classrooms and laboratories is very important. This paper presents the results of the investigation devoted to the quality of indoor air in classrooms of selected Polish nursery school. Six nursery school in a town with a population of 200 000 inhabitants were involved in the investigations. The participating school buildings were built between 1970 and 1993 and had gravity ventilation systems. The variability of basic IAQ parameters, i.e., temperature, relative humidity and carbon dioxide level, was analysed and the assessment of the classrooms in terms of microbiological purity was performed. The outcomes confirmed the low quality of the indoor air in these buildings. Certain modifications aimed at improving IAQ were proposed during the investigations. Two solutions were implemented. The first solution involved a twofold increase in the volume of supply air from 90 m³/h to 180 m³/h. The other modification consisted in installing indoor air cleaning devices based on the radiant catalytic ionization technology (RCI). The results of this study indicate that the proposed solution offers the potential to improve IAQ within classrooms.

Key words: Building physics; ventilation; air exchange; indoor air quality; RCI.

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Sediment transport modelling with advanced hydroinformatic tool. Study case: modelling on Bega Channel sector, in order to reopen the navigation

Mircea Visescu *, Erika Beilicci, Robert Beilicci

Politechnic University of Timisoara, Department of Hydrotechnical Engineering, George Enescu str. 1/A, 300022
Timisoara, Romania

ABSTRACT

Understanding of sediment transports related phenomena's (soil erosion, particles entrainment, transport and deposition) is important for predicting sediment and contaminant transport in surface water networks. Sediment transport is a critical process in many environmental and hydrotechnical systems, due to its negative effects (eutrophication and siltation of reservoirs, watercourses, channels and harbors, earth dams failures, decreasing of reservoirs storage capacity, damage and loss of wildlife habitat, flooding, especially flash flooding, damage to public health, increase costs of water treatment for drinking, decreased fertility of agricultural land etc.). The management of most aquatic ecosystems and hydrotechnical arrangements requires a detailed understanding of sediment dynamics, with their environmental and economic implications, especially where there is any anthropogenic involvement. Numerical simulations of sediment transport with advanced hydroinformatic tools are often the most efficient and practical methods for predicting sediment transport in complex hydrotechnical systems. Numerical modelling requires descriptions of the individual processes involved in sediment transport: erosion, entrainment, movement of sediments and deposition in the water column. This paper analyses the necessity and possibility of sediment transport modelling with advanced hydroinformatic tool. The study case shows the sediment transport modelling on Bega Channel sector (City of Timisoara to Romanian - Serbian border, Bega Channel is trans boundary water course), in order to reopen the navigation and Bega Channel sustainable development, the modernization of the channel corridor for inclusion in the Danube - Rhine (navigation possible for ships up to 1000 tons). For the modelling are use MIKE11 by DHI software, HD and ST module. On the ground of obtained results from modelling, can identify sectors with problems in terms of river bed silting.

Key words: Sediment transport; hydroinformatic tool; hydrodynamic modelling; navigation.

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Head loss modelling with advanced hydroinformatic tool in Sprinkler Irrigation Facilities: Case study of Sprinkler Irrigation Facilities on 400 Ha in Iohanesfeld, Romania

Marossy Zsolt *, Beilicci Robert, Beilicci Erika, Visescu Mircea

Politechnic University of Timisoara, Department of Hydrotechnical Engineering, George Enescu str. 1/A, 300022
Timisoara, Romania

ABSTRACT

In the Banat Plain droughts in the last 10-15 years have imposed finding sources of water for irrigation application on drained land - drained in the last 40 - 50 years. This paper presents an irrigation facilities on 400 hectares on a private area using modern sprinkler irrigation installations, having as water source the river Bega (approximately at kilometre 8 on the course) using modern mobile watering devices: centre pivots and hose - drum irrigation longitudinally propelled. The water intake was studied in two variants. Water for irrigation application is taken from Bega river being transported over a distance of 12.9 km through the existing network of drainage channels (unclogged by the beneficiary) accumulated in a storage pool from which using a pumping station commissioning under pressure is pumped in underground pipe network and distributed to the crops through mobile sprinkler irrigation equipment. Thereby this sprinkler irrigation facilities is using the existing drainage network to transport water from source to landscaped area. For the modelling are use MIKE11 by DHI software, HD module. MIKE 11 is a professional engineering software package for the simulation of flows, water quality and sediment transport in estuaries, rivers, irrigation systems, channels and other water bodies. MIKE 11 is a user-friendly, fully dynamic, one-dimensional modelling tool for the detailed analysis, design, management and operation of both simple and complex river and channel systems. With its exceptional flexibility, speed and user friendly environment, MIKE 11 provides a complete and effective design environment for engineering, water resources, water quality management and planning applications. The Hydrodynamic (HD) module is the nucleus of the MIKE 11 modelling system and forms the basis for most modules including Flood Forecasting, Advection-Dispersion, Water Quality and Non-cohesive sediment transport modules.

Key words: Mobile irrigation installations; central pivot; sprinkler irrigation system; water resources, water quantity, head loss.

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Rural heritage and cultural landscape: guidelines for sustainable seismic reinforcement of Emilian historic rural building (Italy)

Federica Ottoni *, Federica Borghi

University of Parma, Department of Civil Engineering and Architecture (DICATEA), Viale Parco Area delle Scienze 181/A
– 43124 Parma - Italy

ABSTRACT

Historic rural settlements are essential evidences of the Italian cultural heritage because they hand precious architectural, historical and environmental values. Despite its importance, this heritage is rarely protected by specific laws and a great part of these buildings are now abandoned and partially ruined, also as a consequence of the last century mechanized and intensive farming and the consequent lifestyle change. Moreover, the seismic events pose a serious threat to their preservation: indeed, despite they are located in an area - the Italian territory - with a very high seismic risk, often they don't have any proper anti-seismic device able to prevent a serious damage, or collapse. In this work, the results of an yearlong research carried out on a significant number of historic rural buildings in the Emilian area, in Italy, are presented in order to draw up specific guidelines for their sustainable seismic reinforcement and conservation. Indeed, starting from the analysis of the peculiar features of the landscape and the examined buildings, it's possible to recognize some recurring structures and shapes which identify as many rural architectural types, with similar structural behaviour and seismic damage. Thanks to this similarity, it has been possible to set up some reliable guidelines of analysis and intervention which can constitute an easy and expeditious instrument for technicians and restorers in order to safeguard this valuable built heritage, too much neglected until now. The final aim is to evidence the extreme efficacy of a conservation strategy, which can constitute the first guarantee for a sustainable intervention on this precious cultural heritage.

Key words: Rural heritage; seismic retrofit; cultural landscape; sustainability.

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How urban transformation project effects urban and architectural form: case study from Burdur (Turkey)

Seda Simsek Tolaci *, Pervin Şenol

Suleyman Demirel University, Cunur, Isparta, Turkey

ABSTRACT

Urban and architectural practice are affected by wave of rapid urbanization in Turkey last tree decade. The same processes has been constrained urban centre and surround of the central area. These new spatial policies and strategies have been initially started in the end of the 1980's in megacities and became a current issue under the name of "Urban Transformation Projects". In 2000's, the same process started the transform of urban spaces and architectural qualifications in the small and medium scaled urban area, which their developmental dynamics are relatively slow. As a medium scaled city, Burdur, is located in the south part of the Turkey namely "Mediterranean Region", because of having a lot of lakes, the region is locally called "Göller Yöresi". It's announced that the population of Burdur urban city centre by 75.000 in the year of 2014. The history of the city is dated to the Palaeolithic Era. Urban city centre which includes different scaled and structural ruins which represents its historical richness. In the same time, there are a lot of ruins dated from 17.century to the modern time civil architectural samples which were constructed by different social structures during the time. These special pattern in Burdur city centre has been continuous. The main factors of the spatial development restrict of the Burdur city can be summarized: (1)located in the earthquake region, (2) being determined as first degree natural protected area by the government, (3) Burdur Lake and its surrounding come under the convention on wetlands of international importance (RAMSAR). In this paper, urban and architectural transformation practice in the case of Burdur settlement will be held in urban and architectural scales. On the other hand the subject will be discussed different aspects such as: (1) physical dimension of transformation, (2) effects on architectural artefact, (3) social dimension of this process (urban culture and urban memory).

Key words: Burdur; urban transformation projects; urban form; architectural pattern.

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Design principles for ensuring quality built environment: a case of redevelopment in inner city, Addis Ababa

Ararso Beyene *, Pushplata

Indian Institute of Technology, Department of Architecture and Planning, Roorkee 247667, India

ABSTRACT

Cities the world over in general are constantly changing due to socio-economic and technological changes, and more so the inner cities in the developing world. This has resulted in drastic physical and functional changes particularly in built form and character, affecting the quality of living environment. Addis Ababa in Ethiopia is one such city where extensive redevelopment projects have been undertaken in inner city area due to increased demand for housing, commercial and other activities, deteriorating conditions in the inner city areas in contrast to real estate development in the peripheral area, and government policies to redevelop inner city areas and provide better living environment. In these urban renewal projects high-rise buildings for residential, commercial and office have been built in place of low-rise developments, along with changes in public spaces and road-layouts. In this paper these changes in context of inner city area of Addis Ababa have been studied through site observations, photographs, analysis of renewal plans-layouts and building designs and interviews with the residents. Comparative analysis of the old historic inner city areas and newly rebuilt sites has been done. Based on this and extensive literature review, applications of generic design principles for ensuring quality of built environment, continuity of spatial form and character and sustainability of the existing built environment and its emerging residential environments in the context of inner city are suggested. These are relevant not only for sustainable development in inner city context of Addis Ababa city but also similar cases in other developing countries having similar situation.

Key words: Urban redevelopment; inner city; built environment; design principles.

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Influence of the wind and photovoltaic energy sources fluctuations on the hybrid systems with pumped hydro energy storage

Ioan David *, Ioan Vlad, Cristian Grădinaru, Camelia Ștefănescu

Politechnic University of Timisoara, Department of Hydrotechnical Engineering, George Enescu str. 1/A, 300022
Timisoara, Romania

ABSTRACT

It is known that hydro energy is not only a renewable and sustainable energy source, but also a flexible storage possibility for both small autonomous energy supply systems as well large energy storage systems. In this regard hybrid systems using Pumped Hydro Energy Storage (PHES) ensures the improvement the grid stability and represents a support for deployment of intermittent renewable energy sources as hybrid systems like wind-hydro or solar-photovoltaic-hydro. The power produced extra energy by wind or PV during off peak hours is used to pump the water from a lower reservoir to an upper. The water from the upper reservoir is released through hydraulic turbines to produce energy during peak load hours. The main advantages of PHES plants are: flexibility to start/stop, fast response speed, capability to track load changes, adaptability to drastic load changes. Following the PHES is generally the most promising technology to increase renewable energy penetration levels in power systems and particularly in small autonomous energy supply systems. In the paper are presented the main features of hybrid power plants comprised of the Pumped Hydro Energy Storage system operating coupled with a wind or with photovoltaic power plant. It will show that a simplified calculation of hybrid systems based only on energy balance without taking into account the renewable energy sources fluctuations, can lead to significant errors regarding the required hydro accumulation size which has the biggest effect on the efficiency of the entire system. A case study of a hybrid power plant for a small autonomous energy supply in the county Timis Romania is presents as well.

Key words: Hybrid power plant; wind-hydro; photovoltaic-hydro; pumped hydro energy storage.

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Comprehensive management of industrial heritage sites as a basis for sustainable regeneration

Sonja Ifko *

University of Ljubljana, Faculty of Architecture, Zoisova 12, Ljubljana, Slovenia

ABSTRACT

When discussing sustainable development it is essential to equally consider all of its aspects: social, environmental, and economic. In common practice, the economic aspect is mostly the most emphasized and recognized, while in the cases of industrial sites environmental issues are, in general, also considered due to the pollution caused during operation of industries. The experience in Slovenia shows that the third pillar, i.e. the social one, is often neglected, even though it is essential to integrated implementation of sustainable development. This shortcoming is particularly reflected in the cases of regenerating industrial heritage sites. Industrial heritage sites are highly complex structures, which are an important part of our social, spatial, cultural, and technological past. Their complexity is the main reason that they need to be tackled through a specific interdisciplinary approach to research and evaluation and, moreover, as this text points out, also through a specific heritage management approach, which has to start right after the production stops. Many negative consequences of the closure of production, e.g. loss of jobs, social problems, economic issues, affect both individuals and communities as a whole. So it is very important to approach the problem also from the social aspect and make sure that interested former employees are involved in heritage management. Such an approach would have various positive aspects; beside the fact that the industrial site in question would be listed immediately after closure, the involvement would send an important message to others who are negatively identified with the closure, loss of jobs, and social distress. All of this would positively influence and accelerate the site's and community regeneration process. The proposed approach will be presented on the case study of the coal mining town Hrastnik in Slovenia, which is in the process of closing down, and where the industrial heritage sustainable management plan for the Municipality of Hrastnik is under preparation.

Key words: Industrial heritage management; social sustainability; urban regeneration.

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The assessment of benefits of partial thermal retrofit of historic buildings from perspective of individual flats

Karolina Kurtz-Orecka *

West Pomeranian University of Technology Szczecin, Piastów Street 17, Szczecin, Poland

ABSTRACT

Most of the European towns contain a lot of historic buildings, which in comparison with new ones are characterized by a deficit of technical and commercial advantages, which significantly reduces their usability. Their occupants are faced with low thermal quality of building envelope, ineffective technical systems and unsatisfying thermal comfort of old structure. The technical condition of historic buildings results in high costs of their maintenance and a significant burden on the environment in terms of energy sources demand and CO₂ emissions to the atmosphere. In order to improve the situation are taken thermal retrofit works, including the envelope of building and its technical systems. However, in the case of buildings that are under the law protection, with the preserved values of cultural and historical works, general retrofit cannot be carried out throughout the building often excluding main facade. There are two types of the benefits for the residents after successful done general thermal retrofit - decreasing energy demands of the building and increasing aesthetic its look. For both of them the residents bear the costs specified in the repairs fund. The repair fee in relation to the benefits associated with a reduction in energy bills is significantly different depending on the location of the units in the building. The aim of the study is to analyse the real economic and energy benefits of thermal retrofit in historical buildings from the perspective of the building as a whole collection of units and the individual units especially those are located in the front of the building. The scope includes a comparison of energy demand index and economic indicators of some selected tenement houses located in Szczecin, Poland. The buildings taken under consideration are varied in shape, size and share of the protected facade to the rest of their envelope. The adopted study method includes the calculation of the buildings energy demands for two states - current and after the thermal retrofit. The results of energy savings and costs of repair fund are compared for the entire building and each separate flat. Generally the results of the study indicate a significant potential of thermal retrofit of historic buildings as a whole. Achievable energy savings for each building varies primarily because of its shape, location in the urban structure, the structure condition and the period in which it was erected. But the main indicator is the possibility of carrying out work on as large area of its envelope as possible. After thermal retrofit with the renovation works of the facade, the energy benefits are significantly different for individual unites - the smallest are in the case of ones with the envelope of the front facade, highest in the case of premises located in the rear of the building and the share of residents in the repair fund, regulated by law, does not reflect the real benefits of the project.

Key words: Thermal retrofit; historic buildings; energy savings; CO₂ emission; economic benefits.

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The influence of urban form on PM10 concentrations within a medium-sized city

Ligia T.Silva *, Pedro S.Monteiro

University of Minho, Department of Civil Engineering, University of Minho, Campus Gualtar, 4710 Braga, Portugal

ABSTRACT

Global population growth has led to an increase of the number of people living in urban areas. As a consequence, stresses on space, ecosystems, infrastructures, facilities and personal lifestyles have been increased. Problems related to the quality of life in cities are increasingly relevant, especially with regard to environmental issues. Urban air quality can have severe impacts on people who use outdoor spaces within a city. Besides the existing sources, urban air quality can directly be linked to the configuration of the open spaces defined by the street network, building heights and their attributes. Thus, the role of urban planners can be crucial in order to ensure outdoor air quality in open spaces. This paper presents the relations established between urban morphology and variations in observed air quality within a city centre. Urban form is related with urban geometry and can be analysed with different tools. The Sky View Factor (SVF) is considered by many authors as the most appropriate parameter to describe urban geometry. A dataset from four monitoring stations in a medium-sized city was collected and clustered by the amount of traffic-generated air pollutants. For each cluster, it was established the relationship between the configuration of the open spaces using the sky-view factor (SVF), and the average PM10 concentration. This paper aims to present the methodology approach, including the theoretical framework, and to discuss the results and their role within the city's quality of life argument. Results show the impact of urban geometry on the outdoor pollutant concentration, concluding that the increasing SVF leads to the decrease of the PM10 concentration.

Key words: Urban form; SVF; PM10; urban air pollution.

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Contemporary Courtyard Houses – expectations vs. reality

Anita Orchowska *

Warsaw University of Technology, Koszykowa str.55, 00-659 Warszawa, Poland

ABSTRACT

The space of the contemporary European cities and also including Polish cities is very dynamic and spatial. At the base of transformation stands demographic and economic changes. Phenomenon occurring in modern residential architecture associated with changing standards and the needs of modern society make it necessary to take the theme related to the evolution of the conditions of residence and residential space in the urban environment. With a view toward better housing standards and experimental spatial solutions worth using practical and recognized solutions for past periods. The article presents the issue related to evolution and function of the courtyard houses in the contemporary urban tissue. Historical examples of usage of these types of buildings have documented number of functional advantages and benefits, useful and spatial as a result of application of those types of buildings. The analyses undertaken of the spatial and functional settlements of courtyard houses lead to the certain conclusions of simplicity and diversity of those fascinating solutions. Those housing estates were in the past embodiment of the modern city in the social dimension and the guarantor of comfortable residential life and its quality. However this type of building construction is unpopular and very rarely used in development of contemporary Polish cities. Although such buildings fill the gap between very often used multifamily houses of the large cities and single family housing, now is regarded as an experiment in creating new housing environment. The original buildings are often developed and visually changed. What are the reasons: social, economic or the other? Or perhaps need of flexibility, diversity and constantly evolving architecture, all this arising and resulting of the present time changes. The article is an attempt to answer this problem.

Key words: Contemporary; courtyard houses; realities; expectations.

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Modelling diffusion of chloride ions in concrete structures: accounting for corner effect

Diego Pereira *, Margareth Dugarte

Universidad del Norte, Department of Civil and Environmental Engineering, Km. 5 Vía Puerto Colombia, Barranquilla - Colombia

ABSTRACT

Corrosion of reinforced concrete (RC) structures is commonly caused by chloride ions penetrating from the outside and its accumulation on the steel surface; pitting corrosion initiates when a critical threshold value (CT) is reached at the steel concrete interface. Chloride induce corrosion usually takes place in bridge decks and substructure components in the presence of deicing salts and structures in marine environment. Chloride diffusion models applied to concrete structures in similar environments can be used to predict when to expect a critical chloride concentration or a threshold value on the steel surface.

This paper present a modelling effort implemented using Comsol Multiphysics platform. The model simulates the diffusion in concrete under chloride contaminated environments using different geometries as diffusion is the transport phenomenon that prevails in most concrete structures and takes place in the concrete matrix. By knowing the amount of chlorides in the concrete at certain time and the cover depth, the model can estimate whether corrosion has begun in some areas of the reinforcement and the time to initiation for this event. The model included a representation of the phenomena for different 1D geometries that represent elements such as long structural walls, building slabs and bridge decks; as well as 2D geometries which represent concrete beams and piles of bridges. In the case of 2D geometries, the model was formulated to account for the corner effect presented as chloride diffusion occurred in two directions. Model simplifications includes that the chloride concentration at the concrete surface (C_s) and the diffusion coefficients (D_f) were assumed to be constant. The main modelling activity served to obtain the chloride profile in a concrete structure and predict the onset of corrosion for a given threshold value; a method to assess the extent of time to initiation in typical structures and predict durability issues.

Key words: Concrete; corrosion; chloride; diffusion coefficient; marine environment; durability.

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ENI holiday village in Borca di Cadore: rethinking sustainability in conservation and enhancement practices for Modern Leisurescapes

Sara Di Resta *

IUAV University of Venice, DACC Department of Architecture Construction Conservation, Dorsoduro 2206, 30123
Venice, Italy

ABSTRACT

Located in a wood of the Belluno Dolomites, the ENI village represents a total-work that involves architecture, landscape and interior design. Built between the end of the Fifties and the beginning of the Sixties thanks to the Enrico Mattei's political and business ability, the holiday village is an 80,000 square meters large complex articulated by different structures built according to innovative criteria concerning architecture and society. The social value of the village corresponds to the vision of progress and modernity proposed by the company, in which business strategies were not disconnected by the idea of integration, social equality and environment. Edoardo Gellner was the architect who answered to the design requirements: he provided downstream a colony for 400 children, the sports facilities, the community centre, while the church built in collaboration with Carlo Scarpa was situated on a hill. At the edge of the site, a camping in fixed tents was built to host 200 children. The remaining area was occupied by two hotels and a residential settlement with 263 houses. The architectural language evokes the rustic mountain architecture, but it also expresses the innovation transforming the site into a design and technological laboratory. Due to the unexpected Mattei's death the village was never completed. Since 1992, the ENI privatization involved selling the entire real estate assets. Many of the building are actually abandoned or underused. The geological fragilities of the site, the decay of concrete, metal and wooden structures, their waterproofing vulnerability, the obsolescence of the heating system, are waiting for both planning and cultural answers. The current state of the site especially calls for a reflection concerning the issue of sustainability related to the restoration of Modern Architecture. From the environmental point of view, the conservation activities in themselves constitute a sustainable approach due to their intrinsic nature of maintenance and preservation of what already exists, in opposition both to the abandonment and to the consumption of matter and land. In 2014, the town of Borca adopted a urban program that includes measures for the reuse and the enhancement of the village for cultural, social and sports purposes, including new building possibilities. The case-study represents nowadays an actual topic of analysis because it embodies, at the same time: **a.** the requirement to give answers to social issues like childhood, leisure, integration with the environment; **b.** the opportunity to rethink the relationship between man and space, also creating a new sense of community; **c.** the possibility to work on the conservation challenge of modern materials and techniques; **d.** the chance to test the aspects of the adaptive-reuse in keeping resources and values, both tangible and intangible; **e.** the necessity to confirm the cultural relevance of the site also developing a balance between conservation and change.

Key words: Conservation; enhancement; sustainability; modern architecture; modern leisurescapes; environment.

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Sustainable approaches in traditional architecture: the case of a Yuruk village in Isparta (Turkey)

Elvan Kumtepe *, Cetin Sidika

Suleyman Demirel University, Cunur, Isparta, Turkey

ABSTRACT

In addition to being a reflection of the habits, traditions and lifestyle of a society, architecture is a means which is used to shape social values and lifestyle. When we analyse today's buildings, we notice that artificial surroundings which are away from the natural habitat and its effects have been formed. Today it has become a necessity that being in an effort to be involved in eternal powers that nature have, become integrated with the environment we became estranged and built building that sensitive to environment, don't affect human health negatively. Local architectural traditions that being destroyed quickly and sinked into oblivion are quite significant for protecting societies' identities. Our access to most information about history, culture, geography and wildlife is possible with the analyse which is natural and traditional. One of the main goal of this study is to reach a lot of alternatives practical and traditional data that presented in sustainable architecture standard with following the history's trace. We conduct a project which met today's architectural needs with sustainable ways. In this study we are going to include discoveries which are a part of our ongoing research within this project. We specify Isparta as working area. Because Isparta is a settlement that nomad groups used for staying in summer or winter and also be caused Yuruk nomadic ways are within Isparta borders. That's why Isparta has this culture's trace. Yayla of Anamas is built by Yuruk's which we see their reflections in today and which they adopt a nomadic life in West Taurus Mountains. In the foothills of Anamas there is a village named Gedikli in Isparta/Yenişarbademli. Rural architectural tradition in Gedikli Village is going to queried with a holistic approach in sustainable architectural criteria. In Gedikli Village we investigate Yuruk's lifestyle habits which ongoing in Anatolian lands for centuries. This investigation is involve change, development in their life space and the evolution that their life space pass. Our target is to find the trace of Yuruk's authentic habits, traditions and their authentic lifestyle with analyses in their life space and also to carry out architectural identity analyse with aspect of cultural, designment and environmental sustainability criteria. We did analyse of materials details, physical environment and space within purposes and targets that we determined with this analyses we certificate Yuruk culture and space perception. Thus with emphasise of cultural sustainability conscious we will create an extensive data for today and future. In today's aspect sustainability criteria are supplied with advanced technology, big costs and opportunities in a lot of area. Yet one of the most significant approach in the aspect of sustainable architecture is to investigate local architectural data and to adopt today's modern structures. This study is going to be a comprehensive role model to historical, sociological and anthropological but especially to architectural researches about Yuruk Culture.

Key words: Traditional architecture; sustainability; Yuruk culture; the Village of Isparta / Gedikli.

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Integrated sustainable retrofitting solutions for existing large prefabricated panel collective dwellings

Miodrag Popov *¹, Mirela Szitar ¹, Daniel Grecea ²

¹ Politechnic University of Timisoara, Department of Architecture, No. 2/A, Traian Lalescu Street, 300223 Timisoara, Romania

² Politechnic University of Timisoara, Department of Steel Structures and Building Mechanics, No. 1, Ioan Curea Street, 300224 Timisoara, Romania

ABSTRACT

The post-war urbanization process undergone in the former socialist states of Europe generated numerous new state-commissioned housing neighbourhoods near the newly erected industrial cities. The modernist vision of industrialized and affordable housing buildings shaped the new image of the socialist society. In the 1970s, large prefabricated reinforced concrete panel construction was preferred for building the new apartment buildings, based on several types of standardized projects. In the case of Romania, this was the most prolific period of construction that determined the growth of the housing stock to the extent that in 1992 it provided housing for approximately 60% of the urban population of the country. The rapid growth of development and difficult economic conditions led to low-quality materials and unqualified workforce being used in the construction process, resulting in overall low quality, small surface apartments. In the light of the nowadays' society efforts to reduce the building sector energy requirements, this specific building stock is in an acute urge for retrofitting. However, particular property conditions in Romania, where 96% of the inhabitants own the apartments they live in, most of the current global retrofitting approaches remain unimplemented. This paper offers a two-stage retrofitting strategy adapted to the Romanian context and based on the direct needs of the inhabitants, in order to reduce the carbon footprint of these buildings, with a considerable increase in interior comfort. The proposed solution comprising integrated measures ranging from structural interventions, special reconfiguration, accessibility, building services rehabilitation is described and cost-evaluated, proving that the presented strategy is more suitable than the current retrofitting programs being applied.

Key words: Existing buildings; large prefabricated panels; collective dwellings; integrated retrofitting; sustainability.

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The impact of insulation building on the work of ventilation

Ewa Zender Świercz ^{1*}, Marek Telejko ²

¹ Kielce University of Technology, Faculty of Environmental, Geomatics and Energy Engineering, Department of Building Physics and Renewable Energy, Al. Tysiąclecia Państwa Polskiego 7, 25 – 314 Kielce, Poland

² Kielce University of Technology, Faculty of Civil Engineering and Architecture, Department of Technology and Organization of Construction, Al. Tysiąclecia Państwa Polskiego 7, 25 – 314 Kielce, Poland

ABSTRACT

Current trends require a reduction in heat loss through the building casing. The new designing buildings, are not a problem because the most of them are equipped with mechanical ventilation. However, in existing buildings, where the gravitational ventilation is mounted, the thermo-modernization works carried out only warming partitions and replacing windows and doors. Reduce heat losses is associated with reduced, or even blocked, flow of air into the inside. Managers do not treat the building as a whole, ie. the structure along with technical equipment. The analyses show that in objects, where the one and only the change consisted in laying a layer of thermal insulation on the walls or sealing flat roof, were associated with disturbances in functioning of ventilation. The amount of air flowing through the building was reduced and air quality deteriorated or on the partitions occurred fungus. Indoor air humidity increased, despite the lack of changing of use the premises. Moreover, a higher amount of moisture occurred in areas where the only source of moisture is the people. The conclusions of the study is the need for a global view of the building. Sometimes it is sufficient to use another insulating material (allowing for diffusion of air). However, there are situations in which you will need to use mechanical or hybrid ventilation to improve air quality. This approach allows to reduce heat loss while maintaining thermal comfort and avoid sick building syndrome. Fresh air, free from pollution is vital for the healthy functioning of the human in the environment, where he spends most of the time.

Key words: Thermo-modernization; building ventilation; air quality; CO₂ concentration.

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Urban metabolism analysis as a support to drive metropolitan development

Paola Caputo *, G. Pasetti, M. Bonomi

Politecnico di Milano, Department of Architecture, Built Environment and Construction Engineering, via Bonardi 9, 20133, Milan, Italy

ABSTRACT

The research concerns the topic of urban metabolism as a method to orient policies at urban/territorial level. As suggested by other researches, a metabolic analysis of the urban environment could help planners and managers to improve resource use in cities; to reduce environmental degradation; to identify environmental impacts of energy, material, and waste flows; and to isolate problem areas in need of attention. The metabolic framework implies a deep knowledge of the main local input and output flows of energy and matter. This involves in particular energy and environmental accountability. There are thus some difficulties to develop a comparative metabolic analysis of more territories. The research takes origin inside a wide national academic study of post metropolitan territories in several Italian urban regions and focuses, in particular, a square territory of 100 x 100 km² around the centre of Milan, in northern Italy. The main local input and output flows are analysed for each municipalities (904 in total) considering the available regional databases. Urban metabolism is investigated by the application of a fuzzy logic model (a hierarchically organized system of variables and their fuzzy evaluations using a cascade of Takagi-Sugeno models). The overall structure of the model, the definition of the subsystems (built environment, people mobility and socio-economic context in relation to quality of life), the set of the indicators, the adopted benchmarks and the levels of importance of the variables are calibrated on the actual context of application. The model provides as synthetic outcome the UEI (urban efficiency index), which is very clear from the point of view of interdisciplinary approach. Therefore, this kind of index can support policy makers, public utilities, urban designers and other stakeholders in defining strategies for improving the performance of the different urban areas looking at their features, weaknesses and potentialities. Further, the structure of the UEI underlines the important role of utilities and their effects. This study represents an important occasion for applying the metabolism approach to a well-known territorial context and compare several territories at once.

Key words: Urban metabolism; Lombardy Region; sustainable urban development; territorial planning; urban utilities.

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Transforming a city of Alleys into a city of Spanish-Indebted courtyards

David A. Driskill *, Timothy J. Elliott

Texas Tech University, College of Architecture, Urban Tech, 1120 Main Street, Lubbock, Texas 79401, USA

ABSTRACT

This sustainable design proposal for the redevelopment of Downtown Lubbock, Texas draws upon the courtyard traditions of Barcelona and the success of two new urban plazas elsewhere in Texas. The City of Lubbock, located on the Llano Estacada mesa, has been inspired by Spanish architecture since the early 20th century as evidenced by its major churches located in the city's core and the campus architecture at nearby Texas Tech University. This proposal argues that urban courtyards and public plazas, created with existing urban residuals, have the potential to create sustainable, developer-friendly blocks in the urban core. This sustainable catalytic development proposes converting alleys into Spanish-style courtyards in the city's core. The development, at the cross axis of Broadway Avenue and Avenue J, consists of four blocks, each of which would house an internal courtyard, interconnected by former alley ways. In addition, this development restores a historic county plaza by closing an existing street that currently splits the plaza in half. This series of Spanish-indebted courtyards, constructed within the existing infrastructure, would both reflect the city's embrace of Spanish Renaissance design and make the downtown area more appealing to developers and citizens. The project's flexible use of significant residuals retains much of the existing urban fabric, reshaping the space with a series of active and passive courtyards. This project assembles larger development parcels around new courtyards interconnected with the existing alley infrastructure. These courtyards enhance the urban space by accommodating commerce, performance, play, and contemplation. The existing downtown space consists of small 260' square blocks that are divided in quadrants with alleys resulting in even smaller 120' square parcels. This sustainable approach to restructuring the urban fabric contrasts with large scale developments that level existing structures and construct commodity architecture—an approach that emphasizes architectural formulas over specific context. This catalytic plan provides alternative large scale, sustainable development opportunities by including existing residuals in the creation of desirable outdoor urban public space. Our plan has been well-received by city council members, average citizens, downtown businesses, external architectural reviewers, and several potential developers. This proposal places the city and county of Lubbock, who own the alleys and infrastructure, into a leadership and collaborative role in redeveloping downtown.

Key words: Urban plazas; sustainable urban design; urban redevelopment; public space; economic development.

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Analysing socio-environmental, life situation, and attitudinal influences on perceived obesity in consideration of individual and social activities as intermediates

Tae-Hyoung Tommy Gim *

Seoul National University, Graduate School of Environmental Studies, Gwanak-ro 1, Gwanak-gu, Building 82, Room 222, Seoul 08826, South Korea

ABSTRACT

The perception of obesity is affected mainly by environmental, life situation, and attitudinal variables. Using comprehensive data from the Seoul Survey, this study aims to examine their relative magnitudes. In particular, the obesity is evaluated on a five-point rating scale (from “very thin” to “very fat”) in relation to a total of 29 life situation variables (15 household-level and 14 individual-level variables), 27 socio-environmental variables, and 8 attitudinal variables. In a research model, these variables are specified as direct influences on the perception as well as indirect ones through their effects on social and individual activities as measured by 14 behavioural variables. While the Seoul Survey is conducted each year, the 2009 version uniquely asked about the obesity and thus, this study uses its data that represent 46,153 individuals from a randomly sampled 20,000 households in Seoul, South Korea. Among the variables of the life situation, social environment and attitudes—without consideration of the behavioural intermediate variables—a structural equation model finds that married females in debt are the mostly likely to feel they are fat. Following these life situation variables, socio-environmental variables are found to be important: Compared to those living in the urban centre, north easterners tend to consider they are fat, particularly if they were born in Seoul. Among the attitudinal variables, people with a retirement plan have a tendency to feel fatter. By controlling for a large set of variables, this study finds that many of those proxies that have been reported to be significant, such as income and social status, are actually not so. Notably, the levels of satisfaction with the pedestrian environment in the urban centre and residential area are insignificant, but the satisfaction with green spaces makes people perceive to be thinner. As expected, the satisfaction with taxi conditions is not significant, but that with bus conditions has a negative effect on the obesity. If behavioural variables are considered, the variation accounted for by the analytical model becomes larger by about five times. Specifically, among the behavioural variables, whether being on a diet turns out to be the strongest correlate with the obesity perception. Secondly, compared with automobile commuters, those riding public transit and those using nonmotorized modes for commuting appear to be thinner. On the contrary, commuting time is not even a significant variable. Physical exercise is also significant while bike use is not. Lastly, time spent for watching television is positively related to the obesity. The findings of this study strongly confirms the relationship between the social environment and the obesity by controlling for a large number of variables and overall, they imply that better transit systems and the favourable environment for alternative modes to the automobile, including buses and nonmotorized modes, can help reduce the proportion of the obese population by facilitating physical activities in their daily lives.

Key words: Obesity; social environment; life situation; attitudes; activities; structural equation modeling.

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A sustainable core sunlighting system for multi-storey buildings

Liliana O. Beltrán *

Texas A&M University, Mailstop 3137, College Station TX, 77843, USA

ABSTRACT

In order to save energy, we usually live and work in buildings that are often isolated from natural light and where electric light is often around 200 lux and seldom exceeds 500 lux. In recent years core sunlighting systems have been explored because of their potential to introduce natural light further into building cores. This paper presents a long term monitoring of one recently developed: a passive horizontal solar light pipe system for multi-story deep floor plan buildings. The light pipe system was designed to deliver natural light in building cores (6 - 12 m from the window wall) using an optimized geometry and high reflective materials. The current light pipe system was developed for latitude 30.6°N in a predominantly sunny and clear sky location with an annual 81% of clear and partly cloudy days. The light pipe prototype uses a relatively small inlet glazing area, 0.3 m by 1.5 m, to efficiently redirect sunlight at distances up to 12 m from the window wall. The challenge of the design stems from the large variation in solar position and daylight availability throughout the day and year. A 360-degree rotating experimental room was built to test the light pipe performance at different orientations. The experimental room represents a section of a deep open plan office space of 3.6 m high, 6.1 m wide, 9.1 m long, with an area of 56 m². Photometric measurements in South-, East- and West-facing orientations have shown that on clear and partly cloudy days at 8m from the perimeter, the light pipe introduces bright light at the back of the space, with illuminance levels ranging from 300 - 2,500 lux for more than 9 hours between 8:00-18:00. The highest illuminance values (above 1,000 lux) are achieved consistently for about 5.5 to 6.5 hours under clear sky conditions. The light pipe, in combination with sidelight windows, illuminates evenly the workplane and the back of the space. The space shows an overall uniform daylight distribution, the sidelight window illuminates the front of the room and the light pipe illuminates the back. Illuminance values at 4.5 m to 8.5 m from the window wall are higher than at 3.6 m. The high illuminance levels introduced by the light pipe at the back of the space demonstrates the efficiency of the light pipe design, which with an opening of 5% of the sidelight window area provides 5-6 times higher illuminance levels than those provided by the sidelight window at the back of the space. This passive horizontal solar light pipe proves to be a sustainable technology that utilizes direct solar energy with no operational costs, and provides high illuminance levels of full-spectrum light without the negative effects of glare and solar heat gains that are found in buildings that aim to introduce more daylight with large expanses of glass.

Key words: Daylighting; sustainability; energy-efficiency; solar light pipes; building envelope.

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Alternatives for reducing the visual impact caused by the construction of wastewater treatment plants in Monfragüe National Park

Montaña Jiménez-Espada *, Rafael González-Escobar, Beatriz Montalbán Pozas

University of Extremadura, School of Technology, Avda de la Universidad s/n, CP-10071, Cáceres, Spain

ABSTRACT

In recent years, pollution of rivers and natural channels has increased significantly due to indiscriminate dumping of untreated sewage. With the purpose of finding a solution to this problem the European Union imposed an obligation to treat wastewater. The implementation of European legislation has encouraged increased construction of wastewater treatment plants which has caused a modification of landscape environment in some populations. This study aims to provide some solutions in order to mitigate the visual impact of these constructions in locations close to natural environments. To perform the analysis, a quantitative method of landscape assessment supported by images obtained in situ and a series of computer simulations was used. Subsequently, a survey was conducted to compare the results of quantitative analysis and visual perceptions of outsiders to the methodology employed. Once completed quantitative analysis and obtained the results of the survey, it can be concluded that perhaps a good solution could be to bury this type of construction. Since it is not possible to implement this solution, simulating the natural environment of the area under investigation is considered the most suitable option if the aim is to reduce or eliminate the influence it could have on the vision of an external observer this type of construction.

Key words: Grassland; sewage treatment; landscape; visual perception; computer simulation.

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Towards the eco-district rehabilitation: an assessment of obsolete district in Malaga (Spain) using eco-city indicators

Carlos Rosa-Jimenez *, Maria J. Marquez-Ballesteros, Nuria Nebot

University of Málaga, School of Architecture, Campus de El Ejido 2, 29071, Málaga, Spain

ABSTRACT

Urban obsolescence is a widespread problem, the UN warns of inequality problems in many cities worldwide. As cities have grown in size and population, their spatial, social and environmental harmony of urban dimensions has decreased. In Spain, most of important cities have the same problem of messy settlements, substandard housing and spatial segregation. Carretera de Cádiz in Málaga (Spain) is an example how fast construction of 60-70's neighbourhoods surrounding city has degenerated into rapid obsolescence. This is due to different causes: the construction conditions, an inadequate maintenance and necessary repairs of buildings, loss of comfort-conditions by new up-loaded quality standards, traffic problems or new equipment needs. Obsolescence is a morphological problem, often associated with progressive emptying of buildings and urban areas by social classes, which look for better settlements. Once process starts, it feeds on itself and becomes progressively worse due to functional, social and economic degradation and deterioration. The eco-cities appear as a promise for sustainability, they are comprehensive construction urban projects that meet all the requirements of CO₂ emissions and waste reducing. Eco-city concept is a well orientation about how sustainable district can be. The contribution of this paper is to define a range of parameters to refurbish an obsolete district into an eco-district. This paper makes an adaptation of eco-city criteria to the particularities of districts: 28 indicators are chosen to consider specific inherited urban reality, in attendance to the characteristics of high density units analysed. In the methodology, the area is divided to rehabilitate environmental and functional units. The assessment of the environmental units allows us to know the degree of urban disintegration, due mainly to the absence of urban design. The main results indicate that the problem is the provision of parts and housing density. The first is the result of a planning based on the mere placement of architectural objects, and the second requires having some provisions that were not originally projected, and that his resourcing during the decade of the 80 caused problems insertion in the plot existing as well as free public space reduction. This has caused most of the free space is road or has no ability to live together (in what we call residual space), and due to the lack of parking spaces in buildings, has to give much prominence to the car, reducing the possibilities of a space relationship.

Key words: Eco-city; urban obsolescence, rehabilitation, sustainable indicators.

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Rural churches – adaptive reuse vs. historic preservation

Tomescu Raluca *

Politechnic University of Timișoara, Piata Victoriei nr. 2, 300006, Timișoara, Romania

ABSTRACT

The religious landscape is changing nowadays, not only in Romania, but in most European countries. In the same time, the rural environment is facing dramatic shifting of its previous social and ethnical character due to relocation in urban areas, lack of financial resources, political strategies and infrastructure. Some religious communities abound, while other traditional Christian congregations are mostly in decline. Churches are often losing their original function, with a considerable impact not just on the community, but for society at large. Cult buildings have not only religious value, but architectural and symbolic meaning for generations. Even unlisted, the churches become part of our cultural heritage.

Although the number of cult buildings overwhelms the number of social facilities, actual tendency stands for building new churches without real meaning for the small rural society. Meanwhile, cult building with historic significance are degrading rapidly. This study sustains the idea that even without the original purpose, the church should continue to have a positive impact in the community. Churches are socially valued buildings, their restoration and proper maintenance could share value on the surrounding properties. The intervention targeting the church as the centre of rural community - urban acupuncture - transforms it into an intern pole for regeneration` (R.T. 2015).The issue of investing the church with new function is perceived differently, according to the religious denominations. Suitable functions would be community-based uses, in respect with its heritage value. Meanwhile, the historic preservation is reserved mostly for the valuable heritage churches, with regional / national significance. The small communities with unlisted cult buildings cannot afford restoring and maintaining their sacred spaces. The purpose would be re-emerging a landmark with a positive role within the society.

Key words: Church; rural communities; restoration; adaptive reuse; good practice.

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The vulnerability of Algiers' waterfront and the new urban development scheme

Ouassim Chemrouk ^{*1}, Naima Chabbi Chemrouk ²

¹ Université Paris-Sorbonne (Paris IV), Ecole doctorale de géographie de Paris ; unité de recherche : Espace, Nature, Culture, Paris, France

² Laboratoire Architecture et Environnement, Ecole Polytechnique d'Architecture et d'Urbanisme, EPAU BP N°177, Algiers, Algeria

ABSTRACT

The main argument of this paper is that the natural balance of Algiers' Bay is endangered by the massive introduction of large and high-density urban projects. It identifies the physical characteristics of the Bay and highlights the vulnerability of this entity as an ecosystem particularly fragile. And even if, the phenomenon of urbanization concerns most of the Mediterranean coastal areas and cannot be avoided, the research presented in this paper shows the negative impacts of these urban developments and argues for the preservation of the natural features of waterfronts. On a second step, the Coastal Area Management Plan (CAP) proposed for the development of the Algerian coastline will be confronted with the realities of its implementation on the bay. In effect, the Algiers coastal zone and in particular Algiers bay are at a crucial stage which requires harmonization of the imperatives of economic development and environmental protection. Some results of the CAP related to sustainability of these areas and different trend scenario will be presented and will serve as arguments for the evaluation of new projects over the bay. Key indicators were introduced by the CAP experts to propose the shift in the Algerian coastal region towards a more sustainable development in the 2015/2020 horizon; we will use these indicators to evaluate the facts in 2015 after the introduction of priority development projects on the bay.

Key words: Vulnerability; bay; waterfront development; density; sustainability.

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Brownfield topic in the Czech legislation

Zuzana Kramářová *

VŠTE - Institute of Technology and Business in České Budějovice, Department of Construction, Okružní 517/10,
370 01 České Budějovice, Czech Republic

ABSTRACT

The issue of brownfields is currently a very significant factor affecting the sustainable development of the society and construction business themselves since unbuilt areas are ranked amongst the most important non-renewable sources. Despite of this undoubted significance of the topic, brownfields are hitherto not adequately supported by the Czech legislation. Due to this fact, there exists no uniform and consistent terminology and classification of this business in the Czech Republic; opinions and research approaches of various scientific and research teams are highly fragmented, and last but not least it makes education with respect to this topic of the expert community as well as general public very difficult. Currently, brownfields are discussed within land-use planning and laws and implementing Decrees (Act no. 183/2006 Coll., the Building Act, and its implementing Decree no. 500/2006 Coll.) only in general terms, and they can only be included in more general categories such as “areas for redevelopment and reuse” (brownfields intended for revitalization to the level of “environment close to nature” cannot be included), or in some cases there are very specific categories such as “pit-heap, dump, stock-pile, etc.” (future land for regeneration / redevelopment) or “old burdens and contaminated areas” (brownfields without burden and contamination cannot be included). Therefore, there is no need for consistent and good-quality land investigation using given methodology as it is the case for other topics such as development of environmental systems, environmental stability coefficient, landmarks or listed sites and buildings. Unless the concept of “brownfield”, or another relevant one-word term is introduced and the topic as a whole receives adequate support within the legislative framework of the Czech Republic, it will be very difficult to enforce regeneration / redevelopment of brownfields efficiently in practice and create comprehensive and long-term functional brownfield databases that would provide the relevant basis for selection of suitable capital investment sites in the specific territorial units to counterbalance “greenfield” capital projects.

Key words: Brownfield; Czech legislation; regeneration; redevelopment.

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Assessment of selected interior flooring materials on indoor air quality

Ingrid Juhásová Šenitková, Michal Kraus *

Department of Civil Engineering, The Institute of Technology and Business in České Budějovice, Okružní 517/10, České Budějovice, 370 01, Czech Republic

ABSTRACT

Indoor air quality depends on many factors, such as temperature, humidity, odours or presence of pollutants. A lot of materials used in the buildings, either as structural materials or as furnishings, are mostly the indoor air pollution sources. Interior surface materials are generally accepted as the main TVOCs emissions source. The chemical and sensory assessment of selected interior flooring materials on indoor air quality is presented within the paper. Air acceptability, odour intensity and TVOCs concentration for selected interior flooring materials (polyvinyl chloride flooring, tongue flooring and acrylic based flooring) were tested. The chemical and sensory measurements were performed in a glass test chamber. The parameters were monitored by different air change rate per hour. Chemical measurement is based on the absorbed TVOCs gas chromatography analysis. The panellists of sensory assessment consist of group of responsible persons from 20 to 38 years (35 % smokers). Each approached subject assesses the odour intensity and the air acceptability. The improving of sensory assessment with increasing the air change rate was not confirmed. Conversely, the unfavourable results are improving with increasing air change rate, in the case of materials with significantly indented and porous surface.

Key words: Indoor air quality; TVOCs concentration; air acceptability; odor intensity; chemical assessment; sensory assessment.

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Location as a determinative factor of building airtightness

Michal Kraus *, Pavlína Charvátová

Department of Civil Engineering, The Institute of Technology and Business in České Budějovice, Okružní 517/10, České Budějovice, 370 01, Czech Republic

ABSTRACT

The paper deals with location and exposure of the building in terms of building airtightness. Airtightness of the building envelope is one of the basic prerequisites of energy-efficient buildings. Energy efficient buildings situated in areas with lots of wind and in exposed locations could constitute up to 10 % of total heat consumption. The exchange of air through the building envelope is conditional on pressure difference between interior and exterior. The pressure difference is usually caused by a combination of wind effect, stack effect, combustion and ventilation. The location and its parameters (exposure, altitude, wind, temperature and other) can be considered as passive determinative factors of air permeability of the building envelope. The surrounding environment of the building does not have a direct impact on the final airtightness of the building envelope. However, the exposure of the building, the altitude, the strength and wind speed have a significant impact on the pressure effects acting on the building. Pressure effects affect the amount of air flowing through leaks, cracks and gaps in the building envelope. The higher the pressure effects on the building is, the higher the air flow through the building envelope is. The aim of the paper is to verify, or reject, the potential impact of basic parameters of location on the final airtightness of the building envelope. The possible statistical dependence is tested by using test of independence. The calculated levels of significance (Sig.), also called as p-value, are compared with a reference level of significance α (5 %). Fundamental data for testing consists of 150 energy passive houses built in the years 2004 -2014 in the Czech Republic.

Key words: Airtightness; air permeability; building envelope; energy-efficient building; test of independence.

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The economics and politics of process innovation and the sustainable urban development

Marek Vokoun *

Department of management, Institute of Technology and Business in České Budějovice, 370 01 České Budějovice,
Czech Republic

ABSTRACT

The paper analyses process innovators and non-innovators and their characteristics and strategies. The sustainable urban development is dependent on many factors. One of them is the ability of large companies to adapt to changes. The likelihood of engaging continuous process innovation is higher for larger firms in the Czech manufacturing industry. Large companies are important part of region and their instability can negatively affect the whole region. Being part of a business net (part of a group, innovation cooperation activities) is a positive determinant of process but only in certain stages of innovation process. The public policy aimed at regional technological hubs and networks can provide necessary boost for regional development rather than grants and public subsidies for innovation projects.

Key words: Process innovation; business risks; urban planning; sustainability.

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Transport Master Plan versus Sustainable Urban Mobility Plan – Experience from Bratislava City (Slovakia)

Tibor Schlosser *

Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Department of Transportation Engineering,
Radlinského 11, 810 05 Bratislava, Slovakia

ABSTRACT

Experiences from the new Transport Master Plan (TMP) of the City of Bratislava, Capital of Slovakia. In the years 2014-2015, the city has worked out the complete, new Transport Master Plan (TMP) according the public procurement condition. There are a lot of data from traffic surveys for analysis of present time and the prognosis for next 25 years of the city. The aim of the article is to show if the outputs, solutions and recommendations of the work fulfil the regulations and needs of TMP and if it cover the content of the Building Act for urban planning. On the other side in EU is a big influence on the cities to work out the Sustainable Urban Mobility Plans (SUMP), which have another goal and do not cover the experts and professionals point of view for cities. Very often the cities have only a political and popular outputs covered by SUMPs and do not have a solid work behind, which must be done for a qualitative development of the cities.

Key words: Urban planning; Transport Master Plan; Sustainable Urban Mobility Plan; traffic surveys; traffic modelling; urban development.

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The urban recovery of unauthorized building: a case study

Claudia de Biase *, Salvatore Losco

Second University of Naples, Department of DICDEA, via Roma, 29 Aversa Caserta 81031 Italy

ABSTRACT

The present study tries to analyse the phenomenon of unauthorised building in a specific territory. The choice is due to the fact that the above phenomenon has a strong territorial impact, as well as a strong influence on the use and consumption of that land. The final aim is to propose a methodology (based on the overlapping of different maps) able to figure out the phenomenon of unauthorized buildings in reference to a specific municipality. The choice of the above-cited municipality is based on two main reasons. First, it is characterized by a high rate of illegal building, in addition to a strong presence of racketeering. Second, it represents an interesting case, not only for the reading of the phenomenon per se, but also for the pivotal role it plays between the provinces of Naples and Caserta. After investigating the phenomenon of unauthorized building in reference to a specific municipality, the paper tries to explain how the urban plan must act – or properly react – in reference to this phenomenon.

Key words: Unauthorized building; planning, urban recovery.

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The Spanish redevelopment of station areas, after a decade of process

Francisco Segado Vázquez ^{1*}, Juan Manuel Salmerón Núñez, Rafael García Sánchez

Polytechnic University of Cartagena, Cartagena Technical School of Architecture, Cartagena, Spain

ABSTRACT

The expansion of the high speed train network in some European countries offers an interesting opportunity concerning the redistribution of activities in the urban space around the station areas, making urban development more sustainable. In Spain this opportunity has been taken into account during the planning process of several important cities. However each station area redevelopment initiative is placed in a very complex framework made up of context variables (institutional states), process variables (organizations and actors), and object variables (urban location and network node considerations). The combination of these, their variation in the long term, and the results are specifically produced by each city. In 1998 authors of *Cities on Rails* concluded that a condition for learning lessons from the development of railway station areas was to improve the understanding of their context and process variables, and that some themes explored with the European cities included in the book needed further refinement and empirical verification. A first approach to this goal directed at Spanish cities was made by the authors of the present abstract with the article *urban integration of high speed trains, institutions of support in Spain and the keys to its success*, published in the *Journal of Engineering Technology* (2014). Research in more depth is now proposed with reference to the increasing complexity of the redevelopment of railway station areas, analysing their characteristic dilemmas in the Spanish last decade of the Spanish process. The goal of this study is to establish whether differences or similarities can be seen that prove European divergence or convergence in this matter, and to what extent.

Key words: Redevelopment of Spanish station areas; process of urban integration; high speed train network, European convergence.

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Understanding the governance system in the Campus Development; the cases of Norwegian University of Life Sciences and Norwegian University of Science and Technology

Savis Gohari ^{*1}, Terje Holsen ²

¹ Norwegian University of Science and Technology, Department of Urban Design and Planning, NO-7491 Trondheim, Norway

² Norwegian University of Life Science, Department of Landscape Architecture and Spatial Planning, PO. Box 5003, NO-1432 Ås, Norway

ABSTRACT

The purpose of this research is to understand the governance system in the university campus development process in Norway. Norwegian cases can provide appropriate examples to study governance because of two main reasons; Firstly, local governments in Norway have historically performed crucial development functions. Secondly, the national government places a great emphasis on dialogue and cooperation between the state and cities and between public and private parties. This paper is based on the findings of the two different cases in Norway; Norwegian University of Life Sciences in Ås and Norwegian University of Science and Technology in Trondheim. A new and modern, but still historically grounded tradition in Norway views the university as a product of its relationship with the city and its urban surroundings, with a strong belief in a university of the city, and not simply, in the city. Considering the 'university of the city' concept adopts different focuses at different stages, involves many internal and external stakeholders, and attracts divergent interests and power relations. A main result of this study is that a successful campus development depends to a large extent on the process of exchange and governance between the national government (mainly the Ministry of Education) and the universities in Norway. A delay in the campus development process can be a result of the university's neglect of the role and power of the national government. The campus development may not be accomplished, if the governance is based primarily on a self-organizing network within the universities. The governance can be considered as a new strategy based on the plurality and complexity of both hierarchies and heterarchies. The national government should influence institutionalization of the local governance and the degree of autonomy among the local actors (university and municipalities) in order to flow the development processes. According to the findings, developing a mutual benefit and managing the contradictions demand continuing dialogue and resource-sharing between the university and national government, which is superior to the local government's collaboration. In this regard, the national government is recommended to play a significant role, as a prime actor in facilitating the process of networking, negotiation and coordination between local actors. At the same time, the government should try to reduce hierarchical features through decentralization and provide regulations that each local actor can agree to. In this view, national government helps universities to establish and sustain their (re)institutionalization to adapt to the development circumstances; not by having a complete power but by indirectly and imperfectly steering local networks.

Key words: Governance; university; campus development; Norway.

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WebGIS solution for urban planning strategies

Carmen Grecea, Sorin Herban, Clara-Beatrice Vilceanu *

Politechnic University of Timisoara, Department of Overland Communication Ways, Foundations and Cadastral Survey,
Traian Lalescu no.2, Timisoara, Romania

ABSTRACT

In line with the objectives established by the “European capital of culture” initiative, the entire community is involved in embarking socio-economic and infrastructure projects supported by an information platform which ensures efficient data management for the municipality. This platform should provide a good visibility of the candidate city in the context of enhancing the contribution of culture to its long-term development in accordance with its priorities and strategies. In particular, an important role is played by the implementation of a spatial data geoportal at Local Administration level (Timișoara City Hall) to streamline the data workflow and provide easy access to it in order to increase the visibility of cultural and historical heritage of the municipality. The need of this geoportal arises from the fact that Timișoara has the widest architectural heritage area in the country, of important value to both Romania and Europe. The preservation of this cultural heritage is a duty for the authorities and also for the owners. The present paper brings forward proposals and trends in implementation of a dedicated geoportal for the management of heritage objects to complete the existing urban GIS primarily aiming to contribute to fostering the urban planning and the sustainability of the “European capital of culture” project. This geoportal should include the 3D models of the cultural heritage objects for better preservation over time or restauration purposes and offer virtual tourism tours if they are made available by means of webGIS. That is why, the authors propose a webGIS solution in order to make the geoportal available on the City Hall’s webpage. The actuality of the paper is given by the fact that preserving cultural heritage and historic sites represents an important issue that must be taken into account when urban planning projects are required for developing the model of urban growth.

Key words: Urban planning; GIS; cultural heritage; sustainability; European capital of culture.

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Planning the city against barriers: enhancing the role of public spaces

Aleksandra Sas-Bojarska *, Magdalena Rembeza

Gdansk University of Technology, Narutowicza 11/12 street, 80-233 Gdansk, Poland

ABSTRACT

Contemporary cities are being fragmented by growing number of technical barriers like roads, railways, infrastructural objects generating variety of problems of different nature. The aim of the research is to present the issues connected with such barriers in the city and the ways of solving them. The results of preliminary investigations indicate that the main problems are for example: the destruction of the complexity of urban fabric, functional disadvantages, environmental threats and reducing urban landscape's value. In order to avoid such negative effects, city should be designed as a coherent organism in terms of spatial, environmental, infrastructural, social and visual aspects. The various "in-between" areas should connect an urban tissue rather than divide it. A major technical approach should be complemented with humanistic design aspects. This can be obtained due to well designed and functioning public spaces. The role of such spaces should be connecting urban fabric for the benefit of society. Well-designed and functioning public space is the essence of a city. However, good public space should meet a number of conditions. When creating public space it is important not to limit it only to its physical attributes but it should lead to strengthening relationships. The public space has to fulfil certain functions, be safe, accessible, and attractive. Only such public space can effectively connect urban fabric, fill in "in-between" areas by new quality and function, not only in a spatial way but also by improving the urban life and making the society happier. The main conclusion is that creating such space is possible due to the use of existing planning and design tools like urban planning and landscape architecture.

Key words: City planning; technical barriers; humanistic design; public spaces.

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Urban planning and mobility critical issues in post-earthquake configuration: L'Aquila city (Italy) case study

Gino D'Ovidio, Donato Di Ludovico *, Giovanni Luigi La Rocca

University of L'Aquila-DICEAA, Via G. Gronchi, 18, L'Aquila, Italy

ABSTRACT

This paper reviews the critical issues of the current urban planning, mobility and accessibility corresponding to the post-earthquake (2009) settlement configuration of L'Aquila urban area (Italy), the medieval centre of which is unique for the architectural and artistic heritage. L'Aquila has about 70,000 inhabitants with significant historical heritage and is both an important cultural/university pole and the main political centre for Abruzzo region. The purpose of the study is to analyse the L'Aquila urban planning experience and to trace the relationship between the mobility/accessibility and the spatial form and organization of the city. The study briefly considers the contemporary scene, both as an evolutionary composite of the past and as a dynamic scenario where natural forces and decisional choices have imposed a different future. Following an overview of the cultural and historical foundation of L'Aquila inside the city wall (1254), the study introduces and describes the actual urban configuration due to the heart-quake disaster. The accessibility and mobility issues are analysed in comparative way in relation to the pre and post-earthquake spatial form and organization by applying and integrating urban planning and transportation analysis techniques. Due to the almost complete structural damage of buildings, the historical centre (about 1.7 square kilometres) has lost its original social and functional attractive rule that it had with respect to the surrounding area since its foundation. The post-earthquake urban planning dynamic, has given a centripetal action that caused a construction of 19 new-quarters (C.A.S.E. – antiseismic, sustainable and environmentally friendly housing complexes) and new location of all the social and settlements functions in a wide territorial area with a maximum extension along the east-west direction of about 19 km. An high fragmentation of the facilities localizations and a very low population density (147,62 inhabitants/ km²) have been obtained in a very short time (about two years). Due to the transport demand fragmentation, the current public transport system, based on the exclusive use of buses, is absolutely inadequate and therefore the use of private vehicles is significantly increased bringing problems of the environment and transportation costs. As result, the accessibility and mobility of the residents of L'Aquila were strongly worsened, especially those living in the new-quarters (C.A.S.E.) and of the strategic places (public and private offices, education and health care institutions, job clusters and so on) within the urban territory. Within this framework, the results of the study clearly show how the distinctive spatial structure and the geographical re-organization dominate each stage of urban transportation phenomenon. Finally, the study introduces a proposal of public transportation system integrated to an existing intraurban railway a section of which has been re-designed in order to be used at high frequency for urban service.

Key words: Urban mobility; urban planning; earthquake disaster; post-earthquake reconstruction; public transport system; urban morphology.

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A study on the relationship between land use around railway stations and the railway station passengers in Tokyo (Japan) metropolitan area

Takashi Nakamura *

Tokyo City University, 1-28-1, Tamazutsumi, Setagaya-ku, Tokyo, 158-8557 Japan

ABSTRACT

Japan has been facing problems related to decline of population and aging. Also Tokyo metropolitan area is estimated depopulation and hard aging. Additionally a new urban planning that targets the reduction of automobile dependence and the use of public transit is required for realization of sustainable city. Tokyo metropolitan area is originally excellent in railway usage on commuting transit. Under this situation it is important that railway passengers preserve. I study the influence of land use patterns and aging around above 340 railway stations on railway passengers from the viewpoint of sustainable rail transit service and urban regeneration in Tokyo metropolitan suburban area, especially viewpoint of TOD (Transit Oriented Development). In this study I set railway station influence area 800m in land use analysis and 500m in population aging analysis. I use railway passenger's data from 1999 to 2009. In this study land use classification is farmland, forest, low-rise housing, crowd low-rise housing, middle and high-rise housing, commercial and business use, park and green land, manufacturing, public institution and development land. As a result, it's found that aging around railway station affect decrease railway passengers and mixed land use around railway stations has a constant effect on the increase and retention of the number of railway passengers. On the other hand, the station around sprawl area without planned urbanization showed remarkably decreases of passengers. Therefore, it's important to perform mixed land use around railway station, urban redevelopment around railway station at unplanned sprawl area and improvement in convenience of transportation nodes.

Key words: TOD; land use pattern; passengers of railway station; mixed land use; population aging.

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Participative budgeting in Poland – missing link in urban regeneration process?

Dorota Kamrowska-Zaluska *

Gdansk University of Technology, Faculty of Architecture, Department of Urban and Regional Planning, Poland

ABSTRACT

In last thirty years Poland has gone a long way from centrally-steered system to free-market economy and the most important toward democracy. Country went through the process of decentralization. In the same time role of public participation in planning is increasing rapidly though the way the public consultation process is conducted still need improvements. Recently many new instruments of empowering the community is being introduced. One of the most important is participatory budgeting which is becoming more and more present in polish cities. On the other hand urban regeneration is one of the most important challenges of polish cities, more than half of the historic structures of Polish cities are some kind of regeneration or in many places also social and economic revitalization is essential. This situation is caused by lack of investments and modernization urban tissue for last few decades, as this was never priority of former system governments. Recently Polish National government acknowledge the importance of the problem. Last year legislative work to introduce for the first time Bill on urban regeneration on national level accelerated. In last decade many comprehensive regeneration programs were prepared. But though there EU funds relatively easily accessible for single regeneration projects it is difficult to finance comprehensive and integrated ones. Construction of operational programs and limited resources lead to isolated actions – so called “confetti regeneration”. Technical and transport infrastructural investments which are parts of comprehensive regeneration programs are financed public sphere. We can also observe increasing role of NGO’s in neighbourhood regeneration process but their scope of actions is mostly limited to soft projects. It is justified to rise a question if participatory budget can fill this gap and be a source of financing local community needs? Paper will show examples of projects financed from participatory budget in three polish cities: Poznan, Gdansk and Sopot. It will also consist of analyses of structure of participatory budgets expenditures and influence of projects on neighbourhood and city. Paper will try to asses long term influence and identify barriers, challenges and opportunities of using this instrument in urban regeneration process.

Key words: Participatory budget; urban regeneration process; Poland.

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Analysing indexes of urban green space ecological planning

Yu Tang *, Tiemao Shi

Shenyang Jianzhu University, School of Architecture and Urban Planning, Hun Nan East Road No.9, Hun Nan New District, Shenyang, Liaoning, China

ABSTRACT

At present in China some conventional indexes are used for the urban green space ecological planning, such as greening rate, green area per person. These could not reflect the ecology of urban green space. For green space ecological planning plays more and more important role in urban planning, More ecological indexes are needed to applied in urban planning in order to ensure the sustain of urban green space. Three group of indexes of ecology are discussed in this paper, which are closed related to urban green space ecological planning. One is about the green biomass of urban Vegetation, which includes total green biomass, three-dimensional green biomass, etc. One is related to the heterogeneity and diversity of green space, which includes granularity, contrast, patch isolation, patch accessibility, interaction, dispersion, landscape heterogeneity, landscape diversity, fractal, contagion, fragmentation, affinity, etc. The third one is the indexes of the structure of urban green space. Some indexes about green patches, green corridors and green nets are discussed the relationship to green space ecological planning. These indexes above are applied for enhance the level of green space ecology in the urban planning stage, which is the basis of establishing an ecological system of urban green space.

Key words: Urban green space; ecological planning; indexes.

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Synthesis search of urban space and forest area

Aija Ziemeļniece, Una Īle *

Latvia University of Agriculture, Faculty of Rural Engineering, Department of Architecture and Building, Rīgas iela 22,
Jelgava, Latvia

ABSTRACT

The prognostic has an important role in the regional spatial, balanced and sustainable urban development planning processes, determining with scientific and analytical methods the ways of achievement of different scale regional population and its optimization in a certain time period. On planning the achievement of the expected project objectives, existed already structural spatial development specificity, the time and the tempo of the environment can't be ignored. On projecting the structural design development processes of the architecturally spatial planning of the urban and rural settlements – integration, differentiation, transformation, reconstruction, and recovery – balanced and sustainable cyclic or threshold shaped development of these processes should be ensured. The aim of the study is to evaluate the existing urban building and its connection with the existing forest areas, transforming them to wood parks serving both as recreation spaces, and building areas of Mežaparks type. The assignments of the study are linked with transformation processes of 70s – 80s of the 20th century, bringing in rapid changes of suburb areas. The study focuses on the existing garden areas, as well as urban building structure influenced by the intensity of anthropogenic load. Over the past decade the town-planning trends form new direction that connects both the recovery of historical building, and deliberative conservation of certain existing green areas. On moving the development conception further and looking closely separately the southwest and southeast parts of the city, it is evident that existing suburban forest areas retain a great potential for green recreation or rest zone creation.

Key words: Urban landscape space; synthesis; aesthetic quality; cultural heritage; transformation process.

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Type and size of urban cell as tools for sustainable urban (re)development

Alena Bindzárová *

Slovak University of Technology in Bratislava, Faculty of Architecture, Institute of Urban Design and Planning, Námestie slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

Throughout the history of a human civilization, we are witnessing a phenomenon of a demographic explosion imprinted in the Earth's surface. Our environment bears a footprint of evolutionary signs of human activity - creating settlements growing in the sense of geometric progression: bigger areas, higher buildings, more inhabitants. On the basis of newly discovered activities, economically profitable locations and materials, human society is building its dwelling and working settlements on the "greenfields", undergoing the "golden era" of the business bloom and coming to the decline in future economy. This enclosed process can be observed in historical villages, in rush mining towns, in artificially supported planned mass housing estates in socialist countries; but is the misunderstood and misused way of building and swallowing the natural and arable earth's surface still being taken for normal? On the example of several large-sized development plans from different part of the world, we would like to take a closer look at what is the precarious pattern being copied since the era of 1930's. In recent so called "eco-cities" and "sustainable developments", the urban design section of 21st century master plans will be watched closely. Taking a consideration of current state-of-art of the project and its real form, basic planning tools will be defined, excluding the principals of ecology and sociology for this purpose. Within the complex of multidisciplinary, we will try to extract the urban design to its primary elements: the form and the use. These two categories are the very first tools in the design process, even in the process of teaching at universities, although we do not put the other aspects of a design away. As we recall the observed patterns of today "ghost towns" all over the world, some repeating moments can be found in the urban structure. Since the modern ages, big developments - built in a manner of grid (or former army settlements) - are laying in the popular European and world capital cities, in industrial towns and city districts in particular countries. The size of urban cell has grown to a big "zone" in the 1940's and later, the permeable city "block" of smaller dimensions is becoming more popular. As well as the "monofunctional" or "single-use" areas are naturally self-transforming into mixed use areas, some cities are implementing this fact into their master plans, some do not. What sustainability can be expected from a city or district if the social and ecological part is taken for ideal, and if the physical structure is studied in detail? Can it be that the just scale and intensity of different activities would maintain the life in cities?.

Key words: Urban planning; urban block; mixed use; ghost towns; sustainability.

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Quality, subjectivity and responsibility – The process of (Transport-) planning in theory and praxis

Harald Frey *

Vienna University of Technology, Institute of Transportation, Research Center of Transport Planning and Traffic Engineering, Gusshausstraße 30/230-1, 1040 Vienna, Austria

ABSTRACT

The Swiss sociologist Lucius Burckhardt already introduced in 1974, the question of responsibilities and role models in planning processes, in particular in urban planning. Although the planning processes have been adapted and upgraded with participation elements so far, the question about responsibilities for the results of planning processes is justified to ask. Acceleration and commercialisation affect planning to an extent that enlarges the gap between responsibility, needs and constraints. The social perception of this gap is a decisive factor to facilitate a (public) discussion. This paper will present fundamental principles of planning processes, showing examples from transport and urban planning. System thinking seems to be a precondition to follow the question "what is planning"? Interactions and Feedback-Loops between perceived problems, objectives and measurements are discussed. A public discussion of the role of the community about urban space does not take place. The role of politicians and planners with their dependency relationships seem to be clearly defined. A change is not noticeable, the hierarchy of values is implicitly visible on a pragmatic and project basis, a discussion about a change in the hierarchy of values takes place – in best case - between political, administrative and planner level. The result is a form of technocratic pragmatism which is often dominated and characterized by a business fundamentalism. Basic needs and human qualities are not sufficiently taken into account. The simple calculation that 1m² concrete will be less costly in maintenance than 1m² of green space or even a tree in public urban space determines the thinking and actions. The paper will show that the planning process is determined by political and social forces. Instead of asking "How much has to be planned?", the question "How little can be planned?" should be crucial. This would consider flexibility for future generations and takes present constraints into account. The planner has to reduce the level of complexity of reality in order to make decisions (based on models). The choice of fundamental components is subjective. But the excluded, supposed irrelevant elements can create new problems, which often lie outside of the subjective (and intersubjective) realities. Problems seem to be solved in a short time (e.g. congestion reduction by construction of additional lanes), but with time delay again increasingly occur (more congestion) or due to problem reduction or apparent problem solution, other symptoms occur suddenly (e.g. dying of local supply by rapid transport connections). The paper outlines the necessities and limits of simplifications and the role of qualities and quantities. The use of forecasts in planning also involves the danger of mixing up objectives with expectations (self-fulfilling prophecies). According to the discrepancy between status-quo and objectives, the rules of the conventional process of a system should be changed by intervention. The paper discusses the influence of planning on structures, human behaviour and data and the possible discrepancies between the perspective of planner and user.

Key words: Transport planning; planning process; system behavior; user perspective; decision making.

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Simulating urban expansion 2030 and its impact on green space structure

Amal Najihah Muhamad Nor *, Ron Corstanje, Jim Harris, Tim Brewer

Cranfield University, School of Energy, Environment and Agrifood, MK43 0AL, Bedford, United Kingdom

ABSTRACT

Rapid urban expansion has led to high pressures on green space structure. These gaps extend beyond the uncoordinated master planning strategy which contained lack of required information on the past, present and future structure changes in urban expansion and green space. Therefore, a wide variety of modelling approaches have been introduced to simulate urban expansion. However, the effectiveness of the validation model and simulation of the spatial structure and pattern of urban expansion is still lacking and unexplored. Besides, understanding its differences from the master plan are also not well understood. This study validates and evaluates the performance of an integrated Land Change Modeler (LCM)-Markov Chain modelling approach in Kuala Lumpur, Malaysia; Jakarta, Indonesia and Metro Manila, Philippines for simulating urban expansion and green space. This study also compared the spatial structure and pattern of simulated urban expansion 2030 with the master plan to quantify the impact of land use change projected for the future 2030. We proposed validation based on the percentage of agreement between the actual and simulated map of 2014. The agreement of LCM- Markov Chain modelling was then employed to simulate urban expansion 2030. The spatial structure of simulated 2030 was compared with the master plan using spatial metrics. LCM-Markov Chain modelling was proven to be suitable for simulation of the future. Urban expansion of simulated 2030 continued to grow in Jakarta and Metro Manila. Here, increased fragmentation of the landscape will continue in 2030, more shape complexity will be observed and less connectivity between green space patches will be present. In contrast, urban expansion in Kuala Lumpur is greater in the master plan than simulated 2030. There are important differences in the spatial structure of simulated model and master plan in different cities and there is evidence that this is due to the lack of empirical information, management and planning policies. This research represents a new method for interpretation of validation results and is one of the few studies integrating simulation modelling and landscape ecology analytics. Therefore, the use of integration is significant in understanding the spatial structure of future urban expansion and providing the constraint and intervention for future planning and management of green space in the cities.

Key words: Rapid urban expansion; urban master plan; urban green space; Land Change Modeler-Markov Chain; spatial structure and pattern, planning and management.

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Urban sprawl's effects on urban pattern

Nese Aydin *, Erkan Polat

Suleyman Demirel University, Cünür, Isparta, Turkey

ABSTRACT

After the industrial revolution, industrial activities and technological power had been increased. This increment had been caused many changes and transformations in all cities. Today there also exist, in almost all cities, public and private buildings, buildings for assemblies or for single individuals, for rest and industry, for music and silence, for honouring or punishing, for hiding or displaying, for production or consumption, for commercial and industrial purposes, for defence and for war. With the differences in land use every spatial unit has been chosen its specific space in different places in city. And that's why growth type of cities has been changed and it started to show differences. Some of these space usages choose city centre, some of them choose distant spaces from city centres (fringe areas). Because of this choice suburban had been occurred. Gradually cities began to spread, expand, grow and become closer to the rural areas on the sprawl of the cities. This situation reveals urban-rural fringe areas which of them are disconnected, far from the city centre and without continuity and identity. Here this situation observed in city is called 'urban sprawl'. Today sprawling of cities to city's borders/edges/peripheries has been increased. And this seems to be an unstoppable and continuous situation. In this study we research this new style of cities growth and this style's impact on cities pattern. The aim of study is to reveal how urban sprawl occurred and what kind of changes it caused and how it changes city by the time. In accordance with this purpose we analysed city's spatial, social, economic, political, managerial and environmental characteristics. This analyses has been synthesised with literature review, interviews and data collection in public institutions. In conclusion, in this study we handle with cities changeable growth styles and how this growth style change cities pattern gradually.

Key words: Urban; suburban; urbanization; urban growth; urban sprawl.

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The place and role of religious architecture in the formation of urban space

Joanna Gil-Mastalerczyk *

Kielce University of Technology, Faculty of Civil Engineering and Architecture , Department of Architecture and Town Planning , al. Tysiąclecia Państwa Polskiego 7 , 25-314 Kielce, Poland

ABSTRACT

Religious Architecture in cultural heritage plays a unique role, because it is good widely available and one of the most important components of cultural heritage material. Sites remain visible for years and centuries witnessed the historic inter-territorial and events. They are also stimulants for subsequent events. The aim of the article is to present the influence of sacred objects (historical and contemporary) on the formation of their surroundings and to changes in the modern urban environment. Determine their impact on the development of the city structure and urban layout. The basic method of research is the study of cases - including many cases and for different levels of analysis. (Criterion territorial - Kielce - city). The mutual interaction of architectural structures and their surroundings undergoes fluctuations. That is why the research of this kind should be conducted more often and then repeated. The proposed research, due to its unexplored subject matter (contemporary Polish sacral architecture), is innovative in its character. It is based on relatively obscure research material (sacral architecture of Kielce). Sacral objects together with their associated functional environment, have a significant impact on the composition of the urban city. They create an image of public spaces. They are attractive and open to different activities functional structures. Due to the architectural qualities, they have a significant effect on the activation of tourist and business districts and regions, and increase the competitiveness of the city and change its meaning on the national or international level. The complex functional structure of urban, educated around the sacrum, and the associated attractive domination, promotes the processes of change and can become a catalyst for the revitalization of the neighbouring areas. Regardless of the location, latitude, traditions and culture, as well as the styles and the leading trends in the hasty civilization of consumption and market forms of historical and contemporary sacred works form part of the assets in the context of urban structures and play a significant role in the open landscape of the city.

Key words: Architecture; sacrum; urban space; city.

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The VIII CIAM and the urban rehabilitation in Europe

Víctor Manuel Espinosa Muñoz *, Francisco Segado Vázquez

Polytechnic University of Cartagena, School of Architecture and Construction Engineering, Murcia, Spain

ABSTRACT

In 1951, the celebration of the VIII CIAM organized by the MARS group, took place in the English city of Hoddesdon. At the Congress, the insufficiency of the principles of the previous IV Congress in resolving issues relating to urban centres and the need to achieve a substantial improvement in the quality of life of the population are espoused. José Luis Sert, Mary Jaqueline Tyrwhitt and Ernesto Nathan Rogers collected the ideas and thoughts expressed in Congress in a publication called *The Heart of the City: towards the humanisation of urban life*. The choice of the theme of the Congress: the heart of the city, owes its existence to the strong interest in the functions of the urban centre of Jose Luis Sert, who was convinced that contemporary cities should have an important civic centre that managed to satisfy the cultural, social and political needs of the population. The speakers at the Congress, with their reflections and analysis, explained a full range of ideas intended to form the basis of a contemporary city, capable of assuming the challenges that are presented and highlighting aspects that have caused physical and social deterioration of a part of the urban fabric. Urban rehabilitation in Europe during the second half of the twentieth century has three paradigmatic examples that have exerted a great influence on subsequent intervention projects in consolidated urban centres. The rehabilitation of the historic centre of Bologna, the safeguard of Le Marais in Paris and the cautious urban renewal of Kreuzberg in Berlin represent three relevant cases of renewal that show the profound change of mentality regarding the actions in the urban fabric. The three cases prove the growing interest in the preservation of physical and social fabric evolves from being considered as the sum of certain interesting elements to become a whole with its own identity. In all three examples, covering different models of urban setting, a broad overview of the intervention in consolidated urban centres is obtained. The exposure of the paradigmatic cases shows a specific way of understanding interventions in the consolidated centres by acting on a portion of the urban fabric with well-defined and homogeneous characteristics. The analysis of the three plans according to the concepts of the VIII CIAM, provides valuable information about the influence of the Congress in the area of intervention in consolidated urban centres.

Key words: Urban rehabilitation; CIAM; urban centre; safeguard; urban renewal.

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Interview and community participation event about the area history for finding attractiveness of South Town in Prague (Czech Republic)

Yuno Tanaka *, Kiyoko Kanki

Kyoto University, Kyoto daigaku-katsura, Nishikyo-ku, Kyoto, 615-8530, Japan

ABSTRACT

In Czech Republic, the housing estates consist of prefabricated housings developed in the socialist era are often called as "uniform" with negative images. However, these housing estates continue to be one of the main housing stocks in Czech until today and the regeneration of the housing estates has already started in some areas. Therefore, present environments of these housing estates can be reevaluated from the viewpoint of area history. In this paper, South Town (Jižní Město, JM), one of the largest housing estates in Prague, is a case study area. By the cooperation with Prague 11 municipality, the interview research was done in October 2013 with 13 inhabitants and the community participation event "Interesting place of Prague11" was held in September 2015 and about 400 comments were gathered in 3 days. The interviews and the event with inhabitants illustrated that public facilities and transportation systems have been evaluated since the beginning of the housing development because of their accessibility and convenience. At the same time, green areas around JM have been evaluated because they can be used for relaxation and outdoor exercise. In addition, open spaces in JM are highly evaluated compared with them in the socialist era. Through the analysis of the development history of JM and the results of interviews and the event, one of the biggest problems of JM has been the time gap between the completion of housings and other living environmental conditions. Only the panel housings could be completed so quickly at the very beginning of the development, but recently regeneration works for improving the green spaces around housings have been operated. According to the interviews, the upgrading of the qualities of neighbourhoods was evaluated positively, but new housing developments in green spaces were often criticized. The values were pointed out by the inhabitants because of mainly four reasons; utility, memory, personal preference, and public value. About things which have utility, some of them have already existed since the socialist era and the others were made after democratization. Things which are connected with inhabitants' good memories have been accumulating since they start their lives in JM. Personal preference is for example, colour of building, design of art work, etc. Public value means things which have high evaluation by the public. It can be thought that value by utility can be getting better by adding amenities lacked in the socialist era. Even after the utility achieves enough level, value by memory will have been accumulated without limitation and would be one of the important factors of the value of JM. Then, if these memories are shared with the inhabitants, they can be the public value. The results clarified lots of efforts for improvement and values of JM. It also shows a possibility that there are improvements and values in other prefabricated housing estates not only in Czech but also all around the world. In the future, these "uniform" prefabricated housing estates can be reevaluated as "unique" housing estates with their own area histories and values.

Key words: Housing estate; reevaluation; interview; community participation event; South Town; Prague.

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Revitalization of Sopot and Ustka - the seaside spa towns in Poland

Joanna Poczobut *

Gdańsk University of Technology, Faculty of Architecture, Narutowicza Street 11/12, 80-233 Gdańsk, Poland

ABSTRACT

Sopot and Ustka are two Polish seaside resorts. At present, they differ from each other in terms of magnitude, economic and cultural resources, as well as development and revitalization possibilities. As the only spa towns in their province (Pomeranian Voivodeship), both of them boast about unique tradition related to this status. In the past - as early as at the beginning of the 20th century - Sopot and Ustka were famous for the healing opportunities they created: good conditions for resting and recreation. They were places where everyone with enough self-esteem was willing to be seen. It seems that despite the obviously different quality and conditions of life, the life of their citizens and visitors at that time was 'slower' than it is today. Since the post-war reconstruction until 1989 (establishment of local governments in Poland), not much has happened in Polish cities in terms of comprehensive activities in the renewal of their building resources and space. In the 90s of the last century Sopot became a town which was one of the first in Poland started his revitalization programme, becoming the leader and good example to other local governments in the country. Renewal activities in Ustka were the most extensively implemented at the beginning of the twenty-first century. It's obvious that renewal programmes in both cities were very different from each other. The programme in Sopot was more complicated: it lasted longer, concerned larger and more difficult area. During the last 20 years in Sopot and Ustka were implemented a number of new investments. Today, both the spa towns are vibrant with life, especially in the summer. The specificity of these cities resulting from their cultural and spa values, seaside location, possibilities of cultural and entertainment, makes that they attract crowds of resort visitors and tourists from across the Poland, as well as from abroad. On the one hand, the intensity of the use of mass entertainment offers organized in public spaces of Sopot and Ustka is not always conducive to the quality of permanent residence there. On the other hand, the ability to have the flat in the seaside resort is still - just like at the beginning of the twentieth century, something unique and considered to be as a kind of ennoblement.

Key words: Revitalization; urban renewal; spa towns; small and medium-sized cities; Pomeranian Voivodeship; Sopot; Ustka.

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Use of ant algorithms to optimize pedestrian communication routes with the application of GIS tools: a case study of Olsztyn (Poland)

Karol Szuniewicz *

University of Warmia and Mazury, Prawochenskiego St. 15, 10-724 Olsztyn, Poland

ABSTRACT

The authors describe the rules for the use of qualitative research methods and optimization in conjunction with GIS tools to assess and optimize the pedestrian communication. Research was carried out on a part of the urban space, which is characterized by large and visible population trends. The analysis that was carried out resulted in creating cartographic imaging of the pedestrian communication system state in the urban space, its consistency and to provide directions for its modernization. The simplest example of a system that resembles the behaviour of ants is a system of pedestrian communication. This system has the features of self-organization, a permanent and flexible response to changes in a short period of time. Therefore it is a perfect example of a system that can be optimized with the use of the so-called ant algorithms. The aim of this paper is to present the applicability of methods based on ant systems, which can be used for searching the optimum agent passage routes according to the imposed selection criteria. The communication function is one of the most important functions of urbanized areas. Communication routes define the city plan and undoubtedly influence spatial perception and usefulness, introduce movement into space and at the same time enable learning about space. Because of the rising urbanization level and accumulation of spatial functions, communication organization is an important task, often determining spatial usefulness. The problem of communication organization results, among others, from the rising number of space users (including the increasing number of motorized users), which requires the adaptation of the communication infrastructure to their needs.

Key words: Ant algorithm; optimization; pedestrian communication routes; GIS.

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Analysis of the variation of the areas under urbanization pressure using entropy index

Karol Szuniewicz *

University of Warmia and Mazury, Prawochenskiego St. 15, 10-724 Olsztyn, Poland

ABSTRACT

Rural development is closely related to the transformation of land space in the immediate vicinity. The fast growth of Large Urban Zones (LUZ) entails rapid changes in land use not only within the city but also outside its territory, even covering whole regions. The impact of LUZ on social and economic communities living in areas close to the urban zones is noticed by many authors and it's especially manifested in forming and thus in land use. Based on these considerations, on the basis of free access spatial data and GIS technology, the authors tried to identify some relationships in the transformation of the structure of spatial capabilities in suburban areas. The study was based on Corine Land Cover (CLC) - surface data obtained by visual interpretation of satellite images made at the request of the European Environment Agency (EEA), in order to monitor changes in coverage and land use in Europe. Collected in the previous campaign, and now updated every five years the data provide interesting and valuable source of information for analysing and modelling of spatial processes. Based on the obtained data set, the authors using the entropy index, then an indicator of multifunctionality decided to capture the dynamics of change and indicate possible trends of development in the coming years. Definition of entropy follows directly from the Second law of Thermodynamics, and frequently researchers used this value to study the changes of states of various phenomena, including the dynamic development of the area under urbanization pressure. Based on the results obtained erected the argument that the high value of entropy, which is a measure of disorder, is associated with a greater diversity of the area, thus a confirmation of the high dynamics of changes in land use. The authors decided to analyse these issues based on comprehensive and standardized data sets, which is CLC. The purpose of the research was to develop a method to unify the perception of the structure of space, and consequently determine the rules and principles in its place. In the process indicate the space that was to become the subject of research based on the location of the cities that these areas interact. The methodology focuses on a comparison of Central European cities with similar populations, taking into account their choice of countries with diverse economic development. The criterion relating to the number of inhabitants was introduced to the comparability of units and the areas they served. In order to indicate the variability of individual space conditions based on data from the years 2000 - 2012. The last phase assumed to build a forecast of transformations founded, another point in time.

Key words: Entropy index; urbanization; Large Urban Zones (LUZ); Corine Land Cover (CLC).

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Impact of land dynamics on agricultural land

Nisha Radhakrishnan ^{*1}, Sathees Kumar ², Samson Mathew ¹

¹ National Institute of Technology, Department of Civil Engineering, National Institute of Technology, Trichy, India

² Mohamed Sathak Engineering College, Department of Civil Engineering, Kilakarai, India.

ABSTRACT

Land use Land cover (LULC) change has taken place in Tiruchirappalli city in Tamil Nadu, India over the past two decades due to induced industrialization and urbanization. In this paper, the impact of land dynamics on agricultural land was studied by the combined use of remote sensing, geographical information system (GIS) and stochastic modelling technologies. The different land use categories and their spatial and temporal variability in Tiruchirappalli city has been studied over a period of five years (2007-2012), from the analysis of CARTOSAT – 1 images for the year 2007, 2009, 2011 and 2012 using ArcGIS 9.3 and ERDAS Imagine 9.1 software. Maximum Likelihood Algorithm was employed to detect the LULC types. Based on the results of classified images, the agricultural land coverage area was observed to have reduced from the year 2007 to 2012 by 4.42 %, while the area under settlement increased from the year 2007 to 2012 by 7.12 %. An attempt was made to project the LU/LC change for the future using Markov model. The forecasted results indicated that, the area of agricultural land would maintain the decreasing tendency in future. The study demonstrates that the integration of satellite remote sensing and GIS was an effective approach for analysing the temporal and spatial pattern of LU/LC change. The further integration of these two technologies with Markov modelling was found to be beneficial in describing and analysing land use change process.

Key words: CARTOSAT; GIS; land use; Markov; remote sensing.

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Planning the city against barriers: enhancing the role of public spaces

Aleksandra Sas-Bojarska, Magdalena Rembeza *

Gdansk University of Technology, Narutowicza 11/12 street, 80-233 Gdansk, Poland

ABSTRACT

Contemporary cities are being fragmented by growing number of technical barriers like roads, railways, infrastructural objects generating variety of problems of different nature. The aim of the research is to present the issues connected with such barriers in the city and the ways of solving them. The results of preliminary investigations indicate that the main problems are for example: the destruction of the complexity of urban fabric, functional disadvantages, environmental threats and reducing urban landscape's value. In order to avoid such negative effects, city should be designed as a coherent organism in terms of spatial, environmental, infrastructural, social and visual aspects. The various "in-between" areas should connect an urban tissue rather than divide it. A major technical approach should be complemented with humanistic design aspects. This can be obtained due to well designed and functioning public spaces. The role of such spaces should be connecting urban fabric for the benefit of society. Well-designed and functioning public space is the essence of a city. However, good public space should meet a number of conditions. When creating public space it is important not to limit it only to its physical attributes but it should lead to strengthening relationships. The public space has to fulfil certain functions, be safe, accessible, and attractive. Only such public space can effectively connect urban fabric, fill in "in-between" areas by new quality and function, not only in a spatial way but also by improving the urban life and making the society happier. The main conclusion is that creating such space is possible due to the use of existing planning and design tools like urban planning and landscape architecture.

Key words: City planning; technical barriers; humanistic design; public spaces.

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The procedure of assessing usefulness of the land in the process of optimal investment location for multi-family housing function

Andrzej Biłozor *, Małgorzata Renigier-Biłozor

University of Warmia and Mazury in Olsztyn, Faculty of Geodesy, Geospatial and Civil Engineering, Ul.Prawochenskiego Str. 15, 10-720 Olsztyn, Poland

ABSTRACT

Spatial planning as a typical example of decision-making, resulting in the term land use is a complex and lengthy process. The procedure for assessing the usefulness of the land is associated with the determination of the possibilities and limitations for different types and forms of land use. In the process of determining the optimal use of land is evaluation the usefulness of the area with the use of geoinformation. The purpose of this analysis is to make a choice of the optimal location of the investment, taking into account various criteria with a significant impact on the assessment of the usefulness of the land. The paper presents the possibility of applying procedures for assessing the usefulness of the land as a support tool in the process of planning decision. The procedure and criteria for selecting the optimal investment location for multi-family housing function is presented. The aim is also to present the parameters characterizing them and the possibilities of using geoinformation that identify of restrictions and potential uses of the land. The dummy maps usefulness area is developed with the use of Boolean methods for all adopted criteria. The maps are indicating a set of locations that fulfil all the criteria of usefulness. The proposed procedure is also extended through the methods of significance and elimination of superfluous criteria analysis.

Key words: Evaluation of the usefulness of land; multi-family housing; optimization; multi-criteria analysis; geoinformation.

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Factors influencing the location decisions of SME in the suburban areas of The Gdansk Metropolitan Area (Poland)

Olga Martyniuk ^{*1}, Anna Gierusz ¹, Justyna Martyniuk-Pęczek ²

¹ University of Gdańsk, Faculty of Management, Armii Krajowej 101, 81 – 824 Sopot, Poland

² Gdańsk University of Technology, Faculty of Architecture and Urban Planning, Narutowicza 11/12, Gdańsk, Poland

ABSTRACT

Given the importance of SMEs in the European economy it is considered essential to have an adequate knowledge of the various factors which determine their choice of location. However, the size of the company is often an omitted aspect in the theoretical studies and empirical research in industrial location and urban planning. The size of the company, its structural organization, including the spatial structure and form of the spatial relationships with the environment, is one of the internal conditions of the business location. The parallel development of the SME sector and the process of urban sprawl in Poland has led the authors to carry out a research concerning location choices of SMEs in suburban areas. This paper identifies the key factors in the SME location decisions from a survey of 251 companies located in the suburban areas of The Gdansk Metropolitan Area with the highest density of SME. The suburban areas were identified based on studies of two indicators: the suburbanization rate and the index of the SME concentration. The relationships between company characteristics (size of the company, age of the company, type of the business, the character of the company) and factors influencing location decision were studied. The factor most often indicated as important in location decision was the place of residence or proximity to the place of residence, followed by the proximity to the core cities of metropolitan area, favourable conditions of communication, personal reasons. Infrastructure, demand and costs of running business were chosen less often as a locational determinant. The findings suggest that local authorities and urban planners seeking to develop and market land in suburban areas need to devote attention to the quality of living conditions, including communication and the quality of public space. People with high entrepreneurial attitude considering the place of the business activity in suburban area chose the location ensuring appropriate living conditions for their family over the cost aspect.

Key words: Industrial location; small business; SME; urban sprawl; location factors.

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Cultural heritage in spatial planning

Krzysztof Rząsa *, Marek Ogryzek

University of Warmia and Mazury, Faculty of Geodesy, Geospatial and Civil Engineering, Department of Planning and Spatial Engineering, Prawochenskiego Street 15, 10-720 Olsztyn, Poland

ABSTRACT

The cultural heritage objects of each country should have a major impact on the development of space. Unfortunately, this often forgotten. Investment needs are placed in the foreground and only the most precious historical objects are real protected. These less valuable - disappear in a modern space. Often the same monument is preserved, but its surroundings makes the historical value of the functioning of the object, after all, among the other buildings and structures are lost forever. It should certainly not be so. Cultural heritage should be subject to special protection in spatial planning. The records should contain provisions restricting the development of the space around objects, and they themselves must be taken into account in the design of cities and rural areas. In this publication addressed the issues of cultural heritage in relation to the spatial planning system in Poland. Indicated the legal bases for the protection of monuments and their compounds with statutory requirements for space planning. On selected examples located in Warmia and Mazury (voivodship located in is the north-eastern part of Poland), an analysis of the planning records connected with the protection of cultural heritage were made. In the conclusions, the authors referred to the effectiveness of these records and their actual executive power. It also was indicated the need to modify the low, to historical objects have a real impact on the change in land use planning.

Key words: Cultural heritage; spatial planning.

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Planning studies for Isparta (Turkey) until now

Neşe Aydın *, Erkan Polat

Suleyman Demirel University, Cünür, Isparta, Turkey

ABSTRACT

City is a dynamic place that includes social, cultural, spatial, environmental and economic features inside it. City gains qualification and takes form through these feature's powers and size. According to time and age requirements city's pattern has changed and these differences in city's pattern determine city's identity. With city's growth and change we can see dynamism in land use. New settlements, industrial areas, trade blocs, education and health institutions can be seen as indicators of this dynamism. Every city has its own, unique type of dynamism and this dynamism shows us cities growth capacity and their potential. In some cities this dynamism grows fast but on the contrary in some cities this dynamism is slow. The purpose of his study is to show us this dynamism of Isparta (Turkey). Isparta is an old and historical place. It connects Central Anatolia, Aegan and Mediterranean Region to each other. Isparta gained its substantial developments in Republic Period of Turkey. Its first city plan was Prof. Olsner's Plan which made in 1930's. In 1945 Prof. Kemal Ahmet Aru was made Isparta's second city plan. In 1968 Architect Fahri Yetman was made Isparta's third city plan. After 1960 Isparta's city plan handled four times and made lots of additional plans. The last plan of Isparta made in 2008. These plans which were made from 1930 to 2008 shaped Isparta's land use in time and with analysing these plans we are going to see Isparta's growth and change, in other words we are going to see Isparta's dynamism with images of this plans. In conclusion, the aim of this study is to give us the planning history of Isparta from 1930's until now.

Key words: City; plan; planning; city plan, Isparta (Turkey).

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Territorial aspects of entrepreneurial activity in Polish suburban zones

Justyna Martyniuk-Pęczek *¹, Tomasz Parteka ¹, Grzegorz Pęczek ²

¹ Gdansk University of Technology, Faculty of Architecture, Department of Urban and Regional Planning, ul. Narutowicza 11/12, 80-233 Gdansk, Poland

² Sopot University of Applied Sciences, Faculty of Architecture, ul. Rzemieslnicza 5, 81-855 Sopot, Poland

ABSTRACT

Globalisation led to an increased correlation and integration in various fields of modern civilisation, including those connected with allocation of entrepreneurial functions. Connection in the global scale show an increased meaning of worldwide corporations. Territorial allocation of entrepreneurial function becomes the subject of translocation and revaluation. Translocation can be understood as change of spatial orientation. It is manifested through increasingly fading role of industry concentration, mainly the one of processing and production. In the metropolitan scale the scattering of these activities has gained a new meaning as well. This paper presents some research results done by Authors on the relations between urban sprawl and entrepreneurial activity in these areas. The previous research carried out by the Authors shows, that the Polish dimension of suburbanization has a unique quality associated with the small and medium enterprises' activity (SMEs). It is manifested by a significant number of companies located in the suburban zones. The aim of the paper is the search for determinants of location and SMEs development in suburban zones. The list of determinants will be formed based on spatial analysis of urban forms as well as qualitative studies conducted using a questionnaire distributed to the entrepreneurs in the selected areas. Urban analyses refer to the study of the urban and architectural forms in search of a spatial pattern and functional model. The paper describes the spatial structures and the forms of Polish suburban zones demonstrated on the example of two selected towns in the Tricity (Gdańsk – Gdynia – Sopot) Metropolitan Area (TMA). The choice of the towns and the places for the spatial structure analysis follows prior identification of the entrepreneurship nests. The Polish suburban zone distinguishes itself among other such by a large concentration of companies from SME sector. However, this characteristic feature may be difficult to spot at first glance, because the architectural and urban forms do not suggest such functions. This fact confirms that small scale of entrepreneurship assures flexibility in the field of economic activity, as well as in the field of spatial territorialisation. Although the forms of Polish urban sprawl may lack the spatial order meant by a coherent landscape, the economic activity of SMEs, however, together with manufacturing and logistic connections seem to fit well in the process of executing the essence of sustainability. In the SME sector of the suburban area the compatibility of economic (growth factors, threats of downfall), social (family businesses) and ecological (respecting activities not diminishing the "self" environment) aims are realized. This is a tendency far more positive than the one represented by big companies. This paper is written within the project UMO-2013/09/B/HS4/01175, financed by The National Science Centre in Poland.

Key words: Tricity Metropolitan Area; suburban zone; entrepreneurial activity; SME sector; territorialisation; economic activity factors in suburban zones.

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Urban Mentoring as a new method of participatory urban planning in Poland

Justyna Martyniuk-Pęczek *, Gabriela Rembarz

Gdansk University of Technology, Faculty of Architecture, Department of Urban and Regional Planning, ul. Narutowicza
11/12, 80-233 Gdansk, Poland

ABSTRACT

Twenty five years after the return of democracy and the beginning of basing the country's economy on neoliberal developmental paradigm, Poland adopted the regulations regarding management of urban policy, which had been awaited for over a decade (accession to the EU). The National Urban Policy as well as the Act on revitalization have defined, in a modern manner, the field of cooperation between the local government, the administration and the residents; the transition to the second stage of a democratic society – the residents as the co-hosts of the urban space . Slow evolution of this relation, heavily laden by the legacy of the previous system, in recent years has gained significant dynamics – urban activism in a country with a relatively weak tradition of urban culture, among the new generation (the new Polish townspeople) has become not so much as a fad, but a cultural trend, a philosophy of life. It seems, that the difficult dialogue between a city of community worker-activists and a city of engineer-professionals is one of the major fields of research on the Cognitive City in Poland. After decades of domination of technocratic relations within city management, which used to leave the shaping of the vision for a city's development in the hands of an inner circle of administration, a period of radical and fundamental criticism of professional (technical) knowledge has followed, turning into a nearly complete deification of the social side's full competence. Public debate, as an ideological dispute about neoliberal city planning by nature, has been growing under the slogans „the right to the city”. The article describes experience acquired through realization of the project „Quo vadis Gdansk? The residents plan their city” involving participatory, strategic planning for improvement of the public space quality in the districts of Gdansk. An innovative work technique for cooperation of the planners and the local community was developed as an answer to the main current problems in Polish neoliberal urban planning reality – residual cooperation competence resultant from a low social capital; asymmetries in knowledge; lack of experience in genuine socialization of the planning process. A work technique realized through a method of the so-called Urban Mentoring, using a planning tool: the so-called micro strategy of improving the public space quality, will be described. The summary is a reflection on the possibilities of applying the planning results through the use of the above described technique for the study on the city: on learning the mechanisms which develop responsible involvement in shaping of common living environment; on effective methods of mutual exchange of knowledge between the residents, the local experts and professional experts in city management techniques.

Key words: Participatory planning; urban mentoring planning model; quality of urban public space.

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Transformation directions of downtown areas on the example of the city of Czestochowa

Nina Solkiewicz-Kos *

Czestochowa University of Technology, Faculty of Civil Engineering, Institute of Architecture, J.H. Dabrowskiego 69, 42-201, Czestochowa, Poland

ABSTRACT

The issue of the development of urban areas includes spatial phenomena concerning downtown areas. To preserve them in good condition requires constant action. This includes the creation of socially acceptable spaces which would stimulate development processes of central areas of cities. Czestochowa is an example of a city looking for right relations between modernity and the future. This requires delicate and precise decisions related to the introduction of centre-forming functions within the historic city centre. As a result, it has a chance to adapt to modern functional requirements and changing needs of the society. This multidirectional search aims at improving the value of urban environment and is a reflection of the relation between cultural, commercial and service functions. Selected stages of downtown development include both historical period and contemporary one. They are an attempt to illustrate the transformational activities that stimulate the process of the urban environment development at a given time. The first stage -19th century. The merging of the two urban organisms -Old and New Czestochowa- became a vital axis of the city layout. Commercial functions within the Old Market became expanded along the new axial arrangement. This led to rapid development of the downtown areas. At the same time there was shifted the gravity point of mutual social, commercial and service relations. The second stage – second half of the 20th century. The emergence of multi-level department stores results in limiting commercial functions to a small area. Modern facilities complement the existing buildings. They are a response to the needs of residents and the evolving functions of the city. The third stage – beginning of the 21st century. Revitalization of the former industrial areas (occupying the space in the city centre). A shopping mall function emerges. The commercial-service space along the main thoroughfare of the city gets dispersed. The focus of social, commercial and cultural relations moves to the multifunctional consumption centre (located on the post industrial area). The fourth stage. An attempt to revive the central urban areas. There is growing awareness of the need to develop the urban environment by seeking appropriate relations between modernity and the past. The undertaken measures are designed to create socially acceptable space which would stimulate the process of the urban environment development in a sustainable way.

Key words: urban planning; architecture; sustainable development.

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Cities after war

Maryam Moayery Nia *, Hamed Zarrinkamari

Polytechnic of Milan, Architecture & Urban Design, Milan, Italy

ABSTRACT

In addition to the four major wars currently underway, there remain dozens of active conflict zones around the globe. While most of studies are focused on human casualties of these wars, the impact on cities and urban environment is not investigated as it should. Not only the physical context of these cities are changed through war, but also many invisible social, emotional, and spiritual connections are forever broken. This paper attempts to study these cities at different levels with a specific focus on the city of Homs, Syria. A clear understanding of size, population, and other characteristics of a city prior to war, helps us to estimate the volume of building ruins, number of immigrants, and other outcomes projected in the post-war environment. Hopefully, post-conflict, when such environments are to be revived and repopulated, the image of the city in the mind of its population should be revived as well. Therefore, it is important to understand the structure of the city and rebuild it in a way that is relatable to its citizens. Furthermore, it can be a great opportunity to improve the urban environment and refine it in a holistic attitude. The process of redesigning post-war cities is very similar to designing new towns, except post-war cities retain a history, and contain emotions and memories of their habitats. In the other words, rebuilding post-war cities can be the perfect opportunity for urban design and practice. On the other hand, infrastructures have been destroyed in most cases. Considering the impact of war on the environment along with concerns about global warming (and the fact that almost all of these wars are happening in hot and harsh climates) leads us to recognize the opportunity to rethink the whole system of infrastructure in post-war cities. New infrastructures should be built to rely on renewable energies instead of the fossil fuels which have been traditionally more accessible in these regions. Obviously, the easiest solution for rebuilding post-war cities would be to demolish the ruins and build a new city on top, but this is neither wise nor practical a solution. Nonetheless, if we can acquire a collective knowledge of the current situation, then we can find better resources and more creative solutions. The final goal of this writing is to propose such a strategy specific to Homs, and suggest solutions based on our findings.

Key words: City; war; sense of belonging; rehabilitation.

* Corresponding Author

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Comparison of Czech and German Information Systems used for exploration of geological situation in civil engineering practice

Jiri Cejka ^{1*}, Rudolf Kampf ², Ladislav Bartuška ², František Němec ¹, Ján Ližbetín ²

¹ VŠTE-Institute of Technology and Business in České Budějovice, Faculty Technology, Department of Informatics and Natural Sciences, Okružní 517/10, 370 01 České Budějovice, Czech Republic

² VŠTE-Institute of Technology and Business in České Budějovice, Faculty Technology, Department of Transport and Logistics, Okružní 517/10, 370 01 České Budějovice, Czech Republic

ABSTRACT

The main aim of publication is to compare the information systems of the Czech and German geological services from the point of view of information needed for civil engineering purposes. The information systems are bases of modern societies. Thanks to them we are able to apply older exploratory works to assess currently solved projects. Information systems thus become strategic tools in the evaluation of exploratory works but also in land-use planning. The structure of the Czech Geological Survey information systems consists of a database of borehole exploration, a database of final reports and a register of landslides. These three databases are fundamental for civil engineering purposes. The German geological service information system contains similar databases, i.e. a database of boreholes and an archive of scientific reports and publications. A register of landslides is not available in the German geological service information system even if these questions are dealt with within Geohazards. As for maps available online, both the institutes include a geological map, a map of soils, a geophysical map and a map of underground waters, or a hydrogeological map, and a map of resources, or raw materials information system. On the top of that, there is an engineering geological map available in Germany. On the contrary, the Czech Republic disposes of a set of maps which are not available in Germany, namely a map of surface water chemism, mining influence, mining maps, register of risky storage areas and a complex radon map.

Key words: CGS; GGR; information systems; borehole exploration; map server; INSPIRE.

* **Corresponding Author**

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The city as a playground: shaping city space to be more playful for individuals at any age

Anna Martyka *

Rzeszow University of Technology, Faculty of Civil and Environmental Engineering and Architecture, Department of Architectural Design and Graphics Engineering, Al. Powstańców Warszawy 12, Bud. V, 35-959 Rzeszów, Poland

ABSTRACT

As never before, no former city had enough opportunities to satisfy so many human desires. Nowadays people fall into the trap of the consumerism that promises that if they follow the rules, they will be able to satisfy their needs so that they could achieve more happiness. But why that does not happen? It is scientifically documented that an increase in the material status when it reaches a certain threshold does not guarantee happiness. This is confirmed by the fact that the inhabitants of the developed cities in countries where the economy based on consumption did not become happier than people from the less affluent urban population. Moreover, the desire chasing after materialistic values results in lengthening working hours and shortening leisure time for spending on relaxation and rest. Stress, feel of insecurity, continuing uncertainty about the future occur more often and more intensely in developed cities. Modern civilization transformations affect so many areas of human life, it is even difficult to name all of them. Transformations change the nature of work and learning, family life and human relationships, lifestyle, leisure activities and those spheres of human life, which determine its sense of satisfaction, fulfilment and happiness. Growing demographic and ecological problems are urgent to solve, but in addition, cities should ensure a high quality of life for all its citizens. This paper will consider how to transform the city to offer its inhabitants comfortable living conditions in a good physical and mental condition.

Key words: City space; happiness by design; playful city.

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Fatigue behaviour assessment of the orthotropic steel deck for a self-anchored suspension railway bridge

Chong Wu, Yuan Yuan, Xu Jiang *

Tongji University, Collage of Civil Engineering, Department of Bridge Engineering, Shanghai, China

ABSTRACT

A self-anchored suspension bridge for urban railway with the span arrangement of (210+600+200) m is being designed in China. In the deck system of the bridge, there is a rubber layer to absorb the vibration energy between the concrete slabs and the orthotropic steel deck. In order to study the fatigue behaviour of the steel deck, a mixed finite element model that consists of shell elements and spatial beam elements is established, and spring elements are used to simulate the rubber layer. According to the practical axle load which is surveyed, the stress ranges of critical regions in the steel deck are calculated by rain-flow method. The distribution of the open ribs and the forms of the cope hole for open rib are discussed. With the thickness of the deck reaching to 32 mm, it shows that stress ranges in the critical regions of the steel deck are under the cut-off limit, and the cope holes can be adopted by the welding feasibility.

Key words: Orthotropic steel deck; railway load; fatigue assessment; FEM; self-anchored suspension bridge.

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Fear of crime in public spaces: from the view of women living in cities

Oksan Tandogan ¹, Bige Simsek Ilhan * ²

¹ Namık Kemal University, Faculty of Fine Arts, Design and Architecture, Department of Architecture, Tekirdag, Turkey
² Amasya University, Faculty of Architecture, Department of Urban Design and Landscape Architecture, Amasya, Turkey

ABSTRACT

This paper relates to fear of crime in public open spaces from the point of women in cities. Fear of crime, in general terms, can be described as a feeling of fear and insecurity derived from a feeling of a person who senses his/her personal security to be under the threat. This fear of crime is a fact which has a considerable impact of the daily life of urban dwellers directly or indirectly by causing urban open spaces such as public parks, squares, plazas, streets not be used; causing routes preferred to travel between working places and dwelling places be changed; and causing roads and streets chosen for commerce be altered. According to the scientific researches, it has been detected that elders and women are more exposed to fear of crime in cities. Consequently, they have to prefer to stay closed and safeguarded places and to avoid urban streets, parks, plazas, public transportation vehicles and areas, especially in the evenings; they feel insecure while walking on the streets and even at their homes; they restrict the right to freedom of movement of their children in the city; and they have to take measures in public open spaces for the reason of this anxiety. This situation restrains the personal involvements of women in public life of the city. Discussing the reasons for fear of crime in public open spaces, in this paper, it is aimed to focus this fact from the point of women. To conclude, it is examined the reasons and degrees of fear of crime; measures taken due to this fact; and handicaps which restrains the personal involvements of women in public life of the city.

Key words: Fear of crime; women in the city; public life; public open spaces.

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Re-shaping the land and water connections as a way to achieve public space continuity on the post-industrial areas

Izabela Maria Burda *, Lucyna Nyka

Gdansk University of Technology, Faculty of Architecture, Narutowicza 11/12, 80-233 Gdansk, Poland

ABSTRACT

This article concerns the problem of urban transformation strategies applied in recent decades which are based on creation of new water areas and modification of the existing ones. The research is an attempt to prove that modifications of plans of water areas and the forms of their borders may play an important role in achieving public spaces' continuity on the post-industrial areas. What is essential, this continuity is one of the most significant factors among evaluation criteria of the public space quality. The basis for demonstrating the importance of modification of the water borders including introducing new forms of the presence of water in cities are theoretical surveys, comparative studies and in-field analyses. It can be seen that the post industrial areas, that used to create voids in the urban fabric, are most of all perceived as unique but isolated places that should be integrated into structure of cities. Thus, creating continuity of public spaces that will relate converted areas with their surrounding is a well-known objective of many transformation strategies. The research proves that an effective strategy toward achieving this goal could be based on modification of relationships between the land and the water. Namely, introduction of new water areas, designing new pieces of land that protrude into the water, softening the boundaries of water lines or opposite – structuring the smaller water flows into well-defined canals, if consciously designed, may significantly contribute to the quality of public spaces' continuities. This influence does not only rely on providing the stronger morphological links in the pattern of public spaces, but it makes them more related to the environmental qualities of the converted territories. Moreover, it is worth emphasizing that even single steps in such operations such as establishing new outlines for green and blue grids in the cityscape, creating scenarios for social activities in relations to the character of the land-water connection – it all fosters the development of sustainable cities and contributes significantly to the emergence of high quality urban landscapes.

Key words: Post-industrial transformations; land and water connections; public spaces' continuity; green and blue grids in the cityscape; sustainable cities, urban landscapes.

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Post-socialist transformations of green open spaces in large scale socialist housing estates in Slovakia

Katarína Kristiánová

Slovak University of Technology in Bratislava, Faculty of Architecture, Institute of Landscape and Garden Architecture,
Námestie slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

Generously designed broad green open spaces belong to the most characteristic features of the large scale socialist housing estates in Slovakia, designed and built in the second half of the 20th century. Open spaces were designed to satisfy the requirements of the socialist society and were well equipped with roads, parking places, pedestrian walkways, waste collection sites, and also vast green spaces with children playgrounds and sport grounds. Many of these spaces, equipped by artworks and fountains, represented architectural qualities of the modernism of the second half of the 20th century. However the concept of large scale socialist housing estates and their broad green open spaces had its failings and shortcomings, too, manifested mainly by the deficiencies in maintenance, loss of control, or safety. Open public spaces are spaces intensively reflecting the cotemporary needs of the communities for their use. The new socio-economic conditions after the change of communist regime have created new demands and new societal demands transform the open public spaces at the present times. The paper traces the transformations of open green spaces in the large scale socialist housing estates in Slovakia, generated by the new socio-economic conditions after the change of the regime and by new demands today, using the case studies of large scale socialist housing estates in Bratislava. Results of the research show the losses of green open spaces caused by densification of housing, civic amenities, and parking spaces. The cultural heritage values of open green spaces representing exceptional landscape architectural qualities of the modernism of the second half of the 20th century are not protected and maintained. Only few examples in the studied areas have been found, which represent successful green space regeneration.

Key words: Green infrastructure; large scale housing estates; public space transformations.

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Public space and its' role to transforming the community

Ľubica Vitková, Ivan Siláči, Pavlína Kolcunová *

Slovak University of Technology, Department of Urbanism and Spatial Planning, Námestie slobody 2911/19, 812 45
Bratislava, Slovakia

ABSTRACT

The socio-spatial organization of the cities, directly linked to the certain economic and political system, appears as a demonstrative reference of the current urban transition towards post socialist cities. Whether disqualifying socialism is a substantive aspect of post-socialism; either if the contemporary public space should still represent the theatre for programmed, controlled activities, or are they mixture of rejection and adaptation to new situation through informal activities. The presence of symbols in public space is manipulated by ideologies in order to construct eligible narratives. The change of reading the public symbols, when substituting the socialist ideology by the other single ideological attitude of globalized consumption, depends on the critical links between official policies and the types of responses on the community level. The paper is targeting reflection on a new form and structure of selected public spaces in Lučenec, with the emphasis on their iconicity, shaping till nowadays the collective memory through the quiet erosion of the socialist icons. The presented study focuses on transferring old connotations into the new contexts, where the life of the icons doesn't depend anymore on its form or positive narratives, but confide in the trusts in the participation of community. Here comes into the question whether the unity of purpose could be the base for community unity, and how is the purpose connected to the social capital and participation. The aim of the article is to present the possibilities for the future policy making, as the conception of authorities for transparent regulation of public space is missing. The object of the paper will be simultaneously aimed to the evaluation of space exploitation adaptability by different group of inhabitants.

Key words: Public space; post socialist cities; community; participation.

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Grass roots of landscape urbanism: retrospective analysis

Gintaras Stauskis *

Vilnius Gediminas Technical University, Pylimo str. 26 Vilnius, Lithuania

ABSTRACT

We may see the modern period of urbanism as a kaleidoscope of many successful developments as well as the series of endless and repeated mistakes and failures. The paper focuses on detailed analysis of existing and passed urban planning and design practices in the aspect of efficiency of applied methodologies as relates to the outcomes in particular urban settings. The philosophy and practice of Landscape Urbanism that proposes landscape as an organising bone for urban planning and design manifests itself as a paradigm opposing to prevailing methods of urban planning and design that try to organise the space by built blocks and volumes. Methodology of prioritizing natural, historical, cultural layers of the place before urban design of blocks and buildings is implemented leads to socially, environmentally and economically efficient development solutions as compared to conventional process that equals or prioritises urban hardware against the primary natural layers of territorial information. Multiple cases from urban legacy that rendered to be successful and sustainable bring the needed evidence for discussion of Landscape Urbanism impact on urban development in the past as well as at present and especially for the coming decisions and projects. The discussed cases from Vilnius City present the evidence of successful adaptation of urban structures to natural character of the site while keeping and extending identity to the place. On the contrary, prioritising urban hardware tools seamlessly erases the features of the site and deliver uniform solutions lacking identity of locality that are finally abandoned by the users. This results in numerous negative impacts on the city and its citizens. Based on the analysed cases the set of quality criteria is extracted and their efficiency is compared through the past century until today. Using the analytic hierarchy priority method the listed criteria are prioritised into a set of applicable values to be set as a ground for the coming urban development. As a conclusion, the paradigm of landscape urbanism renders its success in the past and deserves most attentive adaptation in drafting recent and future urban development.

Key words: Landscape urbanism; city planning; urban environment; landscape; nature; architecture.

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A method for assessment of the historical urban landscape

Aysegul Kaya Tanriverdi *

Duzce University, Faculty of Forestry, Department of Landscape Architecture, Duzce, Turkey

ABSTRACT

The urban landscape is a distinctive feature of every city, an identical value to be seized, preserved and enhanced through public and private stakeholders and intensive policies. The historic urban landscape is the sum of the layering and interlock of natural and cultural values over time. It includes the broader urban context and its geographical setting, beyond the notion of historical centre. Urban heritage is a key resource in order to enhance the liability of cities. It provides social cohesion and place attachment in a changing global environment. Historical urban landscape is an approach to undertake an evaluation of the city's natural, cultural resources; assess the vulnerability of urban legacy under the socio-economic pressures and integrate urban heritage values and their vulnerability status. This approach is to position conservation as the management of change, by integrating it into broaden planning frameworks. In this research, ancient residential area Prusias ad Hypium, at this time we called it Konuralp town is accepted as cultural landscape district. Ancient city has lived and transformed throughout the historical periods and it conveyed historical references into nowadays. But now Konuralp's historical urban landscape are threatened by growth of university which is caused to increase of population and speculative urban lot movements as well. At the same time, industrial plants tend to choose location to settle down for themselves in Konuralp farmlands. Because of the ,historical past to extent Hellenistic period and was an important city during the Ottoman period, the antique city 'Prusias ad Hypium' or Konuralp is chosen as a search area in order to assessment of the change of the historical urban landscape. In research was studied the town's urban historical landscape used by survey methods and remote sensing methods to assess the landscape character exchange between the years 1982-2015. A series of spatial data layers were used to describe and map the transformation of landscape and to assess the vulnerability of under the socio-economic pressures. Topographical maps, satellite views from different periods used to define urban landscape character, which were mapped as polygons and polylines in a GIS. In time-depth evaluation of modifications in land-use, and settlement pattern. Then landscape metrics were used to describe the change of the historical urban landscape area.

Key words: Historical urban landscape; landscape character; landscape metrics; Konuralp.

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Perceived soundscape of urban historical places: a case study of Hamamönü district, Ankara (Turkey)

Isil Kaymaz*, Cennet Tekin Cure, Ecem Baki

Ankara University, Department of Landscape Architecture, Faculty of Agriculture, Dışkapı, Ankara, 06110, Turkey

ABSTRACT

Conservation and restoration of historic urban landscapes has gained an increasing attention in Europe, as well as in Turkey due to rapid urban landscape change. There have been many urban renewal and transformation projects that aimed to conserve and manage cultural heritage of urban landscapes in Turkish metropolitan areas. Most of these projects focus on restoration of the visual character and gentrification through function change. On the other hand a landscape is far beyond its visual character; it is “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors” as European Landscape Convention defines. In this regard one of the recent developments in landscape research is the inclusion of sound within spatial design and planning processes as an element that contributes to the overall character of a place. Soundscape research aims to promote sound as a positive element of the environment, rather than focusing on environmental noise. This study investigates the integrity between the visual landscape and the acoustic landscape characteristics of an urban historic district of Ankara, namely Hamamönü which has recently faced an urban renewal process. Data were collected through questionnaire surveys, field observations and sound level measurements. Findings show that even though they appreciate the visual landscape which is dominated by the restored buildings, only a minority of them think there is a harmony between the visual and acoustic character. Moreover, users prefer spending their leisure time in Hamamönü district because of its visual amenities; however they are not particularly interested in the district’s historical values. The district, formerly a settlement area, has largely been transformed into a tourism and commercial zone. Despite the visual character of the buildings has been preserved and restored according to the original, the uses, users, and consequently the character of the area has changed. To conclude, urban renewal and transformation might be useful tools for managing change and preserving cultural values in urban areas, on the other hand it is also needed to develop a holistic approach where integrity between different landscape elements and functions should be the focus in order to maintain historical values.

Key words: Soundscape perception; urban historical place; urban landscape character; Hamamönü.

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A linear settlement for emergency structures: the Gaza Strip's case study

Domenico Chizzoniti *, Letizia Cattani, Monica Moscatelli, Luca Preis

Politecnico di Milano, ABC Department, Piazza Leonardo Da Vinci 32, 20133 Milan, Italy

ABSTRACT

This paper tries to analyse one possible approach that has enabled us to experiment a strategy for a new settlement based on emergency structures applied in a particular context: the Gaza Strip. First of all, due to the difference between all the paradigms of the strategies of primary health care and emergency medical assistance, the paper tries to demonstrate that there is one possible model that could be adopted as the requirement for the human condition of the Gaza Strip. In that area the most important problems are related to the lack of educational facilities, health care, relief and social services, microcredit and emergency assistance. Then this paper analyses some different proposals planned by experts about the construction of artificial islands and linear system of communication between the West Bank and the Gaza Strip. Our research, through a holist approach to the problem, identifies some priorities in a possible plan of intervention. By recognizing a long-term strategy, the proposal is defined within a main territorial axis into the Gaza Strip that can be considered as a basic element of a linear settlement for the realization of emergency structure that connects Gaza City to Rafah. Into the Gaza Strip this axis is immediately identifiable as a morphological feature that is, at the same time, communication network and an element of local organization. It represents an essential element for its great grade of accessibility and then for its functional character. Finally, the paper wants to survey urban problems in such situation and intends this axis as a great opportunity in order to achieve a linear system of emergency facilities that includes main cities of the Gaza Strip, passing through the greatest refugee camps and near the principal crossings. Besides, this research is attending modular architecture as an adequate strategy for this case study, considering the property of flexibility, in order to increase / decrease the settlement based on necessary needs.

Key words: Urban design; emergency architecture; modularity; linear settlement.

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Evolution and permanence of city-countryside views throughout the urban development of a city: Madrid as a study case

Eva J. Rodríguez Romero, Carlota Sáenz de Tejada Granados *

San Pablo-CEU University, Higher Polytechnic School, Montepríncipe Campus. Boadilla del Monte, Madrid, Spain

ABSTRACT

The ever-changing contour of a city responds to many factors; the need to expand circumvents the geophysical limitations in an ever-lasting dialogue between the city and its surrounding countryside. The idea of trespassing this rural-urban boundary has existed since Renaissance, for instance with the villa-city relationship. The will to “look in” and “look out” of the city has driven architecture and urbanism to shape the city layout in a certain way. Lookouts, based on its topographic advantage, conform visual relationships that, over time, have become consolidated views, ever-changing, however part of the collective memory. Urban development plans must be especially sensitive towards these elements, for its importance lies mainly in the intangibility. Moreover, in the case of those views from the roads and accesses to and from the city, these “approaching landscapes” become an everyday scenery for those experiencing the rural-urban fringe. The purpose of this research is to study the evolution of these views in a growing city, paying special attention to the city-countryside dialogue. Along with a growing city comes a change in how it is perceived; the visual references can be altered, the scale can be distorted, and iconic or historical views are jeopardized. Madrid is chosen as the study case, as part of a funded project entitled “Proximity Landscapes of the city of Madrid. From the 19th Century to the present.”** This research tackles Madrid’s urban contour and surrounding nature: an area that has been left out both by the regional environmental studies of the Autonomous Community and by Madrid’s City Council Plan for the Quality of Urban Landscape. Through the analysis of historical cartography and other documentary evidence, we detect the areas of urban-rural friction along Madrid’s contour line in four relevant stages of the city’s development: before its first urban enlargement plan, late 19thC, mid-20thC and the present time. This evolutionary analysis allows us to establish the possible continued existence of certain relevant observation points, witnesses of the mutual city-countryside dialogue. The main conclusion drawn from this study is that lookouts from the city towards the countryside show a higher permanence, while the relevant observation points looking into the city not only move further away from the urban contour line, but proliferate as potential places from where to apprehend the iconic image of the city.

Key words: Urban landscape; proximity landscape; lookout; city-countryside dialogue; Madrid.

* **Corresponding Author**

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Historic urban fabric and its conservation problematic in Turkey

Feray Koca *

Mugla Sitki Koçman University, Department of City and Regional Planning, Kotekli, Mugla, Turkey

ABSTRACT

Historic urban fabric is the total representation of urban architecture that has the capacity of creating the urban space and urban life of a particular society. It has guidance on providing the coherence between architectural values and cultural continuity of built environment. The man designs his built environment according to some functional and cultural bases. Therefore, urban architecture is a system or structure consisted of physical, social and cultural entities. In this system, understanding historic urban fabric initially necessitates understanding the essence of the entity. The urban components may alter with changing conditions of the modern world, but the essence of historic urban fabric lies in the relatedness between the architectural elements. In modern world, with rapid urbanization, uncontrolled changes and growth of the cities have become threat to the authentic character and historic urban fabric of the cities. Moreover, with technological developments, functions of the urban environment have changed; thereafter, conservation of the historic urban fabric and its adaptation to new form of living and land uses have become significant issues for urban design and planning policies. The main objective of this paper is to assert the necessity of understanding historic urban fabric in order to provide the perpetuation of the authentic character and architectural qualities. Defining historic urban fabric for a settlement necessitates understanding and reading the space because these practices release the inventory feature of the local character in terms of conservation practices. The study puts forth the conservation problematic of historic urban fabric in Turkey in line with explaining the development process of Turkish planning system. In the last century, many Turkish towns have been disrupted with modernization tools and projects. With capitalist materialism, many global images and architectural features are stamped to the cities as contemporary projects. Sometimes, on behalf of maintaining just the physical historic urban fabric, some architectural elements are copied as a model to the new designs such that they were lack of their soul, meaning and historic significance. In this way, many cities in Turkey transformed due to the pressure of capitalist production and the historic urban fabric could not be preserved. In some Turkish cities, the strong relationship between culture and character has been broken; in the meantime the common language that constitute the urban fabric has been forgotten. This study reveals that urban artefacts of history or historic architectural values are not the end products of a settlement; they are the result of a long-term formation including physical, social, cultural, economic interactions. Inherited environment has the capacity of creating the image of the city; thus, the built environment should be evaluated with its own entirety and continuum.

Key words: Historic urban fabric; conservation; urban architecture; authentic character.

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Technological factors determining transformation of urban functions in Lithuanian cities

Skirmante Mozuriunaite *

Vilnius Gediminas Technical University, Faculty of Architecture, Urban Design Department, Pylimo St. 1, LT- 03227,
Vilnius, Lithuania

ABSTRACT

The world largest cities central parts do not have a homogenous structure due to the factors determining an urban growth and development. The variety of function, their density and concentration in the central part of the city within social, economic, political, cultural and other factors stimulated a rapid urbanisation and urban transformations. Transformations in urban design are not a new phenomenon, rather than a continuous process. Over the past 50 years cities have changed incomparably. The aim of this paper is to discuss crucial transformations, of urban functions and technological factors influencing urban functional mutations based on the outcomes of research carried out in the largest Lithuanian cities from 1960-2011. The research was done concerning the development of a method for determining an urban function transformation. In this paper the main focus is on development of new technologies, economy, globalisation, lifestyle, etc., which along with planning system and ongoing urban process have generated a great variety of urban development conditions. The research empirical methodology reveals the sensitivity of the functions at macro scale, their typology and allocation in the city reveals the character and correlation degree between the functions. Hence, the existing city structures become complicated. Digital technology dissemination through various human activities impact human behaviour, the way how they use and live in cities. However, technological factors by themselves do not result innovations, but trying to meet the residence need, cities structures become complicated. As a result new hybrid morphological types emerge misbalancing the urban functional system and fabric. Therefore, this may require a rethink of the identification guidance and form the regulatory corresponding strategies for this phenomenon.

Key words: Urban functions; planning system; urban transformation; functional mutations; dispersion; functional structure.

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Assessment of lot layout and coverage in business park design

José F. Silva *¹, José F.G. Mendes ², Rui A.R. Ramos ²

¹ Polytechnic of Viana do Castelo, Department of Civil Engineering, Av. do Atlântico 4900-348 Viana do Castelo, Portugal

² University of Minho, School of Engineering, Department of Civil Engineering, Campus de Gualtar 4710-057 Braga - Portugal

ABSTRACT

Planning and developing a business park is a complex task, which demands integration across various fields of design and knowledge. The first choice to be made in the design process is relate to the zoning process and the definition of the lot layout and landscape. These first decisions will constrain all subsequent decisions concerning utilities, facilities and amenities. For this reason, the assessment of those issues is crucial for the perception of the overall quality of the business park design. The main goal of this work is to present a simple tool which can assess the lot layout and coverage by using three indicators: street frontage, lot shape and floor area ratio. These indicators measure the performance of the design solutions by using a transformation function which gives a score. The indicator street frontage evaluate the suitability of the spatial arrangement of the lot and its building footprint in order to ensure proper access to service vehicles, staff and visitors. The indicator lot shape evaluates the performance of the lot design solutions according to the concept of compactness. The indicator floor area ratio is used as a measure of the land use intensity, and intends to evaluate the quality of the site being developed regarding its density. The scores of these three indicators are combined according to weighting and aggregation procedures, resulting in a synthetic score for the lot layout and coverage design quality. This assessment tool proved to be effective in the evaluation of the lot layout and coverage design quality, and has the ability to be useful as a decision support system in choosing between alternative designs solutions for business parks.

Key words: Lot layout; street frontage; floor area ratio; lot shape; lot layout assessment; business park design assessment.

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Determining of landscape character of urban water corridors as visual; a case study of Asar Suyu in Duzce (Turkey)

Engin Eroglu, Sertac Kaya *, Elif Atmaca

University of Duzce, Faculty of Forestry, Department of Landscape Architecture, Turkey

ABSTRACT

Urban open and green spaces both remain under threat and decrease because of increasing population, urbanization, migration, and some cultural changes in quality. An important element of the natural landscape water and water-related natural ecosystems is exposed to corruption due to these pressures. According to European Landscape Convention (ELC), Turkey also signed, countries have been obliged to determine, conservation, development and manage their landscape. A landscape has owned many different types of elements or units, has a more dominant structure than other landscapes as good or bad perceptible extent different direction and variable reveals a unique structure and character of the landscape. Recently, "landscape character" concept plays an important role in identification of the elements constituting of landscape or their owned structures of the landscape and in the planning approaches of countries, regions, or the smallest planning unit. In fact, defining of possibilities of the natural and cultural structure of the landscape are main objectives for determining of the landscape characters. There are a lot of important efforts on landscape and landscape character. If landscape character can be identified as physical, social, ecological, aesthetic, and other features in a region, area or planning unit, it would be possible to get an important way on the basis of the contract in the spirit of conservation, development and management. As is known, the core components of the landscape are defined as patch-matrix-corridor. The corridor in these components means the relatively narrow strip of a special type that it is different from all areas. In urban areas, road and water corridors emerge as an important component of the landscape. In particular, water corridors attract attention having of natural diversity and lack of fragmentation, degradation and artificial results. Thanks to these features, without a doubt, water corridors are the important component of all cities in the world. These corridors both divide the city into two separate sides, and are being assured the ecological connectivity between the two sides of the city. The main objectives of this study is; a. by evaluating urban water corridors to identify as visual of landscape character, b. within this context, this study will be realized along with "Asar Suyu" is an important component the city of Düzce. In the study that realize along with "Asar Suyu" touched contiguous area borders of the city and overlaid the urban development limits of the city, determining of landscape character will be carried out as visual. Whereas patch features (patch analysis), vegetation and habitat of the study area will be held in the images of the area will be evaluated by means of silhouette analysis. As a result, landscape character defining of an urban water corridor at the level of local scale and elements that are effective in the identification of the visual and ecological characteristics will be evaluated.

Key words: Urban water corridors; landscape character; visual and ecological analysis; Duzce (Turkey).

* **Corresponding Author**

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Design process of a campus plan; a case study of Duzce University Konuralp Campus (Turkey)

Ozgur Yerli *, Sinem Ozdede

University of Duzce, Faculty of Forestry, Department of Landscape Architecture, Turkey

ABSTRACT

Human is a social and active organism and people are in constant interaction with the environment where they live in. So people felt the need to design that places. Today it is called "urban design" in metropolitan cities. The universities contribute many advantages like social, cultural, economic etc. to city where they are located. Additionally university campuses affect the cities positively thanks to their open and green spaces and bring under control the urban growth. Campus design can be considered as an arm of the urban design. Duzce city is located in Turkey's western Black Sea region and Duzce University is located north of the city Duzce. The campus is called "Konuralp Campus" which has about 180 hectares area. In campus there are 11 faculties, 3 institutes, a research hospital, sports centre, social activity buildings and a recreation forest. In this paper it was described the Konuralp campus design was developed in "Duzce University Konuralp Campus Development Plan Urban Design Competition". The main materials of the study were campus master plan, satellite photos, and study area photos, various computer software like Adobe Photoshop, Autodesk AutoCAD, and Microsoft Office. The method of the study consist of three stages. Some analyses like location, topography (ecological wind corridors and the meeting point of the valleys), spatial zoning, design axes and circulation were performed at the first stage. In the second stage the concept of the design was created and constructed how apply to the project. In the last stage the design idea of the campus was visualized with 3D materials and presented. The aim of the study is to design a campus which is sustainable and accessible. Consequently, the campus design was realized which has some design principles based on pedestrian priority. Education buildings were separated from social buildings, sports centre and cultural centre by using a pedestrian road that is called "archway". In the middle of the working area campus square was designed which contains some land uses like ceremony area, student centre, amphitheatre, library. Finally a sustainable and accessible campus design was developed for Duzce University.

Key words: Campus; design; visualize; Duzce (Turkey).

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Transforming a dangerous by design street through civic engagement

Jason B. Walker *

Mississippi State University, Department of Landscape Architecture, Box 9725, Mississippi State, MS, 39762 USA

ABSTRACT

Currently, the design professions, allied organizations, and government entities are promoting complete street approaches to street design. This paper discusses how a service-learning studio summer camp (studio school) collaborated with a municipality to reimagine an urban street that was dangerous by design. Studio School's primary objective is to engage underserved students to succeed in meeting the state's educational curriculum framework and graduate high school. The summer camp's goal was for the students to address math, language/arts, and science criteria while working on a hands-on design problem to improve traffic calming at a busy intersection. Historically, this segment of the study street functioned reasonably well due to its context being low-density residential. However, beginning in 2004 the area began a rapid transformation from residential land use to vertical mixed-use with high levels of activity. In just a few years, patrons frequented the restaurants and bars located on both sides of the street. From 2007-2012, five instances of a motor vehicle crashing into pedestrians occurred along this section of street. In the spring of 2012, following the last incident, the municipality approved creating a two-way stop with curb extensions as traffic calming measures. In conjunction with the city's planned improvements, the studio school camp proposed a street mural as an additional traffic-calming measure. The street is on an economically, environmentally and culturally significant ridge that runs from downtown through the university, a distance of approximately 2.5 miles. This ridge, along with nearby springs, influenced the early settlers to establish a community. Prior to Anglo-Saxon settlement, this area was home to the Choctaw Indians. The students' mural design references the places cultural history through the painted symbol that means "continual happiness through all stages of life". The mural's purpose was two-fold: aid in traffic calming and express a sense of joy that brightens up the intersection for passersby. The students' implemented the mural in the summer of 2012 and helped turn a once dangerous street into a safe pedestrian destination without a single accident between cars and pedestrians reported. Furthermore, the studio school campers got excited about learning and embraced a hands-on, project focused learning environment. These students are capable, but perhaps they need a choice of educational venues and alternative pedagogies if they are to reach their utmost potential as learners. Likewise, being involved in a project that integrated civic engagement might encourage them to become active citizens in their neighbourhoods.

Key words: Service learning; civic design; complete streets.

* Corresponding Author

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Building structures roofed with multi-segment corrugated hyperbolic paraboloid steel shells

Jacek Abramczyk *

Rzeszow University of Technology, Al. Powstancow Warszawy 12, 35-959 Rzeszow, Poland

ABSTRACT

A new method of shaping innovative building shell structures composed of many free original complete forms roofed with profiled steel sheets transformed effectively into hyperbolic paraboloid strips is presented in the paper. The method uses tetrahedral compositions of various kinds connected one to another with their faces contained in the planes of a so-called control structure - a spatial network. The control structure enables controlling the general form of a roof shell structure as well as the entire building structure. Each control composition – one “cell” of the spatial network enables integrating a roof shell and plane oblique elevations of one complete part of the building structure. The effectiveness of the transformations consists in the fact that displacements of adjacent folds in the sheeting are big, whereas strain is small. The free transformation makes that the folds are contracted in the middle on their length and extended at their crosswise ends depending on supporting conditions that is curvature and a mutual location of the skew directrices. The supporting conditions are diversified along each directrix, so the diversified arrangement of the supporting points of the shell folds to the skew directrices has to be calculated. Because of the effective fold shape changes, two individual shell sheetings cannot be connected one to another with their transversal borders to obtain a smooth roof shell of bigger span. However, the shells can be set together with their transversal edges if their directrices corresponds to each other in terms of location and shapes. Thus, the line of the joint has to be an edge disturbing smoothness of the resultant compound roof shell. It is possible to combine various types of the control compositions to improve the diversity and attractiveness of the free roof forms as well as the entire forms of the building structures. In addition, an integration of the building structure forms and their natural and built environments can be performed. Locations of the complete shells in the roof structure can be very varied, so the mutual positions of load vectors and the shells are diversified. Therefore, a decomposition of the load vector into components parallel and perpendicular to the direction of each fold including tangent and normal to the neutral surface of any shell is presented in the paper. Selected issues related to shaping frameworks of such building structures are discussed.

Key words: Corrugated shells; profiled steel sheets; free forms; buildings; spatial structures.

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A conceptual framework for the intelligent planning unit for the built environment

Makarand Hastak ¹, Choongwan Koo ^{*1,2}

¹ Purdue University, Division of Construction Engineering and Management, West Lafayette, IN 47907, USA.

² Yonsei University, Department of Architectural Engineering, Seoul, 03722, Republic of Korea

ABSTRACT

Most of the projects in the built environment system are unique in nature and different in design, specifications, constructions, and operations. Accordingly, it is difficult to establish a streamlined flow in the entire process of the complex built environment system and to arrange and optimize the required resources (e.g., labour, materials, and machinery) in a timely manner. To address this challenge, it is necessary to reduce the complexity of the built environment system and to provide the decision-makers with timely and accurate information for making better decisions. For achieving this objective, this paper presents a conceptual framework for the intelligent planning unit (IPU) for the complex built environment system, which is composed of three phases (i.e., IPU planning, IPU application, and IPU network). An IPU represents a well-defined planning unit that can be initiated to optimize a specific purpose and function (e.g., cost, schedule, materials, process, and productivity). An IPU can be defined by breaking down the physical entities and processes in the complex built environment system into carefully planned units (even nano-scale units) at the recognizable level. Since a built environment is a complex system of systems in facilities and in planning process, it can be composed of scalable systems from a nano-scale level to a larger-scale such as cities or beyond. In addition, a well-defined IPU can be replicated and implemented in the complex built environment system that can be expanded to any type of physical entities. Furthermore, the performance of the IPU can be improved through a refinement process that can be achieved based on the intelligent feature of communication. This study provides some example scenarios for the IPU as used in the planning stage of a project to elaborate the concept of the IPU. Finally, this study identifies some of the possible challenges and opportunities for the IPU concept. The concept of an IPU is designed to ensure that a project meets the client expectations on various aspects in the complex built environment system.

Key words: Intelligent planning unit; built environment; complexity; physical entities; refinement process; internet of things.

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Multidisciplinary project for integrated project delivery training: lessons learned

Julian Kang ^{*1}, Mark Clayton ², Geoffrey Booth ³

¹ Texas A&M University, Department of Construction Science, College Station, TX., U.S.A.

² Texas A&M University, Department of Architecture, College Station, TX., U.S.A.

³ Texas A&M University, Department of Landscape Architecture and Urban Planning, College Station, TX., U.S.A.

ABSTRACT

The construction industry in the U.S. has experienced productivity reduction since the 1960s. Many industry practitioners noted that the decreasing productivity was caused by many reasons including unique and unrepeatable nature of construction projects, fragmented project participants, and slow adoption of new technologies. Learning from the implementation of the Toyota Production System and lean construction concept, industry practitioners came up with the idea of Integrated Project Delivery (IPD) to solve these key construction problems. The IPD is designed to facilitate the talents and insights of all participants collaboratively to optimize project results, increase value to the owner, reduce waste, and maximize efficiency in the course of planning, design, and construction. However, the IPD concept has not been fully incorporated with the high-level academic institutes in urban planning, architecture, and construction yet. Still many students enrolled in each discipline are generally educated in isolation from the others. Many of them end up getting engaged in the integrated project delivery process in the AEC industry without prior training in multidisciplinary teamwork. It may be one of the reasons why some industry practitioners experiences challenges in implementing the IPD process for their projects. In Spring 2015, three professors from three Departments, Urban Planning, Architecture, and Construction Science in the College of Architecture at Texas A&M University put together a multidisciplinary class project to test how well the IPD practice can be introduced to students while meeting the learning objectives of each disciplinary. A total of 58 students from three departments formed 13 multidisciplinary teams and created a real estate development solution consisting of a 200 student residential school, grades 6 to 12, and farm for disadvantaged African American students from the Como district in Fort Worth, Texas. Students participated in this multidisciplinary project experienced high-impact learning. They also learned about challenges and benefits of working in a multidisciplinary team with members drawn from very different cultural backgrounds and countries of origin. This paper presents how this multidisciplinary class project was designed, how it was executed, and how students received it. This paper also addresses challenges that three instructors, participating students, and the project sponsor experienced, and some lessons they learned.

Key words: Interdisciplinary project delivery; multidisciplinary class project.

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Free longitudinal vibration of a cracked, pre-stressed continuous bar

Gábor Lengyel, Róbert K. Németh *

Budapest University of Technology and Economics, Department of Structural Mechanics, 1111 Budapest, Műegyetem
rkp. 3, Hungary

ABSTRACT

In this work the free vibration of a pre-stressed continuous bar with one crack at its end is analysed. In masonry and concrete structures, with low tensional resistance the continuity of material is terminated even for a small tensile force, cracks appear which have a significant effect on the mechanical behaviour. In the crack either a compression force arises, or a gap is opening. Thus, for large amplitude excitations the dynamical response of the structure becomes non-linear, however the structure is piecewise linear. The free vibration of non-linear structures is typically non-harmonic, however periodic solutions may exist, which can be referred as non-linear normal modes. This work deals only with such periodic vibrations, where during a period the state of the crack changes exactly once in each direction, and the bar stops during a period twice: once with closed crack, and once with an open gap. A new efficient numerical method is shown, which allows the calculation of periodic vibration paths of the free vibrating bar as a function of the time spent in the open and closed state. The presented method uses the modal analysis of the continuous bar in both state, and connects the modal amplitudes. Finally a robust numerical method is used for the scanning of the parameter space. The convergence of the method is shown as the number of considered modes is increasing. The longitudinal vibration analysis of an example shows the energy dependence of the natural periods, the change and ratio of the modal amplitudes in the presented simple non-linear normal modes.

Key words: Free vibration; non-linear normal mode; natural period; modal analysis; cracked bar.

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Mathematical models, estimation and calculation of technological parameters of the tubular mixer-saturator installations of pressure head flotation cleaning of industrial and domestic wastewater

S.Yu. Andreyev, Vladimir G. Kamburg *

Penza State University of Architecture and Construction, German Titov St., 440028, Penza, 28, Russia

ABSTRACT

The purpose of the study. Theoretical substantiation, estimation, calculation of process parameters and development of recommendations for hardware registration of process of pressure flotation treatment of domestic and industrial waters using tubular mixer-saturator. The basic results. Performed critical analysis of hydrodynamic regularities of the processes of turbulent mixing of the mixture "water-air" into the tubular mixing apparatus applied to the problem of intensification of work pressure saturator. Proposed to use the Stokes law for the velocity distribution of flow in the pipe cross-section for the turbulent flow regime with the introduction and justification of the magnitude of the correction factor on the basis of the analysis of the natural boundary conditions of the geometric dimensions of the cross section and the continuity of flow. A mathematical model describing the kinetics of the processes of mass transfer of air bubbles from the liquid water-air mixture, mixed in a tubular mixer based on the theory of turbulent diffusion Dankvert P. Recommended to evaluate the magnitude of the update factor of the surface of the phase boundary based on the thermodynamic analysis, allowing to take into account the specificity of the action of hydrodynamic pressure forces and surface tension instead of the usual approaches of the theory of dimensions. An estimation of the velocity distribution over the cross section turbulent flow two-phase mixture provide an opportunity to assess the value of the magnitude of turbulent fluctuations and their influence on the kinetics of mass transfer of air from the gas into the liquid phase. To evaluate each of the factors considered mathematical statements allowing you to perform engineering calculations taking into account the real technological situations. The developed package of applied programs, modular types, allowing the simulation to model situational versions with the inclusion and study of the impact of relevant factors of possible ways of development technological process. Key findings. The developed technique and software package of the calculation of tubular mixers have been successfully applied in the design process of hardware design technology physical-chemical sewage treatment plant sewage treatment plant with a capacity 3500 m³/day and allowed to provide the degree of their cleaning to the level of requirements of state standards of quality of the Russian Federation.

Key words: Mathematical models; tubular; mixer; flotation; cleaning.

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A direct construction of an inverse panorama from a moving view point

Jolanta Dzwierzynska *

Rzeszow University of Technology, Department of Architectural Design and Engineering Graphics, Poznanska 2, 35-084
Rzeszow, Poland

ABSTRACT

The aim of the study is a direct and practical mapping of an inverse cylindrical panorama with computer aid. An inverse panoramic projection it is the projection onto a cylindrical, rotary surface or on the fragment of this surface, in which the centre of the projection is not located like in a typical panorama "inside" the cylindrical surface but outside of it. Spreading this idea, the author takes into consideration the kind of the cylindrical projection from the view point moving on a path. This representation is defined as a multicentre projection from the centres dispersed on a line path which can be straight or curved. Such an approach gives maximum approximation of the given results of the considered projection to real perception one experiences observing the image. The graphical mapping of the effects of the representation is realized directly on the unfolded flat background of the projection. That is due to the projective and graphical connection between points displayed on the cylindrical background and their counterparts received on the unrolled flat surface. The paper shows descriptive way of creating edge images of given objects. However, for the significant improvement of the construction of lines, the analytical algorithms are formulated in Mathcad program. However, they can be implemented in majority of the computer graphical packages, which makes drawing panoramas more efficient and easier. The presented inverse panoramic representation, and the way of its mapping directly on the flat background can find application in presentation of architectural space in advertisement and art when drawings are displayed on the cylindrically curved surfaces.

Key words: Cylindrical perspective; panoramic projection; CAD.

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Process of emergence of smart specialisation in Pomeranian Voivodship in Poland

Dorota Kamrowska-Zaluska *, Jacek Sołtys

Gdansk University of Technology, Faculty of Architecture, Department of Urban and Regional Planning, Poland

ABSTRACT

The European Commission put a growing emphasis on the smart specialization as a tool of regional development. This term is present in a number of strategic development documents in the European Union, including Europe 2020, published by the European Commission in 2010. It implies the need for countries and regions to specialize as well as focus development of innovation in areas that are consistent with their endogenous potentials. Objectives of this paper are: (1) to present the method and results of the process of identifying smart specialization in Pomeranian Voivodship; (2) to analyse evolution of the fields of smart specialization; (3) to identify problems and challenges which occurred during this process. In this research, following methods have been applied: (1) analysis of existing documents including application forms for the competition of Pomeranian smart specialization, (2) individual in-depth interviews with members of partnerships and representatives of the Voivodship Marshal's Office, (3) authors' observations while participating in this process. The authorities of the Pomeranian Voivodship see the smart specialization as an area with high potential, relevant to the development of the Voivodship, based on the unique resources of the Region and their innovative use. It is assumed that, among others, implementation of R & I is contributing to the development of existing economic specialization and having an impact on the growth of competitiveness of the Pomeranian Region on the national and international arena. The process of identification of smart specialization has been implemented in three phases. The first one is determination of the economic profile of the region. The second step is discussions, consultations and partnerships building various forms of interviews, workshops and meetings with stakeholder incl. business, R & D institutions, clusters, regional bodies, non-governmental organizations, local governments, academia, Pomeranian Boards of Education and others. The last phase is organization of the competition for Pomeranian Smart Specialization. Presented research shows that the important feature of this process has been a bottom-up approach. Regional Government invited all actors to create a partnership. They worked on identifying potentials, and then basing on this analysis, developed a common strategy for the development of smart specialization. The method of identification of the priorities and implementation of the actions assumes that the process itself should be flexible, meaning that adopted priorities and allocation of resources need to be reviewed and modified if such a need occurs.

Key words: Smart specialisation; Pomeranian Voivodship; regional knowledge-based development; innovation strategy; regional competitiveness.

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Rural development, quality of life and urban amenity usage in the near rural areas

Ozan Hovardaoglu *, Seda Calisir-Hovardaoglu

Erciyes University, Faculty of Architecture, Department of City and Regional Planning, Kayseri, Turkey

ABSTRACT

Rural development strategy and policies have begun to be increasingly intensified within national level development strategies in the 2000s. In this period, national level agricultural policies have constructed in tune with the European Union's Common Agricultural Policy (EU-CAP) and triggering development in the rural areas through EU-CAP has become a national priority of development strategies in Turkey. Through the aim of re-organization of agricultural production in Turkey, professionalization and institutionalization strategies in agriculture have already begun to be apparent recently. Moreover, there are also quality of life related policies concerning improvements in life qualities in rural areas. Those strategies, however, seem to misplace two important problems outside the main concern. In the first place, the aims and targets of professionalization and institutionalization of agriculture indispensably require and depend upon various "urban" services. The second problem of those strategies seems to be their tendency to consider the rural areas as though they were homogeneous except some certain climatic and geographic characteristics. But it is a prevalently known fact that the local development literature underlines contingent nature of regional development underpinned by various empirical studies. The first problem seems to be a common challenge both in national and international level rural development strategies. Since many of the components of quality of life and re-organization of agricultural production are generally the functions of urban services, many of the rural development strategies face either the challenge of lack of accessibility to those services from the rural areas or the difficulty to provide the rural areas with a multiplicity of urban services. Regarding the fact that rural areas are not identical to one another, it is possible to claim that constructing contingent development strategies for different rural areas would be much more efficient for rural development policies. Assuming this statement, this study suggests the concept of "near-rural" which identifies specific rural areas wherein the 'friction coefficient of distance' in terms of accessibility to the multiplicity of urban services located in the regional towns. Having regard to this framework, this study aims at fulfilling three main tasks. In the first place, we underline the necessity to produce place-oriented rural development strategies for near-rural areas. Second, we attempt to identify certain peculiar demographic, economic and social characteristics and problems of these areas. And finally, we intend to construct a framework for rural development strategies in near-rural areas. To anticipate the direction, Büyüktuzhisar settlement, a near-rural area from the city of Kayseri, one of the most popular new industrial districts of Turkey has chosen to be the case study of this research.

Key words: Rural development; near-rural areas; Turkey.

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The Roman Limes as European Cultural Landscape: working on a site in Transylvania

Zsolt Vasáros *, Cicelle Gaul, Gergely Sági

Budapest University of Technology and Economics, Faculty of Architecture, H-1111 Budapest, Hungary

ABSTRACT

Between 2013 and 2015 our department provided its students with an opportunity to take part in an international cooperative project in Transylvania. Under the guidance of the Mureş County Museum and with the participation of other Romanian, Hungarian and German institutes, interdisciplinary research projects were conducted in the territory of the limes of Mureş County. As we got acquainted with the surroundings, it became clear that as architects we could and should play a significant role in the excavations and in the post-processing of the relevant data, a role that goes beyond the preparation of surveys and drawings. We are discussing the “contemporary issue” of the Limes. More particularly, we are concentrating on a small part of Transylvania which once was a part of the military boundary of Roman Dacia, a territory under the socio-economic pressures facing rural settlements throughout the region. We are talking about cooperation between archaeologists and architects, across borders, which no longer exist – or do they? Is there a “Limes” in time that separates the inquiry of the archaeologist from the inquiry of the architect? Is there a border that divides the topographies and artefacts of previous times from the landscape of today, or the imagined landscape of the architect? Do the borders of time separate us from our past, or does the past just recede under layers of contemporary residue to a resting place below the surface, while remaining nonetheless, even in its sleeping-beauty slumber, a familiar and decisive influence in the landscapes of our everyday lives? How deep do we have to dig “in time and space”, how closely do we have to listen, for the boundaries of time to recede and for the sleeping remnants of past times to become reanimate? The architects of the future, students who have been invited to this place, have been given the following task: remap and reanimate the dimensions of this lost world, transpose its map across the face of the present day settlement, and perhaps re-energise the life of the village by reconnecting it with its past. Is this an opportunity to reconnect with the landscape, with one’s birthplace, through a remapping of the familiar surroundings, the rediscovery of new-old stories? The designs and ideas produced by students are of high quality, and they provide an excellent foundation on the basis of which to continue this polemic with the landscape, with the people of today, their predecessors from the limes, in the interests of providing a future for coming generations. The excavations, surveys, and common thinking are going on and will hopefully continue for a long time into the future, and new projects could be started and completed. They will benefit students, teachers, participants in IP, and, last but not least, the local communities. The energies brought to life by Roman culture and the Roman Empire, energies conserved in their constructions, can be used to form the future.

Key words: Cultural landscape; Transylvania; roman heritage; limes; archaeology; contemporary architecture.

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Unknown deformations on the facades of the Pyramid of Khafre at Giza pyramid complex in Egypt

Valdis Seglins, Agnese Kukela *

University of Latvia, Raina blvd. 19, Riga, LV-1586, Latvia

ABSTRACT

The pyramids of Giza in Egypt are the architectural heritage of ancient civilizations and for many thousand years served as great examples of ancient design, planning and construction solutions. Their scale is grandiose and the attempts of ancient architects to find perfect forms to ensure the structure stands for eternity are admirable. The initial geometry of the structures, their form, proportions and symmetry, was adapted to construction material and technologies available at that time. However, during more than 4500 years these monuments were damaged and partly destroyed; some pyramids were razed to the ground due to construction faults and seismic activity. The second largest pyramid at Giza is the pyramid of Khafre. This monument was not reconstructed and rebuilt, therefore it was chosen as an object of our study. During the time period of 2009 – 2012 the photographic documentation of the facades of this pyramid was performed, fixing the location of fractures, cracks and displacement of construction blocks. The location of major fractures and cracks was verified in situ in 2012 and confirmed the validity of the interpretations. Several types of fractures and cracks were identified. One of the types indicates the detachment of stone blocks from the massive crack. The other type refers to the long linear cracks and fracture areas traceable through the major part of the pyramid's facade, threatening the stability and integrity of the whole structure. On the south-east corner of the pyramid some cracks oriented towards the inner structure of the pyramid were identified. This denotes to the sinking process and characterizes the inner structure of the pyramid as heterogeneous, with solid material areas and collapse of some hollow spaces. The studies of earlier photographs allows us to conclude that these processes were mostly active during the last 50 years and more detailed studies in the future would be required to elaborate this monument's preservation strategy.

Key words: Stone material; fractures; cracks; photographic documentation.

* **Corresponding Author**

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Royal Garden design performed in favor of housing and social development in El Pardo, Protected Environment in Madrid (Spain)

Guadalupe Cantarero *

Escuela Politécnica Superior Universidad CEU San Pablo, Campus de Montepríncipe, Alcorcón
28925 Madrid, Spain

ABSTRACT

El Pardo was named Royal Site, in the reign of Fernando VI, because of its history and art qualities. His successor Carlos III proceeded to incorporate to its Heritage its hills and woods. It started then a new urban process and architectural building that finished about 1800 till 1802, henceforth, the course of conservation and consolidation would only be maintained. After the Spanish Civil War in 1939, General Francisco Franco places his residence in Royal Palace encountered in El Pardo. This village begins processing and performing its urban and architectural context into an unrecognizable landscape. Diego Méndez, the architect Head of project, concealed a New Urban Development Plan promoted by General Francisco Franco. In order of Royal Gardening design we find out two performances which broke the original design in order in favor of housing development or new public spaces. The first is about the Royal Palace Garden and the second one is about the Prince House Garden. The purpose of this study is to manifest this changes which altered the original garden design and the consequences about this modifications. This study aims to critically examine the social forces that shape and transform the two main Royal Gardens in this Royal Site in Madrid, Spain. It also takes part of the researching Thesis core for the Phd in which Cantarero is working on, titled Residential Architecture in El Pardo 1885-1965. Repercussion into the Civil Buildings of the Royal Site. This research takes part of the public I+D+I Ministry of Economy and Competitvity Project: Plan Estatal de i+d+i del Ministerio de Economía y Competitividad (Cod. HAR2014-57843-R) titled "Paisajes de aproximación a la ciudad de Madrid: del siglo XIX a la actualidad".

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Key words: El Pardo; Royal Site; Spanish civil war; urban development; environment; landscape.

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Topographic monitoring of landmarks placed in the constructions' foundations within the area of influence of a closed salt mine

Sanda Naş, Raluca Farcaş *

Technical University Cluj-Napoca, Cluj-Napoca, Romania

ABSTRACT

Based on the visual and photographic findings upon constructions and land and also based on topographical measurements made on topographic landmarks placed in the field or on constructions it was sought to find a technical explanation of phenomena manifested in buildings (cracks, deterioration, displacements, etc.) and also to assess the degree of danger regarding the safety of buildings and the land in the area surrounding them. The purpose of the time tracking of the land and constructions of the Victoria mine area is to obtain information in order to ensure the stability of both land and buildings in the area, an assessment of the environmental conditions for preventing various natural accidents, namely prevention by reducing material damages, prevention of loss of life and environmental degradation.

Key words: Instability; monitoring; landmark; salt mining; risk reduction.

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Improving pervious concrete pavements for achieving more sustainable urban roads

Alessandra Bonicelli *, Gilberto Martinez Arguelles, Luis Guillermo Fuentes Pumarejo

Universidad del Norte, Department of Civil and Environmental Engineering – Km 5 via Puerto Colombia, Barranquilla, Colombia

ABSTRACT

Pervious concrete is a novel pavement material characterized by a porous structure that allows the water to percolate through it. The use of this type of pavement minimize the negative effects of storm water run-off, prevent water from forming puddles (avoiding aquaplaning and splash and spray phenomena) with the resulting benefits in safety and comfort for all type of road users: car and bicycle drivers and pedestrians. Moreover pervious concrete pavement is defined as a Best Management Practice by the US Environmental Protection Agency's (EPA) for pollution control and storm water management. It contributes to lower pavement surface temperature and the heat island effect, noise due to traffic, and pollutants. For its environment friendly properties, pervious concrete pavement aids in qualifying for LEED credits (Leadership in Energy and Environmental Design) by the US Green Building Council. Despite its environmental remarkable qualities, pervious concrete high-drainability characteristics do not correspond to high strength and good surface conditions when submitted to vehicular traffic. In fact, the most common uses of pervious concrete pavements are limited to low volume traffic roads, parking lots, pedestrian areas, cycle paths and side-walks. Pervious concrete has to be designed as a proper balance between the desired strength and drainability depending on the final use. Construction rigorous standards have not yet been defined even if the compaction energy is a fundamental parameter that determines the final mechanical and functional properties of the material. In fact, the same design of the mixture can result in different pervious concrete pavement characteristics depending on the timing of compaction and the energy applied. Moreover, admixtures can be added to the mixes to enhance resistance and durability and at same time trying to limit the reduction of drainability. The present laboratory study aimed to compare the properties of several pervious concrete mixtures submitted to different energies of compaction with the following main goals: on one hand, to define the effects of compaction energy on the design requirements of strength and drainability, on the other, to compare the reinforcing effect of different admixtures on the material properties. Different percentages of sand and several reinforcing fibres with various physical and chemical properties were added to mixes, changing water to cement ratio while fixing the aggregate size distribution and the paste content. Laboratory tests, such as indirect tensile strength, elastic modulus, and Cantabro resistance, were conducted to measure the mechanical behaviour of the material; while, porosity, bulk density and drainability capacity were evaluated to define volumetric and functional characteristics. The result of this investigation provided useful information about the effectiveness of laboratory compaction to achieve the optimal strength-drainability balance, adequate for the different urban uses. Moreover, this study identified the suitable admixtures, with the appropriate proportioning, that could enhance the mechanical properties of the material leading to a wiser use in medium-high traffic roads.

Key words: Pervious concrete; urban roads; sustainable pavement; sustainability; innovative material; optimization.

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The concept of Quattro modal freight hubs

Georg Hauger ^{1*}, Monika Wanjek ¹, Claudia Berkowitsch ¹, Sarah Pfoser ², Oliver Schauer ², Lisa-Maria Putz ², Reinhold Schodl ³, Sandra Eitler ³, Matthias Prandtstetter ⁴, Karin Markvica ⁴

¹ Vienna University of Technology, 1040 Wien, Gußhausstraße 30, Austria

² University of Applied Sciences Upper Austria Steyr, Wehrgrabengasse 1, Austria

³ University of Applied Sciences bfi Vienna, 1020 Wien, Wohlmutstraße 22, Austria

⁴ AIT Austrian Institute of Technology, Mobility Department, 1220 Wien, Donau-City-Straße 1, Austria

ABSTRACT

Recent works suggest intermodal freight transport to have a promising potential of reducing negative effects caused by the transport sector. To tap the full potential an eco-friendly multimodal supply chain is required, where the relevant part of the distance is covered by environmentally friendly modes of transport such as rail or inland waterways. Since the transport sector causes substantial emissions, intermodal transport is also being promoted by policymakers and subject to strategy papers on transport policy. The intermodal integration of different modes of transport (MOTs) at one hub is currently usually limited to road, rail, waterways (inland navigation and deep sea) and - depending on the understanding of MOT - also pipelines, which is usually referred to as bi- and tri-modal hubs. This concept is already widely discussed in literature and very common in practice. In contrast, air freight transport is only regarded in an isolated manner and there is only very limited scientific and empirical evidence for the local, hub-related integration of air cargo into multimodal transport chains. Nevertheless, the local bundling of four modes of transport might entail specific advantages due to the additional mode option. Furthermore, when building up failsafe (synchronomodal) transportation networks the effortless transshipment from one MOT to another one is crucial. The improved choice might lead to more sustainable transport decisions. For this reason, the aim of this paper is to examine the potential and practical relevance of quattro-modal hubs in freight traffic. In the following, we define quattro-modal hubs as logistics pivots where four modes of transport (road, rail, waterway and air) are either locally bundled or at least technologically and organizationally integrated. This implies that the concept of quattro-modality is not limited to a specific site where all four modes meet (e.g. an airport). It can also refer to a region or a district where all four modes are available and integrated in an intelligent way. Technological integration means that there is the possibility to overcome physical interfaces, e.g. through cargo-handling technology and appropriate IT systems. Organisational integration means cooperation in terms of transport organisation, e.g. exchange of information and cooperation in processing. The theoretical analysis (desk research, interviews with experts) suggests that there is a potential for quattro-modal hubs in freight traffic, the vision is however in an early stage of development and there might be difficulties due to its implementation. Further there is a need for a feasibility analysis on a regional scale to assess the practical relevance of quattro-modal hubs in freight traffic. This currently takes place in the ongoing Austrian exploration-study Q4, which is financed by the Austrian Ministry for Transport, Innovation and Technology (BMVIT).

Key words: Freight; logistics; supply chain; region; smart cities.

* **Corresponding Author**

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Diagnosis of urban public transport in the city of Cáceres (Spain)

Montaña Jiménez-Espada *, Rafael González-Escobar

University of Extremadura, School of Technology, Avda de la Universidad s/n, CP-10071, Cáceres, Spain

ABSTRACT

The main objective of this study was to analyse the overall performance of the urban public transport franchise in the city of Cáceres (Spain), including its degree of use and the profiles of potential users. A further aim was to ascertain the motives for the journeys and the population's level of accessibility to the service, taking into account the city's current sustainable urban mobility plan. The intention is to provide a possible solution to the city's current problems of mobility. The frequent use of private vehicles over public transport for reasons of convenience creates congestion on the main access roads to the city centre, and generates the need for more parking spaces, sources of stress for the citizens and increasing the levels of environmental and noise pollution. The local administration and users' satisfaction with the quality of their urban public transport service supports the conclusion that a service is being provided that is well adjusted to the particular needs of the city, promoting sustainable mobility and adaptation to the financial resources allocated to providing that service. However, there is room for improvement in its efficacy by implementing public transport lanes on high ADT roads, increasing passage frequencies, encouraging interchanges, providing greater spatial coverage, and instituting traffic light priority systems for public transport.

Key words: Public transport; sustainable urban mobility; accessibility; passage frequency; urban planning.

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Comments and suggestions for improvement of mobility and road safety in the city of Cáceres (Spain)

Montaña Jiménez-Espada *, Rafael González-Escobar

University of Extremadura, School of Technology, Avda de la Universidad s/n, CP-10071, Cáceres, Spain

ABSTRACT

The objective of this study was to examine critically the city of Cáceres's (Spain) current sustainable urban mobility plan, analysing the measures already implemented by the City Council from the perspective of their functionality, and proposing different approaches to improving traffic and road safety in order to optimize the effectiveness of those measures. The current state of mobility in the city was examined to determine how effective the plan's lines of action have been, and to propose alternatives that should result in effective and sustainable improvements in the conditions of urban mobility. In general, the actions proposed in the city's mobility plan are fairly consistent with the city's reality and with the situation in other medium-sized Spanish cities. However, the plan does not provide for the development of measures of institutional, physical, and tariff integration of the various systems of public transport and their intermodality (understandable given the size of the city and the limited number of modes of transport). Another aspect not evaluated in the plan, but whose inclusion is vital, is the improvement of children's mobility to and from school. Specific proposals are presented to improve road safety at certain strategic points of the city which have a high accident rate, and whose urgent need for solutions is a genuine headache for the city's management.

Key words: Sustainable urban mobility; urban transport; road safety; traffic; parking.

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Urban drainage treatment: myths, measurements and sustainability

John Sansalone *

University of Florida, Environmental Engineering Sciences, Gainesville, Florida, USA

ABSTRACT

The urban environs are a complex constructed interface that significantly alters rainfall-runoff relationships, and through the generation of anthropogenic and biogenic constituents results in significant transport of chemical, thermal, microbiological and particulate matter (PM) loads. These loads are largely coupled with the altered rainfall-runoff relationship. In North American cities with municipal separate storm sewer systems (MS4s) the load of volumetric runoff, chemicals and PM are equal to or greater than the untreated influent loads to municipal wastewater treatment plants (WWTP) yet the management of urban runoff loads is at least a half century behind municipal wastewater management yet is greater in scale and cost. Urban runoff management is very challenging; in part due to PM hetero-dispersivity, interactions between aqueous and PM phases, stochastic hydrology and highly unsteady hydrodynamics. Such challenges and associated costs with resolving such challenges have led to the relatively common historical examination of a spectrum of urban constituent control systems as black-box systems and rainfall-runoff chemistry utilizing lumped measurements; and many indices and measurement methods adopted from wastewater treatment. Experience over the last several decades has demonstrated that there continues to be a gap in knowledge transfer between the designs, analysis and monitoring of what are nominally called "Best Management Practices" (BMPs), fundamental unit operations and processes (UOP) concepts, sustainability requirements for BMPs, as well as new developments in the behaviour of green urban infrastructure. Despite such disparity, tools such as UOP concepts, monitoring tools such as laser diffraction, and continuous simulation modelling are removing stormwater controls from the category of "black-boxes". With such tools we can now demonstrate treatment viability as a function of the hydrologic, physical, chemical, biological and thermal phenomena for rainfall-runoff or snowmelt. Success requires the integration of these coupled phenomena. This synthesis is critical whether the objective is hydrologic restoration, source and near-source control, water chemistry control, water reclamation and reuse, or often, a combination of these. However, stormwater systems that do not provide some level of hydrologic restoration, for example through "green" infrastructure materials, are not sustainable. Additionally given the particulate matter, gross solids and pollutant load inventories that build up in urban areas, source control practices and load credits must be an integral part of any management plan that includes restoration, treatment, control and reuse. Stormwater treatment, urban maintenance and green infrastructure will play an increasingly critical role in the entire urban water cycle and therefore we must develop maintenance practices such as pavement cleaning, source control and near-source control. Further advances with respect to sustainability of urban water requires tools such as continuous simulation models, smart sensors and computational fluid dynamics (CFD) and a focus on fundamental unit operation and process concepts.

Key words: Urban drainage; green infrastructure; urban design; water cycle; unit operations and processes; permeable pavements.

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The natural conditions of Vilnius city (Lithuania) and historical development

Regina Morkūnaitė ^{1*}, Aldona Baubiniene ¹, Gediminas Vaitkevičius ², Daumantas Bauža ³, Darijus Veteikis ⁴

¹ Nature Research Centre, Institute of Geology and Geography, Akademijos str.2, 08412 Vilnius, Lithuania

² The Lithuanian Institute of History, Kražių str. 5 01108 Vilnius, Lithuania

³ Geological survey of Lithuania, Konarskio str. 37, 03123 Vilnius, Lithuania

⁴ Vilnius University, Vilnius, Lithuania

ABSTRACT

When assessing conditions for urban formation and expansion, historians and archeologists tend to underestimate the importance of natural conditions. The current study was intended to assess natural conditions on the basis of the cartographically reconstructed former relief of Vilnius city. The chief aim of this study was to reconstruct and to ascertain natural conditions of the medieval Vilnius and on that basis to substantiate directions of its expansion. For that purpose, properties of surface sediments as well as geoecological landscape of the territory were assessed, and the former structure of the hydrographic network and groundwater occurrence was reconstructed. Based on the findings of geological, geological-engineering drillings as well as on the other material available, naturally-occurring sediments and the origin of their formation were determined. The distribution of land surface sediments of the primary historical period revealed the previously prevalent flows of surface water, which are traceable by gravel layers. The first arterial streets in Vilnius go along the tracks of the former surface water flows that nowadays coincide with gravel corridors. Arterial streets of Vilnius provided the basis for the formation of its street network and zonation of the Old Town area. The performed investigations allowed tracing the existence of the 16th century Vingrė stream only to Vingriai springs. The Vingrė stream was extended during the defensive city wall construction when surplus waters of these springs were canalized from the Medininkai Gate along the track of Bazilijonų-Pylimo streets. When the flow of spring waters had been managed and the Gate of Dawn had been built, the track of Medininkai road was straightened by building a street leading to the Town Hall and connecting it to the already existing streets. These are important details for the understanding of urban development of Vilnius city. The analysis of Vilnius expansion directions leads to the conclusion that the hilly, wet and in many places springy riparian zone of the Neris River (first of all, the fluvial terrace above the Neris River floodplain) complicated development of this territory. It was one of the reasons why the city expanded not along the Neris River but on the territory of the present-day Old Town. It is also possible to ascertain that great anthropogenic transformations of Vilnius city natural conditions were induced by environment optimization aimed at meeting production, defence and lifestyle needs of the society. The performed interdisciplinary study has enhanced the informative value of thematically close data. This study has broadened and made more accurate the knowledge of the earliest communications in Vilnius and has revealed causal links between the relief, lithology of the territory and city structure.

Key words: Medieval relief; antropogenical layer; geological boring; Vilnius; istorical environment.

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Design of ground surface sealing in the spatial policy of communes

Maria Heldak *, Beata Raszka, Jakub Szczepanski

Wroclaw University of Environmental and Life Sciences, Department of Spatial Economy, ul. C.K. Norwida 25 50-375
Wroclaw, Poland

ABSTRACT

This study undertakes the subject of sealing the surface of the Earth in the context of planning development of urban areas in planning documents. The research analysed planning documents determining spatial policy of Wroclaw district communes located in the Lower Silesia region. The assumptions related to the spatial policy have been evaluated with regard to the planned increase in sealed areas. The analyses involved a zone which is to undergo a change in the manner of use from the previously pursued extensive use (agricultural production) to intensive use (residential developments, economic activity). The research was expanded by taking into account the decisions of local plans in the scope of minimal biologically active surface. The research results showed planned significant decrease of biologically active surface for urban areas.

Key words: Ground surface sealing; spatial policy; minimal biologically active surface.

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The landscape rurality: new challenge for the sustainable development of rural areas in Poland

Anna Górká *

Gdańsk University of Technology, Faculty of Architecture, ul. G. Narutowicza 11/12, 80-233 Gdańsk, Poland

ABSTRACT

The standard of country living was a matter of Polish elites' concern from the eighteenth century. In different historical conditions different concepts of the rural renewal were formed. Today in rural areas of Poland some spatial processes that threaten the quality of life occur. The disadvantageous changes are the result of national or local governments spatial policy and they are an inhabitants' response to it. The political transformation, launched in 1989, included the Polish countryside to The Rural Development Program, which involves the participation of local communities in the implementation of sustainable development policy. Participation has made the quality of life in the countryside a common problem of intellectual elite, institutions of government and other stakeholders. The bottom-up principle has given importance to the common rural landscapes. As a result, present degradation of rural landscapes informs about the need of a distinctive and collective vision of rurality to cooperate with the sustainable spatial policy as the test of individual spatial decisions. Selected cases of the countryside improvement will be presented to prove the presents of ideas level and grass-roots level in the physical landscape. It shows the ideological and social background of the renewal. Contemporary examples of rural settlements demonstrate that contrary judgments, as to what is rurality, are responsible for the unsustainable development. Then the possibility of participation of physical and mental landscape in creating a positive, collective image of the rurality, which could interact with the sustainable development policy will be considered. The importance of sensory experiences that come from the landscape in a contemporary vision of rurality formulation will be analysed. Grass-roots implementation of spatial policy requires ordering, social vision. Due to the facts that sustainable development remains rather a concept of intellectual elites and that the landscape is the framework of the perceptive experiences, it should be regarded as the foundation of the wanted social vision of rurality.

Key words: Rural landscape; sustainable development; vision; rurality.

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Application of remote sensing for monitoring degradation of wetland urban lakes – urban Lake Jarun case study

Duska Kunštek *¹, Jadran Berbić ², Almin Džapo ³, Branko Kordić ³, Luka Babić ³

¹ University of Zagreb, Kačićeva 26, The Faculty of Civil Engineering, Zagreb, Croatia

² University of Zagreb, The Faculty of Civil Engineering, Zagreb, Croatia

³ University of Zagreb, Kačićeva 26, The Faculty of Geodesy, Zagreb, Croatia

ABSTRACT

Based on multi-temporal spatial data it is possible to analyse and quantify changes in the topography of the coastal (wetland) areas. Spatial data can be collected using different remote sensing surveying methods such as airborne laser scanning (ALS), UAV photogrammetry and multibeam sonar. By combination of these methods high resolution geospatial data sets, above and below the water surface, have been obtained. Data was collected at several time periods. Such multitemporal data set is the basis for the research of degradation of wetland in this urban lake Jarun case study. Urban lake Jarun is located in the sports and recreational area of the City of Zagreb. This paper describes the analysis of the collected multi temporal spatial data by methods of remote sensing, and for the purpose of monitoring and evaluating the degradation of lake shore and riparian buffer of wetland urban lake. Methodology for evaluating the state and temporal dynamics of wetland urban lake is given, including recommendations for lake shore protection.

Key words: Remote sensing; wetland urban lake; airborne laser scanning (ALS); UAV photogrammetry; multibeam sonar.

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Strategic environmental assessment- an instrument for better decision-making towards urban sustainable planning

Ingrid Belčáková *

Slovak University of Technology, Faculty of Architecture, Nám. Slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

The connection of urban planning and SEA is understood as the inevitable condition for acceptable development and an important opportunity for enforcing approaches leading to sustainable development in the decision making process. Application of SEA in such planning could be observed for decades and urban planning is a field to which SEA is most commonly applied in many countries since it is probably the easiest field to implement all types of SEA. This paper is focused on pointing out the “added value” and potential benefits of linking SEA with spatial planning, on reviewing the recent development and application of SEA in planning in various countries worldwide with a special accent to circumstances and conditions under which this development took place. In addition it provides a summary of the experience with evaluation in this area based on the SEA systems founded so far and case studies. This knowledge implies also proposals for future developments. A special attention is given to the dynamic development of SEA application in spatial planning in all EU member countries. Furthermore, it gives a summary of practical experience in this fields based on available reference SEA system evaluations as well as on a number of published case studies and on personal experience.

Key words: Strategic environmental assessment; spatial planning; sustainable urban development; better decision-making.

* **Corresponding Author**

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Improving mechanical properties of cold-mix recycled asphalt: towards sustainable urban development

Gilberto Martinez-Arguelles *, Luis Guillermo Fuentes

Universidad del Norte, KM 5, Via Puerto Colombia, Colombia

ABSTRACT

Cold and half-warm mixes using asphalt emulsions and foamed asphalt assure significant environmental benefits because mixing and placement are completed at lower temperatures, thus implying energy savings, reduced aging of the asphalt, fumes, odours, and less atmospheric pollution. In addition, recycling end-of-life asphalt pavements results in a great challenge for addressing sustainability in transportation infrastructures. However, the professed environmental benefits have to be balanced with the generally lower performance of recycled mixes respect to standard paving materials. Including fibre reinforcement can help enhancing strength, moisture susceptibility, rutting resistance and fatigue performance, increasing the overall long-term durability and thus limiting maintenance operations. In spite of the benefits and advantages commonly ascribed to fibres on standard hot-mixes, very limited experience is available in literature as additions for being included into cold foamed mixes. The present paper presents the results of a laboratory investigation concerning the mix-design characteristics of cold 100%-recycled foamed mixes using fibre reinforcements to improve durability. Mechanical properties were assessed by means of the dynamic modulus, indirect tensile strength of dry and water-conditioned specimens. Results showed that recycled mixes can be improved to increase their service lives providing at the same time a valuable and sustainable alternative to be commonly adopted in road construction practices.

Key words: Cold-mix recycled asphalt; foamed asphalt; fiber reinforcement.

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What are the challenges for an incorporation of daylight assessment methods into residential urban planning in Poland?

Natalia Sokol *, Justyna Martyniuk-Pęczek

Gdansk University of Technology, Faculty of Architecture, Department of Urban Design and Regional Planning,
Narutowicza 11/12, 80-233 Gdansk, Poland

ABSTRACT

The purpose of this ongoing research is to find out whether modern daylight assessment and design methods can be useful for urban planning especially regarding planning of urban residential areas in Poland. The research gives a chance to describe and appraise modern daylight design methods. The other purpose is to illustrate how daylight knowledge could be used as an incentive to rethink the way urban environments are designed? What current Polish building and lighting regulations are missing in regard to daylight solutions? What kind of channels should be created to propagate daylight knowledge among professionals engaged in urban planning frameworks? While discussing a role of daylight in residential buildings and dwellings an emphasis is put not only on an energy optimization but also on the qualities related to inhabitants' needs, preferences and behaviour patterns. This paper focuses on findings from the literature review and two pilot studies. A role of daylight in urban planning is very complex, depending on the implemented filters of objectives, from social, cultural and psychological to energy optimization objectives. Several studies confirm that daylight studies are crucial in the early stages of residential urban planning especially while making decisions concerning urban density, buildings location, shape and height of the buildings, locations of open areas and playgrounds, window to wall ratio, size of apertures on a building facade or roof (Reinhart, F, Mardaljevic, & Rogers, 2006), Although daylight design is acknowledged in literature and case studies as a tool for fostering residents' well-being, daylight design strategies are not common practice in Poland. Furthermore, despite a growing role of daylight studies and assessment methods in sustainable architecture, modern daylight assessment methods including Climate Based Daylight Modelling (CBDM) are not described in Polish literature. One of the main barriers is a lack of daylight design knowledge, as well as, a lack of proper educational channels dedicated to modern lighting design techniques. Other barriers include limited daylight recommendations present in Polish building regulations, lack of new recommendations, limitations of residential buildings market (small plots vs. big buildings with relatively small apartments. Current Polish building standards containing daylight recommendations do not precisely indicate what actions are required to provide good daylight design and what kind of daylight metrics are needed to achieve a better quality of daylight. The research results suggest that daylight design guidebooks explaining how to effectively plan for a daylight environment are essential. National standards for day-lighting are needed. The results of the two pilot questionnaires show a lack of daylight training among future architects and urban specialists. The first survey carried out among 54 students illustrated the importance of daylight as a natural resource considered essential in sustainable approaches to urban planning, and highlighted the belief that daylight and electric light projects should be holistically integrated in the implementation of the town lighting plan. The results of the second pilot study showed a growing demand for better daylight education and an urgent need for revision of the existing outdated lighting recommendations in Poland. From this study the barriers that emerged on the implementation of daylight design strategies in Poland are: **a.** deficiencies in residential stock and rising land prices that mainly drive new residential developments; **b.** priorities in residential design that focus on quick delivery & profit, but

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not residential comfort; **c.** lack of awareness that daylight design is a factor contributing to better living conditions; **d.** lack of national daylight standards and guidelines; **e.** very limited daylight guidelines in building regulations; **f.** lack of national initiatives towards promoting daylight design as a sustainable design approach; **g.** low quality of design solutions as an effect of gaps in education (lighting courses are offered in electrical engineering faculties); **h.** low awareness of daylight dynamic metrics and assessment methods.

Key words: Daylight assessment; urban planning; urban residential areas.

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Refurbishment in large housing estates: a review on restructuring and upgrade

Cesar Diaz ¹, Pere-Joan Ravetllat ², Cossima Cornado ^{*1}, Sara Vima ¹

¹ Universitat Politècnica de Catalunya-Barcelona Tech, Department of Technology in Architecture, Av, Diagonal 649, Barcelona, Spain

² Universitat Politècnica de Catalunya-Barcelona Tech, Department of Architectural Design, Av, Diagonal 649, Barcelona, Spain

ABSTRACT

The current renovations and improvements taking place in housing stock, particularly in large residential buildings, provide a great opportunity for Spain and Europe to make a transition towards a more environmentally friendly housing that additionally contributes to improve the socio-economic condition of its inhabitants. Among the various issues that motivate the need of restructuring and repair, Large Housing Estates must face their adaptation to the current housing standards, maintenance and upkeep, adaptation to current energy efficiency goals and search of greater social integration mechanisms. In this framework, complex urban, spatial, technological and social topics cannot be addressed independently, and a broader multi-disciplinary approach in the research of mechanisms of contemporary upgrade is required. The present research aims to make a contribution to the state of the art on the very abundant casuistic that refers to tools and mechanisms that shape the diverse forms of intervention carried out in the last decades, as well as to analyse those that have proved to be particularly successful. With this purpose, an analytic procedure with a special focus on actions that addressed one or more scales of Large Housing Estates from both a technological and social point of view, aims to highlight patterns of intervention and their straight or indirect relationship with the achievement of certain goals. The aim of this research, is to provide new analytic tools that can be applied in the future in order to shape models of action that take into consideration all variables regarding Large Housing Estates renovation and upgrade in an holistic way including a multidisciplinary and multi scalar approach.

Key words: Urban restructuring; refurbishment; building upgrade; large housing estates; social integration.

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Sustainable development of historic cities: rediscovering Madrid's urban facade from its river

M.A. Flórez de la Colina

Universidad Politécnica de Madrid, Building Technology Department, ETSEM –Avda. Juan de Herrera, 6 – 28040 Madrid, Spain

ABSTRACT

Urban planning related to historic cities should take into consideration sustainability and visibility criteria. But this is not always the case, as quick profit as main economic development criteria for important urban interventions modify sometimes historic structures that cannot be recovered afterwards. The purpose of the research presented in this paper is a critical analysis of some of these transformations of Madrid's urban façade, to understand why these sustainability and visibility criteria are necessary in urban planning of such cities. The image of European cities, since medieval times to 19th Century, has been related to paintings or drawings representing them from a distance. But the extensions of the cities and some motorways around them, have transformed and sometimes completely destroyed these views, where the main public buildings and institutions of the city were clearly visible. This has been the case in Madrid with some of the infrastructures done in 20th Century, such as the M-30 motorway. The partial resolution of a traffic problem has created deterioration in the perception of the city, for both its citizens and the visitors coming from abroad. A series of recent and expensive projects has recovered in the beginning of the 21st Century this urban façade; but the high amount of resources involved made it controversial. The main result presented in the paper is related with the costs which are not so easy to value when dealing with such interventions, related to the "visibility" or the "image" of the city. Some of its conclusions and proposals, link the evolution of this urban façade to what could be done in Madrid - and also in other cities - to introduce parameters such as "historic perception of the city" or "urban façade impact" when considering projects that can transform it.

Key words: Urban planning; sustainable urban development.

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Urban development and energy access in informal settlements: a review for Latin America and Africa

F. M. Butera ¹, Paola Caputo ^{*1}, R.S. Adhikari ¹, A. Facchini ²

¹ Politecnico di Milano, Department of Architecture, Built Environment and Construction Engineering, via Bonardi 9, 20133, Milan, Italy

² Enel Foundation, Via Arno 64, 00198, Rome, Italy

ABSTRACT

The impressive urban growth that we are witnessing in the last decades is essential for our future development, and even more cities are considered among the most important engines of development. At the same time, they also concentrate some of the worst characteristics of urbanization, such as inequalities and very poor living conditions especially in large peri-urban areas, often surrounded by informal shanty towns, where people in the lower income bracket live in very poor conditions. Improving the living conditions of slum dwellers, whose global number is estimated in about 1 billion, is a crucial topic also addressed by the sustainable development goals, and access to modern energy services (electricity, clean and safe cooking systems) is a fundamental step in achieving such goal. Focusing on Latin America and Africa, a review on energy access, efficient energy use, and energy efficiency of the built environment in informal settlements of developing countries is presented, providing information on energy issues such as access, consumption, distribution, services, end use, technologies, and energy efficiency. Information about the main patterns of energy use and consumption in slums is provided, and the main barriers that reduce access to modern (and more efficient) energy sources for dwellers are highlighted. This study also shows that there are settlements in which, despite the physical access (e.g. to electric grid, LPG distribution system, and gas network) is available, the final potential users cannot afford it and/or the service is perceived unreliable, mainly because of frequent outages, low quality, and uncertain availability of electricity and gas bottles. As a consequence of this mechanism, the final user tends to make use of illegal electricity connections, and to use the energy sources being at lower steps of the energy ladder (such as kerosene, charcoal, wood and other biomass residues) for cooking. This review also reveals from one side that data on energy, and in particular energy efficiency, are missing or out-dated, as well as the interaction between energy distribution companies and slums' users. Further investigations are now in progress in order to fill the gap. In particular, in cooperation with local stakeholders, workshops and surveys with interviews to people living in slums are being carried out.

Key words: Energy access; informal settlements; sustainable urban development; Latin America; Africa.

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Open spaces in peri-urban areas as resources for the sustainable development of metropolitan regions: an economic perspective for the decision making

Giulia Pesaro *

DAStU - Politecnico di Milano, Via Bonardi 3, 20133 Milan, Italy

ABSTRACT

The crucial importance of green and open spaces as a part of a balanced sustainable development path seems, nowadays, to be a common and shared point in territorial governance and management, as the joint work of important international organisations like UN, OECD and UE demonstrates. Still, moving from theory to practice, the influence of pure economic private interests on decision-making remains predominant. This often drives land-use decision making to favour uses able to produce high financial, mostly private, revenues, leaving more sustainability sound uses in the background. Such dynamics appear particularly critical in peri-urban and urban areas, where green open spaces are besieged by urban uses as the income rents coming from these lasts are very high. In the light of the increasing attention paid to the environmental, cultural and social quality of territories, the essay aims at identifying a multidisciplinary framework for a decision making approach where peri-urban open spaces could become opportunities for and key components of the wellbeing of communities. In peri-urban areas, increasing pressures can be observed coming from a persistent demand for new surfaces where to locate urban functions. An ongoing dynamic process where a multiplicity of different stakeholders, representing different interests and revenue goals, demand spaces for a huge variety of possible uses. A variety which calls for an interdisciplinary approach able to make decision makers understand the values and revenues embedded in the conservation and valorisation of open spaces in peri-urban areas and to integrate the critical importance of their availability and quality as a main goal in land use, governance and management. After a discussion around peri-urban open spaces as a fundamental territorial capital of key resources for the development of urban regions, a taxonomy of open spaces in per-urban areas is proposed, underlining the use of open spaces. An analysis outline is then introduced, in a cost-benefit perspective, to enlighten the contribution of the economic perspective in an interdisciplinary assessment framework to better integrate the values and benefits coming from the enhancement of sustainable uses of open spaces in peri-urban areas.

Key words: Peri-urban areas; open spaces; decision making for urban planning; environmental and cultural value assessment; interdisciplinary assessment tools.

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Sustainable planning approaches and strategies in middle scaled cities: Isparta (Turkey) province example

Pervin Senol *, Erkan Polat, M. Ilgar Kirzioglu

Suleyman Demirel University, Faculty of Architecture, Department of Urban and Regional Planning, Isparta, Turkey

ABSTRACT

Sustainability arguments are put on the agenda by having the acceptance for the corruption of ecological balance gradually and this corruption as much as today also for the future generations' necessities which are also under threaten. Discussions show the necessities for the precautions for every kind of actors from global to local scale. Protecting natural/ecological balance as basic principle is wide spread accepted in the use of natural resources during national development and urbanization processes. Sustainable cities and planning practices are started to be applied with basic acceptances. Protecting ecological balance in planning the sustainable cities is defined as the basic target and realization by protecting natural resources which are directed to this target, are coming to the fore. In Turkey, middle scaled cities which are outside the metropolis cities are seen as locations which may be evaluated from the point of view of demographic, administrative and spacial characteristics, for the realization of sustainable planning studies. Isparta city is a location area within Mediterranean Region boundaries and having rooted background in history. Isparta city is rapidly developing with the university which was founded afterwards 1990's, effected by developing dynamics of Antalya tourism city, is middle scaled city, having some central functions those choosing places in the city, with having speed of developing process. In the scope of this declaration, in the peculiarity of middle scaled Isparta city; a. how urban developing dynamics and urban administrative practices define sustainable urban planning, b. what are the sustainable planning principles' scientific frame with practical relation, disagreements and coverings going to have a discussion from the perspective of sustainable urban planning.

Key words: Sustainability; planning; middle scaled city; Isparta province.

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Driverless mobility: the impact on metropolitan spatial structures

Piotr Marek Smolnicki *, Jacek Sołtys

Gdańsk University of Technology, Department of Urban Design and Regional Planning, Narutowicza 11/12 Str., 80-233, Gdańsk, Poland

ABSTRACT

Emerging technologies' diffusion is followed by the need of solving particular problems. Each innovation produce also some undesirable consequences. Many examples from the past have shown that along with the spread of each technology their side effects are accumulating until the level they need to be solved. One of the examples is automobile, which advantages and disadvantages were already described including its spatial consequences. But automobile did not change its general way of functioning for over one century, and recent technological advances in automation may revolutionize the way how it is used. Nowadays automotive and IT industry are investing in autonomous automobiles, driverless vehicles and self-driving cars, the meaning of which intertwine. Diffusion of automation in mobility is going to accelerate in the near future. The earliest implementations of new transport technologies appear in metropolises which also have the highest level of general mobility. Due to the possible significant consequences of this innovation's diffusion for metropolitan (urban and suburban) spatial structures it is important to anticipate its potential side effects to avoid negative consequences, and if necessary – to prepare to encounter them. This led to undertake research on the relationship between modern mobility innovations and metropolitan spatial structures. The article presents the assumptions and principles of scenario-based research. The example shows how different levels of diffusion of innovation determine possible scenarios of the future impacts of driverless mobility on spatial structures.

Key words: Autonomous automobiles; driverless vehicles; metropolis; scenarios; self-driving cars; spatial structures; urban design.

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The benefits of a modular green roof technology

Elena Korol, Natalia Shushunova *

National Research Moscow State University of Civil Engineering, Institute of Environmental Engineering and Construction Mechanization, 26 Yaroslavskoe Shosse, Moscow, 129337, Russian

ABSTRACT

This article aims to the various benefits of a modular green roof technology. Nowadays smart solutions of green roofs are popular for their ecological, technical, economic benefits and aesthetic qualities. Green roofs are used in residential, commercial, government and public buildings. Innovative energy-efficient construction technologies will bring great benefit to the ecology and help to relief the heat island effect. The purpose of this research is to provide an effective apparatus and method for green roof system, the principal results of this research are focused on adjusting of optimal physical parameters of green roof modules. This friendly-environmental green roof technology is oriented on policy of sustainable development and protection of the urban ecology.

Key words: Sustainable development; modular green roof system; urban ecology; energy-efficient construction technologies; green building.

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Technology of implementation of the pitched green roof on the testing building EnviHut

Petr Selník *, Klára Nečadová, Martin Mohapl

Brno University of Technology, Faculty of Civil Engineering, Veveri 331/95, 602 00, Brno, Czech Republic

ABSTRACT

The idea of vegetative roofs with the simple application aims to expansion of using green roofs in the contemporary construction industry. The local climatic conditions of larger urban units may be positively affected due to a numerous incidences of these structures. The application of environmentally friendly materials of green roofs dramatically increases the economic cost of the whole project in this time. This article describes one of possible solutions that would minimize the effect of the negative aspects mentioned above. The technology of testing installation was carried out on a residential research project EnviHUT. The inclination of the saddle roof is 30°. The project EnviHUT is designed as a self-sufficient mobile unit that can be used for example as a weekend recreation facility. A more detailed description of the testing installation is a part of this article. The process of continues monitoring is regularly restore by the team of Brno University of Technology and more information is indicated on the website <http://envihut.com/>. Three variants of green roofs - extensive roof, biodiversity semi-intensive roof and roof made up from turf carpets were implemented on the described building EnviHUT. Each layer's set of the examined vegetation layer system shows different building-physical characteristics and also different properties from an architectural and also botanical perspective. The tested vegetation-retention mats are made from recycled polyester fibres and they are a part of all the above mentioned variants of green roofs. This solution allows to simplify and speed up the installation of pitched and flat green roofs and it also provides a high level of protection of waterproofing layers during installation. The partial retention tests were carried out on the comparative elements and they proved required retaining capability of water in the roof system. Different systems that prevent sliding of substrate and soil were optimized for each variant of green roof. The main monitored periods are: the period shortly after the installation of vegetation, changes over the first year of existence and the last is the gradual process of consolidation of the entire installation. This article selects the main benefits and weaknesses of basic stability and technology of the various tested variants of green roofs and their systems against sliding the vegetation part. Material characteristics of the vegetative-retention mats and methods of installation, depending on exposition, inclination and type of green roof are recommended by the research team based on monitoring of the testing building EnviHUT.

Key words: Green roof; technology of application; vegetative-retention mat.

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Reshaping place based urban innovation through digital systems

Oliver Frey ^{*1}, Geraldine Fitzpatrick ², Esther Blaimschein ³

¹ University of Technology Wien, Department of Spatial Planning, Karlsplatz 13, 1040 Vienna, Austria

² University of Technology Wien, Faculty of Informatics, HCI Group, Argentinierstraße 8, 1040 Vienna, Austria

³ University of Technology Wien, Department of Spatial Planning, Karlsplatz 13, 1040 Vienna, Austria

ABSTRACT

The transformation of place based as well as virtual social interactions through ICT will be the core research interest. By enabling new forms of individual and social groups related communication processes, there can be generated social innovation to shape urban transformation. To gain e.g. augmented social capital can be important for inclusion processes in neighbourhoods, specific knowledge and information exchanges by sharing open data could strengthen community life. The assignment of virtual communication networks, protocols and Big Data with place-based interactions in neighbourhood centres or facility management offices as well as the local based city administrations can contribute to better design future urban challenges for integrated sustainable urban societies. Urban development in the future is not only depending on different kind of smart technologies in housing, mobility and daily life but also on people's handling and use of these products and services. It is also as much about the people in urban environments as it is about technological innovation and devices. The ongoing great societal transformation through a technological shift restructures fundamentally the social structure of urban societies. The processes of individualisation and differentiation by specific possibilities of digital generation of data, value and life-styles provides risks and changes for stable urban social structures. Social binders and layers in groups and milieus are liquefying to more subjective oriented actions and behaviours. In consequences the interplay between structures of social classes and individual biographies mediated in urban spaces and places is reconfigured. On the one hand these processes of strengthening the importance of subjective oriented values, mentalities, interactions and behaviours by using digital systems led to a strategic research question: How social interaction and collective mentalities are transformed, and what opportunities of new forms of urban innovation they enable. In grounding this strategic research to applied questions it will offer new knowledge and understandings of handling new resources, data and information in reciprocally ways of communication systems in urban governing processes: How new data generated by individuals through digital systems can be made usable for city administration processes. Thus technics of digital systems alone are not sufficient for realising 'good' societal transformations that serve the people of the city.

Key words: Social interaction; collective mentalities; societal transformations; digital systems.

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Migrant mobility; informal workers in the EU, the connection to space and use of network capital

Vilde Ulset *

Norwegian University of Science and Technology, Faculty of Architecture and Fine Art, Department of Urban Design and Planning, Alfred Getz vei 3, 7491 Trondheim, Norway

ABSTRACT

The paper investigates migrant mobility by employing the concept of motility defined as the aptitude for movement that allow actors to work around rules and find ways of survival in the counter geographies of globalisation, the shadow economy. Motility is understood as a new form of social capital, also referred to as network capital, which creates new types of social inequalities in transnational links and nexuses.

The analysis is based on empirical findings from interviews with illegal immigrants on the Spanish coast, here which display a tight knit community of men from one village in Senegal. The community of informal workers is highly mobile and, despite having lived in Spain for up to 13 years, still maintain a strong link to their home in Senegal, where their family reside. People carrying home with them in a network of informal spaces, highlight motility and mobile mind-sets expressed in case data such as "I go home for four months every year, it is only four days by car and then I am in my village". But what does this then mean for identity and the localities where they reside? How does it affect family, home and community?

I argue that the "shadow people", by claiming the right to livelihood – express motility in their everyday. They are employing insurgent space-making by negotiating their illegality in Spain while being systematically excluded from the European community.

Key words: Network capital; motility; insurgent space making; informality in Europe; illegal immigrants; localities.

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Structural transformations of economic functions of Warsaw (Poland)

Katarzyna Przybyła *

Wrocław University of Environmental and Life Sciences, Department of Spatial Economics, Grunwaldzka Street 53, 50-357 Wrocław, Poland

ABSTRACT

The purpose of the article is to identify the specialized (exogenous) functions of Polish capital – Warsaw – and to analyse this town functional structure in the period 2004 - 2014. The discussed period is characterized by the development of country economy, which coincided with Polish accession to the European Union structures. The conducted research covered the size, structure and changes of employment. The research was conducted at the background of economic base theory with regard to a city using two measures – surplus employee index (SEI) and Florence's index of specialization (FIS). The research can turn out useful in urban development planning and in city management.

Key words: Structural transformation; economic functions; surplus employee index; Florence's index of specialization; urban planning; Warsaw (Poland).

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Transforming innovation models to change the development paths of less-developed regions

Korneliusz Pylak *¹, Elżbieta Wojnicka-Sycz ²

¹ Lublin University of Technology, Nadbystrzycka 38D St., 20–618 Lublin, Poland

² Gdansk University, Bażyńskiego 8 St., 80–309 Gdańsk, Poland

ABSTRACT

The aim of the paper is to determine if changes in regional innovation models could speed up the development process of less-developed regions. In this paper, innovation models are identified by a set of specific variables describing the availability, creation, absorption and diffusion of knowledge in the region. This paper is based on the assumption that it is possible to identify a few groups of regions that share the same innovation models. Because these groups also differ in their development levels, there is an opportunity for a region to transform its innovation model and join the group of more-developed regions. Thus, based on the literature review, we hypothesize that less-developed regions in the year 2000, which have developed relatively quickly compared to the rest of Europe, had to change their innovation models to achieve such a high growth rate. The analysis in the article is based on the statistical data of regions in the European Union at the second level of Nomenclature of Units for Territorial Statistics (NUTS2) and is carried out with statistical and econometric methods. The performed cluster analysis shows that transformation of the innovation models has occurred in some European regions in the years 2000 through 2013. Some regions upgraded their innovation models, and some regions remained within weaker innovation models. Most of the regions that upgraded their innovation models experienced relatively greater gross domestic product (GDP) growth than most of other regions. Thus, we confirmed the hypothesis. Additionally, the analysis, supported by the logit regression technique, also shows that chances for achieving greater economic growth by less-developed regions were better in the case of regions with higher values of variables related to innovativeness, such as high technology transfer, increase of the share in employment of the high technology industry, increase in the share of people with tertiary education and employed in science and technology, and increase of the employment rate of females aged 15 to 64. These findings may allow regional authorities to develop development policies tailored to regional conditions and thus renew the economy and improve quality of life in less-developed regions.

Key words: Regional development; development path; less-developed regions; innovation model.

* **Corresponding Author**

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The spatial-temporal diversification of poverty in Wrocław (Poland)

Małgorzata Świąder *, Szymon Szewrański, Jan Kazak

Wrocław University of Environmental and Life Sciences, Department of Spatial Economy; Grunwaldzka 55, 50-357
Wrocław, Poland

ABSTRACT

Until recently the problem of poverty has been kept on the margin of public policy and debate. With its alarming growth, the issue became a topic of international discussions and research. The reason behind the issue is considered the result of an inadequately implemented development policy, focusing exclusively on economic growth. This leads to a situation in which one part of society is wasting all kinds of available goods, with others being unable to satisfy their basic existential needs and to find a place for themselves in a new consumer reality. So-called development indices, including those used for measuring poverty levels (i.e. the headcount ratio), are aimed at complementing the analysis of the socio-economic or developmental situation of a given area. So far, spatial-temporal analyses of the percentage of poor people within a given community were carried out largely at a supra-regional level. This is why this article serves as an attempt to perform research on a local scale calculating the headcount ratio for ten Social Assistance Terrain Units (SATU) within Wrocław between 2010-2012. This resulted in an estimate of the poverty index for the percentage of city residents in danger of falling into poverty, which in turn allowed to determine the city's problem areas. The analyses are used to determine the standard of living in the city and for the establishing of problem areas in order to make adequate decisions in the context of development and the spatial and social policy of the city, revolving around the balancing of disproportions in urban space.

Key words: Urban poverty; poverty measurement; social inequality; quality of life, poverty index, headcount ratio.

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The use of waste materials in the construction industry

Paulina Kostrzewa *, Ryszard Dachowski

Kielce University of Technology, Faculty of Civil Engineering and Architecture, Department of Building Engineering Technologies and Organization, Kielce, Poland

ABSTRACT

Waste materials are a major environmental problem, which is a threat to the environment. It is important to reuse these materials and dispose of them. Waste can be used in the construction industry in two ways: by reusing (reuse components) and recycling (processing waste into raw materials used in the production of building materials). The paper presents own research using substrates resulting from the processing of waste: foam glass and high-impact polystyrene and the possibility of their use as modifiers composition of basic construction materials. Glass foam is made from glass cullet. It has many advantages, positive effect on the adsorption of sound and workability. Due to the spherical shape, and low density are used as a filler ultra-light. The second addition is High Impact Polystyrene (High Impact Polystyrene - HIPS for short) is a butadiene rubber modified polystyrene. With the change amount of the rubber are changed mechanical and physical properties of the material, for example, increasing toughness HIPS. Article presents a critical review of the literature on changes in the composition of traditional building materials on the example of cellular concrete, cement and products of sand - lime. The paper presents own research and detailed analysis of them. The aim of the study was to determine the impact of additives on the parameters of the physical and mechanical properties and microstructure of the newly created materials compared to their traditional counterparts. The analysis has been subjected to the results of own research: compressive strength, water absorption, bulk density and construction of structural material. The results were presented in the form of tables, the graphs and SEM micrographs.

Key words: Calcium silicate products; waste materials; recycling; glass foam; high impact polystyrene.

* **Corresponding Author**

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Spatial assessment of the soil water storage as identifier of the areas threatened by drought

Milan Cisty *, Miroslava Jarabicova, Peter Minaric

Slovak University of Technology, Faculty of Civil Engineering, Department of Land and Water Resources Management,
Bratislava, Slovak Republic

ABSTRACT

A soil drought corresponds to the amount of water content in soil when plants suffer from a chronic water deficiency and subsequently wither. This process especially occurs during long periods with no precipitation and high evapotranspiration values. Therefore, a precipitation and soil water regime, particularly the soil water-retention capacity, has to be evaluated to determine areas threatened by drought. In the case of precipitation deficits or a small soil water-retention capacity, some actions for reducing or eliminating the risk of droughts should be proposed. If appropriate spatial indicators of the threat of droughts are available, it is possible to design irrigation systems in such areas, with the aim of artificially supplying crops with water during those periods. The aim of this work is to provide a method for determining such spatial indicators and the available water capacity of soil (AWC) is used for this purpose. It is defined as the amount of soil water between the field capacity and wilting point and represents the capacity of soil to retain water that agricultural plants can use. Data containing the percentage of grain categories according to the textural classification (clay, silt sand), reduced bulk density ρ_d , and the points of the drying branches of the water retention curve (WRC) measured in the laboratory were used for building so called pedotransfer function. On the basis of this function AWC, field capacity and wilting point were determined in many points of investigated area. As pedotransfer functions typically have a nonlinear character, a nonlinear data-driven method is used to fit them in this work; the authors used a Random Forest algorithm for this purpose. Its results are compared with standard multi-linear regression and various advantages of this approach are presented in the paper. Pointwise evaluation of AWC was subsequently interpolated to whole investigated area by geostatistical method and soil moisture identifier was obtained. This identifier can serve as an important basis for deciding on the possible location of irrigation structures. The Zahorska Lowland (Slovak republic), which is an agricultural area situated in a warm and slightly dry zone was used for evaluation of the proposed methods.

Key words: Irrigation system; soil moisture; pedotransfer function; Random Forest.

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Land use change after large scale disasters: a case study of Ishinomaki City after the Great East Japan Earthquake

Michio Ubaura *, Junpei Nieda, Masashi Miyakawa

Tohoku University, 6-6-06 Aramaki-Aoba, Sendai, Japan

ABSTRACT

In the area affected by large-scale disasters, land use changes massively not only due to the disaster itself but also in the recovery process. This is partly due to the relocation of the affected people based on their independent decision and partly due to the land use restriction in the disaster risk area by the local government. The present study surveys and analyses the land use change after the Great East Japan Earthquake in the urban area of Ishinomaki city, the most affected municipality by tsunami caused by the earthquake to clarify the effect of large-scale disaster on the change of urban form. The analysis is consisted of macro study on the municipal level and micro study on the district level. In conclusion, the authors found following three facts from the macro study analyses. Firstly, reconstruction of houses progressed in the inland area shortly after the disaster, followed by the developments near the coastal area. Secondly, industrial facilities locating along the coast recovered in the early phase. Thirdly, the expansion of urban sprawl is, in general, avoided because of the land use regulation in the urbanization restricted area. The studies on the micro level also illustrate the following three points. Firstly, vacant lots in the unaffected inland areas, some of which were unsold lots after land readjustment projects while some of which were unused lots in the existing urban area, were filled by the new housing developments. This contributes to keep the proper land use density. Secondly, the reconstruction of the houses in the devastated area, in which reconstruction activity is allowed, is not sufficient at all to use the urban area with proper density. This leads to the emergence of low-density urban area. Thirdly, the expansion of urban sprawl in the large scale agricultural land is avoided due to the land use regulation by the Agricultural Land Act, while some housing constructions are observed dispersing in and around the villages through conversion of agricultural land.

Key words: Great East Japan Earthquake; large-scale disaster; recovery process; land use change; low-density urban area.

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Urban risk assessment and management in a protected area of Bucharest, Romania

Emil Sever Georgescu *¹, Cristina Olga Gociman ², Iolanda Gabriela Craifaleanu ^{3,1}
Mihaela Stela Georgescu ², Cristian Iosif Moscu ², Claudiu Sorin Dragomir ^{4,1}

¹ National Institute for Research and Development URBAN-INCERC, Bucharest, Romania

² Ion Mincu University of Architecture and Urban Planning, Academiei Str., No. 18-20, 010014 Bucharest, Romania

³ Technical University of Civil Engineering, Lacul Tei Blvd., No 124, 020396 Bucharest, Romania

⁴ Univ. Agronomic Sci. and Veterinary Medicine, Faculty of Land Reclamation & Env. Engineering, Bucharest, Romania

ABSTRACT

The research addresses the roots and patterns of the Bucharest seismic risk issues within their interactions with other natural and anthropic hazards in a protected area, i. e. a heritage area with special legal and urban planning requirements. The research takes into account Romania and its capital, Bucharest, suffered building collapses, heavy damage and casualties in 1940, 1977 earthquakes, and hundreds of high-rise buildings are listed as highly vulnerable and in the first class of seismic risk. In the study area, the urban fabric was partially demolished by force in the 1980's and it has a mixture of major and minor heritage and new buildings, which are not risk-assessed, but they are threatened by other hazards and will be weakened or decayed before any earthquake will strike. Starting point was to select presents methods for risk assessment, using affordable tools. First step was the field identification of functional value and then to evaluate materials, structural types and physical state of buildings for assessment of seismic vulnerability, for each building class. Cultural value was scored with 13 criteria and six scaling stages of the Romanian Law of Monuments. Several multi-hazard scenarios have been developed and the results are: A. In case of earthquakes, for the seismic intensity 8, a number of 63 buildings would suffer great damage, while for intensity 8 and half the damage would affect 165 buildings, mostly low-rise structures. The number of heavy injured persons would be 29 and 64, while live loss will be 59 and 92, respectively, for the considered intensities. B. In case of climatic and hydrologic hazards, the scenario is dominated by an extreme event of accidental flooding, in which the water cover could be as high as 2.5 m. C. Scenarios for explosions considered hazards from various tanks with gases or chemicals, although they do not reach area. D. In case of terrorist blasting scenario, there are three hypotheses, and as much as explosive quantity increases, impacts would have a greater potential of radiuses of damage, injured people and casualties. The impact of recent earthquakes in the World (Italy, 2009; 2012; Chile, 2010; New Zealand, 2010; 2011; Spain 2011; Japan, 2011; Taiwan 2016), had shown that the risk reduction considering individual buildings takes too much time, while urban fabrics, infrastructures and heritage buildings require additional evaluations. On the other hand, the Sendai Framework for Disaster Risk Reduction 2015-2030 (2015) prompted a holistic approach to achieve the resilience to disasters for sustainable development. Obviously, there are many gaps that may prevent the timely urban risk management. The presented research and the risk assessment results allowed the tailoring of local planning needs and the identification of potential shelter / security community centres and their endowment for risk management. The proposals for risk reduction strategies and policies were structured on emergency and perspective terms, within the Romanian Research Project URBASRISK, for multi-hazard risk reduction.

Key words: Urban risk; management; planning; earthquake scenario; multi-hazard assessment.

* **Corresponding Author**

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Risk index calculation of flood protection object in Brezovička village (Slovakia)

Martina Zeleňáková *, Lenka Zvijáková, Pavol Purcz

Technical University of Košice, Vysokoškolská 4, 042 00 Košice, Slovakia

ABSTRACT

Flood protection is at present very actual topic and it has come to the forefront due to the increased incidence of climatic and hydrological extremes, and the related increased incidence of flood events.

Flood protection objects – construction projects are a trend in flood protection and prevention in developed countries around the world. The unquestionable advantages of the measures involved are their sophistication, environmental friendliness and sustainability of land use. In their preparation, implementation, evaluation and authorization it is necessary to ensure consistent application of the environmental impact assessment in accordance with Law No. 24/2006 Coll. on Environmental Impact Assessment, as amended in the Slovak Republic, so as to ensure the validity of the assessment. What is important is the selection of environmentally acceptable alternative solutions. The proposed risk index calculation is based on multicriteria evaluation and the weighting method. The proposed assessment may be used in the process of comparing alternatives and the choice of optimum alternative for the purposes of environmental impact assessment of hydraulic structures. Application of the calculations for Slavkovský stream in the village of Brezovička proved that Alternative 0, Alternative 1 and Alternative 2 have different levels of risk acceptability and achieve different risk index values. Based on the risk index the suggested alternatives can be compared with each other, and thus we recommend Alternative 1, which represents the lowest risk to the environment.

Key words: Environmental impact assessment; flood protection; risk analysis; multicriteria analysis.

* **Corresponding Author**

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Italian seismic sequences: year 2000, the emergency phase in Romagna

Gaia Civiletti ^{*1}, Romano Camassi ², Ricardo Monteiro ³

¹ UME International Ph.D. School, IUSS - EUCENTRE, Via A. Ferrata 1, Pavia 27010, Italy / European Commission's Joint Research Centre, Institute for the Protection and Security of the Citizen IPSC, Via E. Fermi 2749, Ispra 21027 (VA), Italy

² Istituto Nazionale di Geofisica e Vulcanologia (INGV), Via D.Creti 12, Bologna 40128, Italy

³ UME International Ph.D. School, IUSS - EUCENTRE, Via A. Ferrata 1, Pavia 27010, Italy

ABSTRACT

The study presented in this paper, carried out with the Italian National Institute of Geophysics and Volcanology (INGV), is aimed at the identification of the institutional and social decisions that increase the resilience of the communities exposed at risk, by analysing observations during seismic sequences occurred in Italy in the last decades. It is an unprecedented kind of analysis given that, typically, attention is paid only to major crisis or catastrophes, while those examined were substantially ignored because they were not high magnitude event nor caused destruction of the anthropic world. The research framework and methodologies that are used include aspects of macro-seismology and disaster epidemiology fields. Extensive surveys are carried out to rebuild the entire seismic phase with the documentation collected, at local and national level, by the scientific/authority entities and the media/press review database. The April-May 2000 seismic swarm affecting the Faenza-Forlì districts is used as case-study. The emergency management phase is observed through: (a) the institutional entities' actions, (b) the civil protection's system, (c) the infrastructures and public communication networks and (d) the reactions of the population. The nature and consistency of this information were verified through the institutional reports and decisions implemented by the Civil Protection and local authorities at different levels (municipality, province, region). The selected case study enabled the identification of the paradigms of the techniques and means that were utilized by the local administrations and civil protection mechanisms to assess the emergency management options in each situation. Moreover, several practical and still useful lessons emerging from the past have been drawn. As such, this analysis of the past experience in seismic sequences can establish a basis for the identification of optimal risk reduction practices and purposes. Finally, through comparison with identical issues and effects that emerged in other severe Italian post-earthquake phases, this research will ultimately permit: (i) to establish a pattern drawn by most of the problems bound to a severe earthquake and the emerging or collateral risks that arose from past seismic sequences (such as psychological issues, mass commuting, weakened mobility or communication networks) and (ii) to identify and prioritise the best effective actions to implement.

Key words: Earthquakes; disaster risk reduction; macroseismology; disaster epidemiology; emergency management; risk awareness.

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Development of a fragility and exposure model for Palestine – application to the city of Nablus

Iason Grigoratos ^{*1}, Jamal Dabeek ², Barbara Borzi ³, Vania Cerchiello ¹, Paola Ceresa ¹, Ricardo Monteiro ¹

¹ IUSS Pavia - Piazza della Vittoria n.15, 27100 Pavia, Italy

² UME Graduate School - Piazza della Vittoria n.15, 27100 Pavia, Italy

³ EUCENTRE Foundation - via Adolfo Ferrata n.1, 27100 Pavia, Italy

ABSTRACT

Earthquakes are one of the most catastrophic natural events, in terms of both casualties and economic losses. Regions with a large percentage of non-seismically designed buildings and reduced urban planning are particularly vulnerable to seismic events. In such regions, it is nevertheless possible, if not urgent, to mitigate seismic risk, which comes from the convolution of seismic hazard, exposure and vulnerability. As such, the main goal of this study is to propose simplified vulnerability and exposure models for the Palestinian region, specifically built upon local field surveys and national data collection. The municipality of Nablus, a city in the northern West Bank, which is a Palestinian commercial and cultural centre, has been chosen as case-study. An existing state-of-the-art hazard model, specific for the Middle East region, has been used as input. Special attention has also been given to the understanding of the local building/construction practice, for different time periods. The identification of building types and their relative percentages within the built environment has been thoroughly conducted, leading to a preliminary taxonomy that is able to classify the most common structural systems. The outcome of this study enables the assessment of earthquake scenarios at city-scale, the future rapid loss assessment at regional scale and the introduction of guidelines for future urban planning based on the its findings.

Key words: Fragility; exposure; Palestine; seismic; hazard; vulnerability.

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Urban infrastructure resilience to fire disaster: an overview

Thomas Gernay ^{*1}, Serdar Selamet ², Nicola Tondini ³, Negar Elhami Khorasani ⁴

¹ The National Fund for Scientific Research F.R.S.-FNRS, University of Liege, Quartier Polytech 1, allée de la Découverte 9, 4000 Liege, Belgium

² Bogazici University, Department of Civil Engineering, Bebek 34342 Istanbul, Turkey

³ University of Trento, Department of Civil, Environmental and Mechanical Engineering, via Mesiano 77, 38123 Trento, Italy

⁴ University at Buffalo, Department of Civil, Structural and Environmental Engineering, 136 Ketter Hall, Buffalo, NY, 14260, USA

ABSTRACT

The concept of disaster resilience has gained increasing attention over the past years. With urban population growing at a record pace, city infrastructure systems are under strain and disruptions due to hazardous events need to be minimized. For a society, this calls for the necessity to develop mitigation plans, be prepared, be able to withstand, and to rapidly recover from such disruptions. Among man-made disasters and natural hazards, such as earthquakes, tsunamis and flooding, which trigger technological accidents, fire is a serious threat to the functionality of the built environment. Fire can severely affect buildings, bridges, tunnels, power plants and other large-scale facilities, which may disturb a city's ability to deliver a proper service to the community. Despite the great importance on the built environment, fire safety issues are still mostly considered at the level of individual elements, disregarding possible cascading effects and global impact on the system functionality. The goal of this paper is to present an overview of urban infrastructure resilience to fire disaster. The paper starts by reviewing the existing definitions of resilience in structural engineering and the different frameworks that have been established to quantify this concept. Applications of the resilience framework to other types of hazards, such as earthquake and flooding, are then reviewed. In fact, although the concept has not yet been adopted in fire engineering, other disciplines have embraced it. The paper points to the specificities of fire hazard and to the areas where previous works in related disciplines should be used as an inspiration. The paper then summarizes the current state of research in structural fire engineering, with a focus on uncertainty modelling and reliability approach. Research in the field clearly shows a trend toward performance-based methods with an explicit quantification of the safety level. However, intensive research efforts are still needed to address some important issues, such as the lack of reliable data, or the lack of efficient reliability methods for assessing the thermo-mechanical response of structures. In the end, several possible applications of the resilience framework to fire hazard are discussed. The four dimensions of robustness, resourcefulness, redundancy, and rapidity, are used to highlight the possible implementation of the resilient design against fire and provide recommendations about major challenges for future research. The insights of this research will be helpful to re-formulate the current design codes towards a more resilient urban infrastructure against fire hazard.

Key words: Urban resilience; disaster mitigation; fire hazard; critical infrastructure; literature review.

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Comparative analysis of existing tools for assessment of post-earthquake short-term lodging needs

Annibale Vecere ^{*1,2}, Ricardo Monteiro ², Walter J. Ammann ³

¹ REM Programme, UME School, IUSS Pavia, Italy

² Institute for Advanced Study (IUSS) of Pavia, Italy

³ Global Risk Forum GRF Davos, Davos, Switzerland

ABSTRACT

The assessment of shelter needs of displaced population in the aftermath of major earthquake events is one of the main challenges that emergency responders currently have to face. Based on the scale of the disaster, the short-term shelter demand can turn into a temporary housing need for displaced population, which is a local government responsibility. The study presented here is focused on a critical review of currently available methodologies and software packages that were developed specifically to estimate the number of displaced people and those who will most likely seek public sheltering and will need temporary housing. The main features and shortcomings of such tools are highlighted and interpreted with a view to future improvement and application in the disaster management field. In order to also test the implementation stage and their usability, a full application of both programs is briefly illustrated for the modelling of the February 22nd 2011 Christchurch's earthquake. Hazard, vulnerability and exposure (both physical and social) were thus characterized as input. Two software tools, HAZUS-MH and ERGO-EQ, have proved to be more exhaustive in considering all the different variables involved in the shelter needs estimation. Furthermore, for both of them, a discussion is presented on possible ways to improve and to better reflect the local conditions, in order to produce more realistic outputs.

Key words: Seismic risk; short-term shelter needs; HAZUS-MH; ERGO-EQ; 22nd February 2011 Christchurch earthquake; temporary housing software tools.

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Understanding changes in seismic risk following a major earthquake event: the case of L'Aquila 2009

Athanasios N. Papadopoulos *, Ricardo Monteiro

Institute for Advanced Study (IUSS) of Pavia, Palazzo del Broletto, Piazza della Vittoria n. 15, 27100 Pavia, Italy

ABSTRACT

The advancement of probabilistic seismic risk assessment methods over the last decades has provided public authorities with the necessary tools to devise efficient risk mitigation schemes, and has been a key development for the insurance and reinsurance industry when setting, for instance, annual premiums. Nevertheless, as seismic risk is commonly modelled and evaluated in a static manner, it can be prone to significant alterations over the course of time; in contrast with current practice, all components of risk — hazard, vulnerability and exposure — can be seen as time-variant and thus conceal important features that should be modelled. Despite the recent rise of interest in long-term time-dependent risk assessments, there have been no studies, to our knowledge, investigating the potential effects of a high intensity earthquake occurrence on future risk. Such events can considerably alter the initial conditions of a seismic risk model, which might then need to be updated to accommodate the changes in the locality of the catastrophic event. These changes may be cumbersome to model, but comprehending the controlling variables (event characteristics, hazard variations, prior vulnerability, retrofit/reconstruction schemes, socioeconomic factors, etc.) can provide significant insight for mid to long-term post-earthquake risk-reduction planning, as well as for the further development of time-dependent seismic risk assessment methodologies. In this paper, we investigate the effects of the 2009 Mw 6.3 L'Aquila earthquake on the seismic risk in the municipality of L'Aquila. Risk is evaluated as of prior to the event (2009), and as of now (2016), considering the current hazard level and state of the reconstruction process. A time-dependent earthquake recurrence model has been employed to model hazard accounting for the recent rupture in the Paganica fault, along with modified exposure and vulnerability data derived from the reported damages and reconstruction plan status. The findings of this preliminary study can be used, along with future research and supplementary case studies, to quantify the long-term effect of damaging earthquakes in urban areas, define trends, and guide future risk mitigation and post-earthquake reconstruction schemes.

Key words: Seismic risk; time-dependent hazard; urban environment.

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A multi hazard analysis model for risk assessment of archaeological sites

Giuliana Quattrone *

National Research Council of Italy, Institute of Atmospheric Pollution Research, via Marsala n.2/b, 89127 Reggio Calabria, Italy

ABSTRACT

The territorial structure of archaeological sites is often fragmented and heavily compromised by a variety of factors which, over time, can contribute to aggravate the deteriorating conditions of the archaeological areas, without a serious territorial policy for the control of the territorial transformations and planning instruments considering the possible territorial risks. Natural disasters, often, have caused irreversible damage (crashes, loss of finds, etc.) at the archaeological sites. The paper shows the results of research aimed at developing an innovative risk assessment model, oriented to sustainability criteria, that can provide help in making decisions process about the protection, conservation and valorisation of archaeological areas. The proposed work presents a logical and operative model suitable to estimate the actual risk condition for archaeological sites developed by integrating the information concerning vulnerability of archaeological areas and the danger condition of the sites upon which they are located. The determination of the risk, derived from the evaluation of potential co-presence of independent sources of danger within a given geographical area, has been modelled by a type of approach multi hazard. The methodology is applied at the case study of archaeological area of Sybari in Calabria Region, in south of Italy, where tried to develop an integrated and coordinated cognitive methodology - evaluation within an overall information system for assessing the vulnerability of archaeological heritage and environmental dangerousness in order to identify the level of risk which is under the archaeological area in relation to the territory of reference. The results obtained, by applying a comparative evaluation based on the characteristics of the archaeological goods being valued in relation to the reference context, allow to relate the risk with the risk factors, the detection of damage on archaeological heritage in question, determine the tolerance threshold within which it is possible the preservation of goods and to propose a synthesis strategy between environmental protection and sustainable exploitation.

Key words: Archaeological areas; risk management; vulnerability; territorial planning; resilience; environmental sustainability.

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Risk and reliability based maintenance planning for offshore wind farms using Bayesian statistics

Mihai Florian *, John Dalsgaard Sørensen

Aalborg University, Department of Marine Structures, Denmark

ABSTRACT

Operation and maintenance (OM) of offshore wind turbines contributes with a substantial part of the total levelized cost of energy (LCOE). The objective of this paper is to present an application of risk and reliability based methods for planning of OM, where decisions on maintenance are taken with regards to reliability estimates, which are updated regularly using a Bayesian network framework and input from time based inspections. The study focuses on maintenance of turbine blades, for which a fracture mechanics based degradation model is set up. Based on this model, and the uncertain input in terms of cracking on the blades at the start of the lifetime, an initial reliability estimate is made. During the operation period, inspections are performed at regular time intervals, and the results are then used to update the reliability estimates using Bayesian networks. Based on the updated estimate, decisions on repairs are taken, thus potentially minimizing the maintenance effort while maintaining a target reliability level. The study is made on a reference wind farm, using a discrete event simulator. Cost and availability results are obtained with respect to naval logistics, weather conditions and work force capabilities, and a comparison is made with traditional condition based maintenance to highlight the potential effort reduction when using reliability based decision making.

Key words: Offshore; maintenance; Bayesian; reliability; blades; degradation.

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Performance evaluation of implementation of continuous water supply projects: two case studies from India

Abhay Tawalare *¹ and Yazhini Balu ²

¹ Visvesvaraya National Institute of Technology, Department of Civil Engineering, Nagpur- 440010, India

² Larson & Toubro Projects Ltd., Chennai, India

ABSTRACT

Most of the Indian cities have intermittent water supply. The inadequacies in intermittent water supply system like deterioration of network, bacteria contamination and absence of free chlorine content have increased the necessity of the continuous water supply system. Therefore, Indian government implemented 24x7 water supply projects in few selected cities. These continuous water supply projects were implemented either under Public Private Partnership (PPP) or direct funding by government. However, many projects witnessed failure during later stage of project life cycle. The paper aimed to carry out performance evaluation of implementation of continuous water supply projects against the various risks. The case study research methodology was adopted for the study. Initially, various risks in water supply projects were identified through literature review. Two polar cases were selected for the study, one was implemented under Public Private Partnership (PPP) and other was implemented under direct funding from government budget. The cross case analysis of both cases against the identified risks is presented in the paper. The project under PPP mode could not perform well against risks like consumer risk, legal risk, financial risk and socio political risk. While, project under government funding, showed good control over the risks except financial risk. The result showed that both the projects could not achieve the desired success as planned initially still it can be concluded that continuous water supply projects under government funding performed better.

Key words: Public private partnership; continuous water supply project; PPP in water supply project; risks in water supply project.

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A novel approach to gas pipeline risk management under influence of horizontal strains

Agnieszka A. Malinowska *, Ryszard Hejmanowski

AGH University of Science and Technology, Al. Mickiewicza 30, 30059 Cracov, Poland

ABSTRACT

The costs of laying and maintenance of gas transport infrastructure depend to a certain degree on such factors as safety of gas pipelines. The hazard relating to the potential loss of tightness and breaking should be excluded and their probability minimized. The gas pipelines frequently have to pass through areas which are subject to anthropogenic movements and deformations. A proper analysis of potential influence of impact of such deformations on the gas pipeline in the aspect of failure occurrence can be done by predicting deformations, taking into account causes of ground movement. On the other hand the hazard also depends on technological factors connected with the pipeline design. The presented method is based on the artificial intelligence methods and allows for variant evaluation of the risk of the gas pipeline sections. Its application can contribute to the optimization of the cost of protection of the planned pipelines and evaluation of demands as far as maintenance of the existing lines is concerned. The method has been exemplified in the paper.

Key words: Gas pipeline risk management; horizontal strains; fuzzy logic; GIS.

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The flood impact assessment from Ilisua catchment area on the environment

Mihaela Pisleaga *, Codruta Badaluta Minda

Politechnic University of Timisoara, Hydrotechnical Department, G. Enescu Street, No. 1A, 300022, Romania

ABSTRACT

In the first part of the paper are making a geomorphologic description of the catchment area and the flash floods taken into account. All these events shows the vulnerability of the catchment area studied to hydro morphological and geomorphologic hazards, fact that draws attention to their management by a new approach, namely of the flood risk management. Flash floods produced in June 2006 in catchment area Ilisua had a rain genesis, with values between 28 l / m² in the low area, respectively 53 l/m² in high areas of basin areas. Low surface of the superior catchment area has determined quick concentration of the water toward the main collectors and formation by flood, phenomenon facilitated and by the fragmentation relatively high of relief, thus ensuring a contribution hydrological important. Floods formats in superior river basin of Ilisua River, have determined in addition by the erosion effect, entrapment and redistribution of a huge volume of silt. At the end of the paper, by applying the current concepts of the effect reduction in impact with environmental, is proposed a series of structural and non-structural measures for reducing flood intensity.

Key words: Flash flood; risk management; catchment area; nonstructural measures.

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Study of surface temperature monitoring in the field of buildings

Richard Slávik *, Miroslav Čekon

Brno University of Technology, Faculty of Civil Engineering, Brno, Czech Republic

ABSTRACT

Building simulations are the tool that can contribute to the current issues of the building science, energy efficiency and many different relations covering the thermal phenomena. The rapid development in the area of building simulation performance is undoubtedly influenced by the various validation procedures combining both empirical and analytical methods as confronted with real world experimentations to develop reliable tool for need to obtain an adequate virtual reality approach. Surface temperature monitoring and its aspects does have not only a useful merit for thermal analysis of the buildings and their virtual simulations, however overall, is equally of highly relevant use for the field of building physics as primarily those of more complex analysing concerning on specific thermal phenomena. The measuring of surface temperatures at the building envelopes by means of well-practiced commercial temperature sensors are typically applied whose attributes can successfully be employed especially for the field of thermal building performance aspects. In addition, besides of their certain own accuracy level and final implementation as an input parameter into the simulation model, typical methods of their final application related to the opaque and transparent building surfaces and their contact and non-contact modes may have a significant influence. Basically, it represents two specific fields of an interdisciplinary nature, first based on the integration of recent advances in electronics, whilst second on the application level in buildings. The paper presents a representative confrontation of surface temperature monitoring of several temperature sensors as finally compared with the form of their final application on the building surfaces. Three typical ways of installation are demonstrated on opaque and transparent building components under real climate conditions applying of commercial thermocouples digital temperature and infrared sensors. Experimental measurement assemblies are proposed and introduced with aim to pinpoint specific indicators in the presented area. Representative in-situ measurements are performed and final comparability of sensors and typical methods of their final installation is presented. An obtained result, both at existing and proposing types, demonstrates its relations to the field of buildings. In spite of that, an additional confrontation based on non-contact regime as compared with contact ones shows an attainable option directly concerning on building surface temperature monitoring.

Key words: Surface temperature; temperature sensor; thermocouples; digital sensor; infrared thermometer.

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Buildings under the rocks: an interdisciplinary approach for a safe conservation

Eva Coisson ^{*1}, Andrea Segalini ¹, Sabrina Maria Rita Bonetto ²

¹ DICATeA – University of Parma, Parco Area delle Scienze 181/A, 43124 Parma, Italy

² DST – University of Torino, via Valperga Caluso 35, 10125 Torino, Italy

ABSTRACT

Vernacular buildings have always been built by man in a strict relation with nature, with the materials it offered and the limits imposed by the environment. This relation is particularly evident in the case of shelters built under rock protrusions, taking advantage of the natural element as a part of the building itself. Given their geological characteristics, the Western Alps are particularly rich of these type of vernacular buildings, which became a typical element of the local architecture and acquired a specific toponym (“barma”). Nevertheless, their conservation poses serious safety issues that need a wide interdisciplinary approach to be solved. In this paper, the case of the Barma Mounastira hamlet (in Angrogna, Piedmont, Italy) is presented, with the joint researches of both architectural restoration and rock mechanics scholars. First, the group of buildings was surveyed in its geometry, materials, decay phenomena, structural disorders. Then, the overhanging rock face was analysed starting with a geomechanical survey of the rock mass, in order to define potential instability phenomena and their implications on the safety of the Barma Mounastira site. This analysis enlighten that the three main problems for the conservation of the existing structures are strictly connected with the geological features of the site: water leaks from the rocks inside the buildings, the rock debris and soil where the structures are built are locally subjected to settlements and the rock cliff outcropping above the site can generate rock falls. Thus the proposals for the solution of these problems could only come from an interdisciplinary approach, which aimed at ensuring stability both for the buildings and for the rock face, as a first fundamental step for the preservation of an important typological witness of the past building traditions, respecting its equilibrium with nature.

Key words: Vernacular architecture; preservation; rock stability analysis; natural hazard; rockfall.

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Landslide susceptibility mapping using a fuzzy approach

Giovanni Leonardi *, Francis Cirianni, Rocco Palamara

University of Reggio Calabria, DICEAM, Via Graziella, 89124 - Reggio Calabria, Italy

ABSTRACT

The present paper proposes a new methodology to characterize the landslide susceptibility of Reggio Calabria territory. The values obtained were classified into five categories and exported into GIS environment to produce a landslide susceptibility map. The principal objective of the proposed study is to identify the sections of the road network exposed to landslide hazards starting from the susceptibility map. To this aim, a fuzzy system was implemented for the assessment of the landslides susceptibility of the considered transport network.

Key words: Lifelines; fuzzy logic; landslide; susceptibility map; roads; Reggio Calabria.

* **Corresponding Author**

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Assessment of flood risk from flash floods in the eastern Slovakia

Martina Zeleňáková *¹, Lenka Gaňová ², Pavol Purcz ¹, Peter Blišťan ¹

¹ Technical University of Košice, Vysokoškolská 4, 042 00 Košice, Slovakia

² Slovak Water Management Enterprise, Ďumbierska 14, 042 00 Košice, Slovakia

ABSTRACT

The paper had a primary task, namely “Proposal of a methodology for the process of preliminary assessment of flood risk – a methodological procedure for preliminary flood risk assessment from flash floods with respect to the need for its updating following from directive 2007/60/EC and its application in the conditions of a modelled territory”. The methods which are used in the contribution emerge from practical experience as well as from knowledge obtained from the available literature and consultations with experts dealing with the given problem in practice. The foundations of flood risk assessment are hypotheses on the impact of physio-geographical attributes of basins on the origin of floods. The conceptual framework for flood risk assessment of flash floods comes from the definition of a multidimensional conception of flood risk, and a process approach is used. The proposed methodology consists in the identification of critical points and contributing surfaces from the viewpoint of creation of a concentrated surface flow from flash floods and their adverse impacts on the built-up areas of a municipality. The primary goal of the assessment of risk of contributing surfaces was determining the riskiness of the locality with an ordinal degree (i.e., low, moderate, and high) and providing a foundation for a second stage, called controlling risk. The resulting risk of contributing surfaces is determined as a combination of danger and vulnerability according to a set matrix. Processing and analysis of the input data as well as visualization of the achieved results is carried out in the GIS environment (ArcGIS 9.3, 10) in integration with a spreadsheet (the program Microsoft Excel).

Key words: Flash floods; food risk; hazard; vulnerability.

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Accuracy assessment of very high-resolution multispectral images derived data for river flow modelling

Cristian Gabor, Ioan David *, Camelia Ștefănescu

Politechnic University of Timisoara, Department of Hydrotechnical Engineering, George Enescu str. 1/A, 300022
Timisoara, Romania

ABSTRACT

The increased frequency of disaster events and the need for a rapid response for prevention and remediation of flood disasters require realization of flood risk maps with very good precision based on high performance hydrodynamic river models using advanced hydroinformatics tools. Modelling performance, topographical data quality and quantity, hydrological and hydro meteorological surveys as well have very important for a correct understanding and interpretation of all hydraulic aspects for minor and major river bed. These are key factors in the need for new sources of data for hydrological modeling and flood risks management process. In this regard the actually development of satellite sensors, data, availability, Geographic Information System (GIS), and on the Hydroinformatics based river flow modelling techniques gives new opportunities in the analysis of the floods phenomenon. Use of the Very High Resolution remote sensing raster images to derive data useful for hydrological modelling is inviting and the answer to the question of accuracy of the data derived from remote sensing images is very important. In the present paper is investigated the use of multispectral satellite images acquired by Worldview2, SPOT 6 and SPOT 7 sensors for deriving hydrological model data and its corresponding accuracies. A case study using multispectral images relates to river Timiș in Romania will be presented as well.

Key words: Remote sensing; river flow modelling; multispectral imagery; hydrodynamic river modelling.

*** Corresponding Author**

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Modelling the climate change impact on monthly runoff in central Slovakia

Kamila Hlavčová ¹, Zuzana Štefunková ², Peter Valent ^{*1}, Silvia Kohnová ¹, Roman Výleta ¹, Ján Szolgay ¹

¹ Slovak University of Technology, Faculty of Civil Engineering, Department of Land and Water Resources Management, Bratislava, Slovakia

² Slovak University of Technology, Faculty of Civil Engineering, Department of Hydraulic Engineering, Bratislava, Slovakia

ABSTRACT

The aim of this paper was to evaluate the possible impact of climate change on the runoff regime of the Hron River basin up to the Banská Bystrica profile until the year 2100. The daily rainfall - runoff models Hron which was developed at the Department of Land and Water Resources Management, SUT Bratislava, was used. The determination of the models' parameters was performed for different methods of processing the input data. The calibration period was from 1981-1995. After the calibration, the models' validation was performed for the period of 1996-2010, and the most accurate set of outputs was chosen. For the simulation of the possible impact of climate change, the KNMI and MPI climate change scenarios, which illustrate changes in daily precipitation, daily air temperature and the average air humidity in the river basin for future periods, were used. In conclusion the average monthly flows for the future time horizons of 2011-2040, 2041-2070 and 2071-2100 with a reference period (1981-2010) were compared. The results were processed in a tabular form as well as graphically. Based on the results of the two hydrological models and the two different climate change scenarios, we can expect an increase in long-term mean monthly discharges for the winter and spring periods and a decrease for the summer period words concise and factual abstract is required.

Key words: Climate change; Hron model; KNMI; MPI.

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Session Title:
Computer Aided Design

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Contemporary experimental projects of mass customized detached houses - prospects and limitations

Maria Helenowska-Peschke *

Gdańsk University of Technology, Faculty of Architecture, 80-233 Gdańsk, ul. Narutowicza 11, Poland

ABSTRACT

The article presents the results of several case studies of selected experimental projects conducted over the past two decades, the authors of which intended for rethinking both the means of production and the typology of the residential houses. The purpose behind the study was to establish in what way new advanced computational modelling and fabricating techniques could contribute to satisfying the demand for detached houses for the moderate-income families in Poland. Statistics show that even in towns the average family in the EU prefers living in a detached house to living in an apartment although the requirements and expectations are changing. For instance there is a growing request for consumer-specific, unique versions of the product satisfying individual needs and eco-friendly solutions. The selected projects include among others: Embriological House designed by G. Lynn, Re-thinking Lascaux by moh-architects, Fab Lab House by IAAC, system BURST*008 by D. Gauthier and J. Edmiston and Parametric Design System for Passive Houses developed by J. Pavlicek and M. Kaftan. Analysis cover contemporary design issues such as variation, curvilinearity, customization, flexible manufacturing and assembly and most importantly ecological concerns. For instance moh architects examine how far space itself can help create an efficient sustainable single-housing unit without the immediate necessity for cutting-edge technologies. Lynn's rethink the idea of house typology as an organic, flexible, genetic/generic prototype from which an infinite number of iterations can be generated. According to the author's opinion the idea of linking ecology and availability in the form of mass individualization houses is best supported by parametric algorithmic methodology as it links design with CNC production in so called digital chain. The advantages to be gained by operating within this methodology are: absence of geometrical constraints, the enrichment of passive solutions, responsiveness to customer specific needs, fabrication preciseness, the economical availability, fast construction techniques. FabLab House besides allowing for adaptation to the programmatic needs of the consumer and the environmental conditions can be manufactured (rather than built) anywhere in the world, through the network of Fab Labs. However what the architectural and construction industry in Poland has achieved so far is a poor result of modernizing itself to join the shift towards new typologies and ways of house assembly. One of the ways to loosen commitment to traditional solutions would be creating a new brand.

Key words: Passive single family houses; mass customization; participatory design, soft geometry, parametric-algorithmic modelling.

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Fictional architecture: new realms, new services

Hamed Zarrinkamari *, Maryam Moayery Nia

Polytechnic of Milan, Architecture & Urban Design, Milan, Italy

ABSTRACT

During recent decades, the game industry, along with cinema and virtual reality, has turned into a multi-billion dollar business which has as its final goal not only mimicking the real world, but also adding new layers of fantasy and fiction to it. While the academic studies and skills of architects cover the majority of requirements for designing and representing fictional spaces, surprisingly, the number of architects employed by these businesses is close to zero. There are examples of cooperation between architects and producers, which have led to masterpieces like the Spanish environment of Assassin's Creed II. On the other hand, adopting a profession for a new business cannot be risk-free. This paper will attempt to investigate potentials, experiences, and challenges in defining a new version of the architect's profession in relation to architecture in imagined spaces. From roots of fictional spaces in holy books to cutting-edge technologies like virtual reality, details of architectural and urban spaces have always formed an important part of our stories. Considering the capacities afforded by computers, we are the first generation of architects who can contribute to the experience of a story by ensuring expected qualities of the space as its context. Such a rich context can enrich narrative in ways that have never been possible previously—especially in the areas of interactive environment and augmented reality. Big game companies are hiring small offices to do portion of the design on daily basis and there is no reason for environment design to be exempted. Movies like Star Wars, 2001: A Space Odyssey, and Lord of the Rings are the references which will frame our discussion as historical examples of fictional architecture. Then, Environment Design and Level Design will be discussed as the main target of fictional architecture in the realm of blockbuster games of recent years. Reviewing experiences of fictional architecture will be completed with addressing applications to Virtual Reality for architectural purposes as seen at the Venice Biennale and on other occasions. On the other hand, although imagination and creativity have always been engines of architecture, history of the field is full of ambitions that resulted in monstrous inhabitable spaces. It is important to manage the dialog between the real and fictional architecture to make sure concepts are translated into real world considerations, limitations and requirements of this realm. In order to facilitate the relationship between reality and fiction, a general categorization of different types of fictional architecture will be provided in this writing. Each category will be defined and represented with examples from games and film. Then, wherever possible, we will address real-world architectures which can be seen to closely mimic those of imagined worlds. Such classification can be used for future projects which can help in shaping the role of fictional architect as a new profession.

Key words: Architecture; fiction; level design; special effects; profession.

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Session Title:
Mathematical and Statistical Methods

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Two step optimisation of the large irrigation systems

Milan Cisty *, Zbynek Bajtek, Lubomir Celar

Slovak University of Technology, Faculty of Civil Engineering, Bratislava, Department of Land and Water Resources Management, Slovak Republic

ABSTRACT

Due to the high costs associated with the necessary material and the installation of an irrigation water distribution system, it is essential to optimize its design by selecting the lowest cost combination of its components, while the hydraulic requirements (e.g., the required pressure on irrigation machines) of the network are gratified. A variety of optimization methods have been proposed for optimal water distribution designs, but there is still some uncertainty as to how close any optimization method can get to a global optimum of this uneasy optimization task. For solving the optimal design of a water distribution system, the authors of this work propose a new two-step methodology that utilizes as its most important feature the ensemble approach, in which more optimization runs cooperate and are used together. Because the authors of the present paper assume that the main problem in finding the optimal solution is the size of the search space in which the optimal solution should be found, the second main feature of the proposed methodology is a two-step optimization approach. This means that the optimization is accomplished in two phases and that, in the final run, the optimization problem comes with a reduced search space, and the final solution is thus easier and with greater guarantees found. Both phases of the optimization are accomplished by the NSGA-II algorithm. Two options for this two-step approach are evaluated in the paper on real-life, large irrigation network. In the first alternative, diameters from the sub-optimal solutions (produced in first phase) are used to enhance the optimization run in the second phase; in the second alternative, flows in the pipes from the sub-optimal solutions are used. Obtained solutions are compared and advantages and disadvantages of both alternatives are evaluated. Irrigation network, which is used as case study in this work (Balerna network), is so called benchmark network, i.e., it serves for comparison of various optimization methods in scientific literature. It was optimally designed with success because best price than any other published for this network was obtained with proposed methodology.

Key words: Irrigation, water distribution system; optimal design; NSGA-II.

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Diffraction of plane SH waves by a cylindrical cavity in an infinite wedge

Hasan Faik Kara *

Trakya University, Department of Civil Engineering, Edirne, Turkey

ABSTRACT

Diffraction of plane harmonic SH waves by a cylindrical cavity in a homogeneous, isotropic and linear elastic infinite wedge is investigated. Analytical closed form solution is obtained by utilizing Wave Function Expansion Method and Image Technique. Governing equation of this two dimensional steady-state wave motion problem is the Helmholtz equation. Helmholtz equation for polar coordinates is solved by using Separation of Variables Method. Displacement fields are expressed in terms of Fourier-Bessel series in complex form. Complex coefficients of Fourier-Bessel series are to be determined from boundary conditions. Zero-stress boundary condition at cavity inner surface is satisfied directly since polar coordinate systems are used. Free stress conditions at flat surfaces of the infinite wedge are satisfied in closed form via imaging method. In this technique, imaginary cavities symmetric with respect to flat surfaces are considered. With this consideration, scattered waves from imaginary cavities would represent reflections from flat surfaces so that stress free boundary condition on flat surfaces would be automatically satisfied. This technique would generate two additional displacement fields with two additional set of unknown complex Fourier-Bessel constants. These unknowns could be determined from boundary conditions of imaginary cavities. The cylindrical scattered waves from each cavity are defined in different polar coordinate systems. Addition Theorems are used for adequate coordinate transformation. Since Image Technique is used, to maintain angular symmetry, analytical solutions are obtained for a specific wedge whose internal angle is 120 degrees. Also, direction of incident waves has to be either horizontal or on the symmetry line of the wedge and cavity centre has to be on the symmetry line. In numerical results, parameters in length dimension are normalized with respect to cavity radius. Free field waves are compared with earlier studies and they all agree. For various values of normalized distance between cavity centre to flat surfaces and wave length, surface displacement amplitudes are plotted. It is observed that the presence of cavity has significant amplification and deamplification effects to surface displacements. Therefore, for practical purposes, this investigation may be helpful to determine the effect of an underground tunnel to the surface motions near steep mountain slopes during an earthquake.

Key words: SH waves; wedge; cylindrical cavity; Addition Theorems.

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A semi-analytic solution for prismatic bars by large displacement and non-local continuum field theories

Gökhan Güçlü *, Reha Artan

Istanbul Technical University, Faculty of Civil Engineering, Maslak 34469, Istanbul, Turkey

ABSTRACT

Response of prismatic bars is investigated by using two approximation functions for the elastic curve according to large deflection and nonlocal continuum field theories. In large deflection theory, deriving closed form analytic solutions are not always possible. Even when it is possible, great mathematical difficulties arise. Solution technique implemented in this investigation uses elementary functions of mathematics and gives very accurate results compared to exact solution with significantly decreased mathematical complexity. Governing differential equation of the elastic curve is written according to large deflection and nonlocal continuum mechanics theories. Instead of solving this differential equation directly, elastic curve is approximated by using two approximation functions. The first approximation function is selected as closely as possible to the exact elastic curve. On this one, equilibrium equations and moment-curvature equation is written. Second approximation function is for correcting small displacement differences from the exact elastic curve. It is selected so as to satisfy boundary conditions and some criterions which are required to obtain an elastic curve which is as close as possible to the exact elastic curve. In the first approximation function, displacements are large whereas in the second one displacements are small. As examples, a cantilever beam and a simply supported beam is solved. Results are used for estimating magnitude of nonlocal effects. It is found that when span length decreases to nano lengths, nonlocal effects becomes more significant. On normal scale nonlocal effects are negligible. As importance of nano technology increases each day, it is beneficial to incorporate nonlocal continuum theory into mathematical models of prismatic bars on nano scale.

Key words: Large deflection theory; nonlocal continuum mechanics; nano technology; approximate method; prismatic bar.

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Mathematical modelling in tasks of construction

Alexander N. Koshev, Valentina V. Kuzina *

Penza State University of Architecture and Construction, German Titov St., Penza, 28, 440028, Russia

ABSTRACT

The tasks formulated in article from area of construction were solved by methods of mathematical simulation with the assistance of authors. It is optimization of the amount of constructions of port constructions; calculation of transfer of impurity in different environments and concentration of metals in sewage, prediction of properties of construction materials. Research objective – to show as far as a broad spectrum of subjects and tasks of construction branch which can be successfully solved by simulation. For simulation and optimization of the amount of constructions of hydraulic engineering constructions for port the method of limit statuses is used. The choice of the optimum diagram was made from a construction cost minimum condition for two diagrams: with the unloading console and without it. Independent parameters are selected: width of underwater part and width of a superstructure. Were researched: stability of a construction and restriction of values of the squeezing and pulling stresses. Development and deployment at design institute of the computer program for the solution of this task yielded the following results: labour productivity of a designer increased by 35 times, the cost of a construction decreased by 10%. The actual task of heating and ventilating technique by calculation of fields of temperatures and concentration of impurity in flows of air or water was solved in two stages: 1) fields of average speeds and characteristics of turbulence were defined; 2) function fields Φ (temperatures, concentration, enthalpies) on the basis of the solution of the equation of transfer of passive impurity in limited space were calculated. Received good coordination of model calculations and the experimental data. The problem of prediction of properties of construction materials for protection against radiation was solved on the basis of regression models. It allowed to research dependences of change of protective properties of materials on change of composition. So, in case of increase in amount of oxygen in concrete with boron for 20% the linear coefficient of weakening of γ -radiation increases by 12% that improves protective properties of concrete. Mathematical simulation of distribution of moisture when moistening porous materials allowed to set dependences of moisture content on relative air humidity. The problem of monitoring of distribution of possible technogenic pollution of the water environment on the basis of mathematical models was solved. Three main options of a mass transfer were considered: diffusion; convective-diffusion; convection. For these purposes one- two- and three-dimensional mathematical models are constructed. Simulation allowed to apply voltamperometriya methods to determination of residual concentration of ions of heavy and non-ferrous metals in industrial sinks. The reviewed examples show a possibility of the solution of actual problems of construction by methods of mathematical simulation.

Key words: Mathematical simulation; optimization; prediction; construction tasks.

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Session Title:
**Integrated Coastal Zone Planning and
Management**

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A finite volume morphodynamic model useful in coastal environment

Silvia Bosa, Marco Petti, Francesco Lubrano *, Sara Pascolo

University of Udine, Polytechnic Department of Engineering and Architecture, via del Cotonificio 114, 33100 Udine, Italy

ABSTRACT

The economy of a coastal region is often strongly influenced by activities connected to industrial, fishing and touristic navigation, which can involve not only offshore and nearshore areas, but also typical coastal waterways such as lagoon channels or river mouths. All these natural environments need dredging operations to ensure the navigation in lagoon waterways as well as the access to ports located in the lagoon or in the lower reach of the rivers. On the other hand, the dynamics of river mouths and tidal inlets can strongly influence the sediment balance of the littorals with their sediment supply. Clearly, in this situation an integrated coastal zone planning is necessary for the management and development of the area and an accurate analysis of the morphodynamics of the coastal environment is needed. In particular, the morphological evolution of transitional environments is strictly related to the current flow as well as to the sea waves. In fact, the dynamics of sediment transport in this area is influenced by the mutual effect of wind waves and currents due to river flow and tides (Soulsby, 1997). Hence, a trustworthy investigation of the coastal morphological evolution must take into account the mutual interaction between river flow dynamics, tides and wind waves induced processes. Numerical approach requires the development of an appropriate model, which can efficiently compute at the same time current hydrodynamic, wave motion and sediment transport. Thus, as a first step, in the present paper a hydrodynamic and sediment transport model is presented, that has been developed at the Polytechnic Department of Engineering and Architecture of the University of Udine. It integrates the bidimensional depth-averaged nonlinear shallow water equations by means of a finite volume scheme. The sediment transport scheme considers both bed and suspended loads. These two mechanisms can be computed using an equilibrium approach or solving an advection-diffusion equation of depth-averaged sediment concentration (non-equilibrium approach). Moreover, to a better representation of the meandering of the final branch of a river, also the secondary currents have been included. As a whole, the resulting model is very efficient and hence suitable to study morphodynamic evolution in complex and large domains, where wet-dry transitions are of great importance and bottom morphology is very heterogeneous. In the validation process of a model, the comparison of the numerical and experimental data in controlled laboratory tests is a key point. In fact, only this type of analysis, where physical process is fully monitored, is reliable to check the numerical scheme. Thus, some significant validation tests are presented and discussed: a 2D dam break over mobile bed (Soares-Frazão et al., 2012), a trench migration (Van Rijn, 1987) and a test reproducing a meander of a channel (Yen and Lee, 1995). Obtained results are in good agreement with experimental data and computation with other different numerical models. Following previous considerations, the presented model seems adequate to be applied in field studies in rivers, estuarines and coastal areas, being useful for integrated coastal and fluvial zone management.

Key words: Numerical model; finite volume method; sediment transport; coastal area.

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Session Title:

**Accreditation of Civil Engineering, Architectural,
City and Regional Planning Education**

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Experimental and numerical study of pile-to-pile interaction factor in sandy soil

Mehdi Modarresi ¹, Habib Rasouli ¹, Abbasali Taghavi Ghalesari ^{*2}, Mohammad Hassan Baziar ¹

¹ Iran University of Science and Technology, 1684613114, Narmak, Tehran, Iran

² Babol University of Technology, 4714871167, Shariati Av., Babol, Mazandaran, Iran

ABSTRACT

In structures to support large vertical and horizontal loads, piles are usually used in the form of closely spaced group. The piles in a group are not only affected by their individual loads transmitted from the pile cap, but also by additional loads transferred through the soil from the interference of neighbouring piles. This group interaction influences the group stiffness, load-transfer mechanism and group settlement. In order to predict the response characteristics of pile groups, the interaction factors calculated using Mindlin's solution based on the theory of elasticity has been widely applied. The pile-to-pile interaction factor is defined as the ratio of displacements or rotations of an unloaded receiver pile to those of neighbouring loaded source piles due to soil deformation. In this paper, a series of centrifuge model tests were carried out to examine the effect of soil relative density and pile spacing and pile tip condition on the interaction factor between two adjacent piles. Based on the results, soil relative density has a significant effect on the interaction between piles and thus it must be considered in the calculation of interaction factor. For this purpose, a correction to the Randolph and Wroth equation based on the test results is proposed in which the effect of soil relative density is contemplated. With an increase in the pile spacing, the value of interaction factor for all cases decreased. Compared to the effect of pile shaft, pile tip condition has a little effect on the interaction factor. The obtained results were also compared to those from a three-dimensional finite element analysis and a good agreement between the measured and the calculated results is observed.

Key words: Pile-to-pile interaction factor; soil relative density; pile tip, centrifuge test, finite element method.

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Industry interface in undergraduate civil engineering education: Indian context

Shekhar Kumar Chakrabarti *

Indian Institute of Technology Kanpur, Department of Civil Engineering, Kanpur 208016, India

ABSTRACT

It is imperative that Undergraduate Civil Engineering Education is a professional education which demands its integration with industry vis-a-vis society. History of development of the Undergraduate Civil Engineering Education in India depicts that the existing programmes, since their inceptions, are predominantly having no or at the most, insignificant interaction with industry in respect of formulating the contents of the curriculum and their implementation; and this is true not only for Civil Engineering Programmes, but also for other Undergraduate Engineering Programmes. The students of Civil Engineering must be exposed to the real life situations in a holistic sense so that they are ready to take up the real challenges for accomplishing the jobs in hand, on completion of their undergraduate programme. One of the professional educations that I know about, is the Medical Education in India; it is not permitted in India to start and operate a medical college without having its permanent linkage with at least one hospital in operation. Somehow, it is not the case for the Engineering Education in India for having similar arrangement as one of the primary requirements in allowing the programme to start and run. The need to have embedded industry involvements and orientations through suitable institutional industry-interface systems in place on permanent basis, is strongly felt in order to achieve the objectives of the Undergraduate Civil Engineering Educational Programmes of India. It is needless to mention that both the teacher and the taught would be quite motivated in undergoing this process of experiencing the practical project related issues and problems during the conduct of the courses as part of the academic curriculum. In this proposed scheme, the associated industry experts would be willing to participate in providing all necessary information and exposure to the students through lectures, workshops, site-visits etc.; the industry experts should also be available for working as examiners for evaluating the performances of the students, jointly with the instructors of the courses. Finally, it is to be noted that, the existing accreditation processes for accrediting the Undergraduate Civil Engineering Programmes in India, are in need of undergoing thorough reform to include the very important element of its industry interface; this is a primary component of the Civil Engineering Education, and must be put in place through adequate and effective systems in all Undergraduate Programmes.

Key words: Industry-interface in undergraduate civil engineering education; engineering education in India; accreditation of civil engineering educational programmes in India.

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Specific Session:

**Sustainability in the conservation of the existing heritage: from
the archaeological ruin to the industrial heritage**

Conveners: Assoc.Prof.Dr. Manuela Mattone & Prof. Marco Pretelli

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Sustainable interventions for the preservation of earthen cultural heritage

Manuela Mattone *

Politecnico di Torino, Dipartimento Architettura e Design, viale Mattioli 39, 10125, Torino, Italia

ABSTRACT

Earth is the most common material used for the construction of historical villages, the conservation of which ensures the transmission of a technological culture that represents architectural, landscape, as well as historical values. The "culture of the earth" is found mainly in rural settlements that are now often severely compromised. Abandoned because considered unhealthy and unsafe, but, first of all, because they are incompatible with the concept of modernity to which contemporary man aspires, earthen buildings have been, unfortunately, since a long time ago, placed in a situation of great vulnerability and intended to rapid extinction. The preservation of this rich, but very fragile, heritage requires the development of projects that don't take into account one single artefact focusing the attention exclusively on aspects such as material, structural and functional compatibility. On the contrary, they should be promoters of sustainable interventions, which can be defined in such way not only when they are able to guarantee a limit in the consumption of resources, but also when (and this is the meaning to which we refer to in this paper) they allow the activation of local development processes through the implementation of the value of the resources locally available, generating externalities that can significantly contribute to the preservation of tangible and intangible assets. Pursuing sustainability in conservation intervention, as well as in the design of new architecture, may involve several aspects (concerning materials, structures, functions, performances, costs) and may be difficult due to the specific characteristics of the cultural property that it is necessary to cope with. As far as it concerns earthen vernacular architecture, widely spread in Italy, the development of thematic itineraries, pointing out not only the buildings, but also other assets, could give a significant contribution to the enhancement of this cultural heritage. It would promote its conservation and, in the meantime, the recovery of the sense of belonging that local communities seem to have lost and that would be an incentive to the preservation of earthen construction, restarting maintenance processes broken off a long time ago.

Key words: Conservation; earthen architecture; sustainability.

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Experimentation of earth-gypsum plasters for the conservation of earthen constructions

Fabio Fratini ¹, Manuela Mattone ^{*2}, Silvia Rescic ¹

¹ CNR-ICVBC, Head Office-Via Madonna del Piano,10,50019 Sesto Fiorentino (FI), Italia,

² Politecnico di Torino, Dipartimento Architettura e Design, viale Mattioli 39, 10125, Torino - Italia

ABSTRACT

Widely spread in many countries, earthen structures bear important and significant witness of knowledge, building techniques, technological culture. Even if specific devices were and are still today used in earthen buildings in order to protect them from the damages caused by external agents, most of them display a lot of different kinds of decay. The preservation of the rammed earth architectural heritage, as well as the use of this material in contemporary architecture, asks for the experimentation and the development of proper materials and intervention techniques in order to prevent decay which may compromise the conservation of earthen heritage over time. Today, the substances that are usually employed to stabilize earthen plasters (Portland cement) are not compatible with the rammed earth support, both from a chemical and physical-mechanical point of view. Hence comes the need to study the formulation of plasters compatible with rammed earth walls from all points of view; they should be studied according to the specific characteristics of the support itself and to the specific environmental conditions as well. The research aim is to design and test earth-based plasters prepared mixing earth and gypsum, with the addition of natural or synthetic products, which can offer an effective compatible means of protection against the atmospheric agents characterising the places in which the constructions are or will be built. It intends to pursue the following goals: a. develop additives which allow to enhance the quality of raw earthen plasters for the new buildings and for the restoration and conservation of the existing ones; b. improving the environmental and economic sustainability increase of earthen plasters through the use of stabilizers with reduced energy impact such as gypsum. The experimental campaign, which includes tests in order to evaluate physical and performance behaviour of the different plasters, intends to assess their capacity to guarantee an appropriate protection of the rammed earth walls – both ancient and recent – on which they should be laid.

Key words: Earthen construction; decay; conservation; gypsum; plaster.

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Villa La Petraia: historic indoor microclimate, effects and permanent changes

Leila Signorelli *, Kristian Fabbri

University of Bologna, Department of Architecture, via Cavalcavia 61, 47521 Cesena, Italy

ABSTRACT

Villa La Petraia: Historical Indoor Microclimate as Immaterial Heritage. The several kinds of buildings used by users, which modify the material and immaterial component, are a historical fact. The indoor microclimate should be considered as an immaterial heritage, deeply connected with the material component: it can be studied to increase knowledge and as a sensitive data for the overall assessment of the quality of the architecture, constituting an important reference for the restoration project. So, in our point of view indoor microclimate could be study as historic document data, then we talk it Historical Indoor Microclimate. Immaterial Heritage, or Intangible Cultural Heritage, defined, by UNESCO, includes "tradition or living expressions", so indoor microclimate is a result of several architectural, cultural and human behavior traditions in order to improve building living. The concept of Historic indoor microclimate has been defined by Kristian Fabbri and Marco Pretelli in ongoing research and ongoing book by Springer (Historic Indoor Microclimate, 2016). In this paper we present the ongoing research about case study of Villa La Petraia, one of the most famous among the Medici villas in Florence. In the late sixteenth century the configuration, attributed to Bernardo Buontalenti, has a central courtyard. This court was "open-air" until the acquisition of the Villa by the Savoia, which produced a significant change: a wedding party (1872) was the occasion of installing a glass structure to cover the court. This high quality architectural solution, altered the indoor microclimate. In the twenty-first century using the same criteria has been installed an electric fan-convectors to use the court at extemporaneous events. These modified the microclimate (again!) and, in addition, without taking care about the aesthetic compatibility with the peculiar artistic value of the complex. How above architectural solution changed indoor microclimate? Which are effect on heritage and human comfort/discomfort? In order to discover these issue we done an indoor microclimate monitoring and virtual environmental model. A team is currently working on the monitoring of indoor microclimate. The data show a critical condition of the courtyard microclimate: 45 °C peaks during the summer period (21 august) means high discomfort for visitors and watchpersons. The data obtained allowed to calibrate a 3D model of the Villa and to simulate through a virtual environment model his microclimate behaviour. The simulation is a powerful forecasting tool, which permits to compare the configurations to find out an adequate solution for improving the indoor microclimate. Purpose of the intervention is to show the state of the art of the investigation carried on about the progressive alterations of the microclimate of the court.

Key words: Historical indoor microclimate; heritage virtual environment; microclimate; heritage building simulation; Villa Medici La Petraia; intangible cultural heritage.

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The effects of the vegetation framework on microclimate in archaeological areas: the study case of Villa Romana in Russi (Italy)

Andrea Ugolini *, Kristian Fabbri

University of Bologna, DA – Department of Architecture, Via Cavalcavia, 61, 47023 - Cesena FC, Italy

ABSTRACT

A wide range of scientific literature has existed for some time on the effects (and risks) produced by the environment and in particular by vegetation in archaeological areas. Vegetation in fact, by nature modify, according to seasons, the environmental and micro environmental conditions of an archaeological site to the point where it has become common practice to “sterilize” these places from trees and bushes. A multidisciplinary unit of research from the Department of Architecture at Bologna University, composed of restorers, landscape designers and building physicists, is evaluating the possibility of reviewing, at least partially such assumptions, verifying the effects caused by the presence of vegetation in some archaeological areas in Emilia Romagna. The assessment was made using software modelling of the outdoor microclimate specifically the ENVI MET software which permits the evaluating of the exchange of energy and water vapour between the part of a territory and the celestial vault in relation to the local climatic conditions. The thermo-physical data relative to materials regards, mainly, the albedo, while for the vegetation and for tree the quantity of water vapour released is taken into consideration. The output data permits to control the effects of the vegetation present in the area on the distribution of the temperature and velocity of the local air and the relative humidity. The software has at present a limited database of materials and trees and specific situations in archaeological areas are not present. This contribution is intended to illustrate the results relative to “Villa Romana” an archaeological area in Russi (RA), a rural villa from the Roman age in Northern Italy. The archeological-site, discovered in 1939 and studied in the Fifties, covers 8000 square meters, and includes the living and manufacturing areas. The original design of the villa remains, the walls have been completely rebuilt and parts of the geometrical mosaic floors have been removed, restored and relocated in situ. The site is situated in the homonymous area of ecological equilibrium, realized between 1994-1995 in a disused clay pit. To sum up the remains of the villa are surrounded by dense vegetation composed of local autochthon species typical of the Padana plains. The particularity of the study case is constituted by the fact that the archaeological area is surrounded by a barrier of trees inserted in an area of cultivated fields and a partially built up zone. To assess the effects of the vegetation on the archaeological area simulations in different periods of the year have been carried out, hypothesizing the removal of all the surrounding trees, with the aim also to evaluate the effects on visitor comfort. The data permits an effective evaluation of the risks and benefits produced by the vegetation in the surrounding area and also to verify the comfort of visitors, in the knowledge that this last parameter, although useful in terms of mise en valour not always coincides with the optimal conditions of conservation of the archaeological remains.

Key words: Archeology; conservation; vegetation; decay; outdoor microclimate; mise en valour.

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A new concept: HIM (Historical Indoor Microclimate). Learning from the past for a more sustainable future

Marco Pretelli *, Kristian Fabbri

Università di Bologna, Dipartimento di Architettura, Via Risorgimento, 2, Bologna, Italy

ABSTRACT

Historical architecture is long time studied in Europe. About most of it, we know building techniques, materials, problems linked to the decay and solution for the restoration project, depending on the goal of the restoration itself and the intended usage. Knowledge about restoration increased much since Viollet-le-Duc and Ruskin times, with an increase in study cases and theoretical approaches, and in disciplines and disciplinary sectors as well, such as History of Architecture and Chemistry of Materials. In this field, though, one of the most neglected subject concerns a non-material characteristic of an architecture, which is the Historical Indoor Microclimate, i.e. internal climatic conditions that, thanks to the building itself, allow to perform the specific activities. Strategies to control microclimate within spaces are born in the dawn of times, as well as architecture itself, with the first braziers to cook, heat and protect our ancestors' caves. From that first fire, then, techniques evolved until the modern HVAC (Heating, Ventilation and Air-Condition System), that are able to modify the internal microclimate of buildings independently from the outer space. In historical buildings, mostly built before 20th century and of HVAC introduction, indoor microclimate conditions were strictly dependent on the architectural, technological and local techniques used to build them. This means that each architecture belongs to the epoch, territory, usage and architectural traditions that built it, and that this architecture is characterized by a specific Historic Indoor Microclimate (HIM). Thus, before the introduction of HVAC plants, the internal microclimate of each building was strictly connected to the specificities of its territory and architectural traditions. Researches currently carried on in the Department of Architecture of Università di Bologna aim specifically to study this field of architecture, considering it highly relevant to accomplish the goals of any restoration intervention. Thanks to monitoring campaigns, we already have data related to three distinct buildings, different in their construction times, typology, location and used techniques. These data show that historical microclimates guaranteed by these architectures are surprisingly overlapping to the parameters considered, nowadays, appropriate to conserve them and the historical patrimony they contain. Monitoring, moreover, allowed developing the analysis further, from survey to simulation. This way it was possible to verify the effects of minimal variations in the architecture characteristics, such as opening or closing a window, covering an open yard, or else, removing a cover, reducing the source of light etc. All of these interventions have significant effect on the microclimate of buildings and can improve the conservation status of architecture, sometimes to such an extent that more costly and invasive restoration become unnecessary.

Key words: Historic architecture; historic indoor microclimate; virtual environment; microclimate; heritage management; thermal comfort.

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Sustainable redevelopment of public spaces in city centres: a bioclimatic approach

Eva Coisson ^{*1}, Sandro Del Lesto ², Barbara Gherri ¹

¹ DICATeA – University of Parma, Parco Area delle Scienze 181/A, 43124 Parma, Italy

² Architect – via XXV Aprile 97, 50050 Gambassi Terme (FI), Italy

ABSTRACT

In many European countries, the attention towards the restoration and redevelopment of the urban centres is increasing, as the pressure for the use of new “virgin” soil for building expansion decreases, for many reasons. This leads on one hand to the reuse of existing buildings, and on the other hand to “renew” the public spaces as a symbol to show off the rebirth of a part of town. As far as the first approach is concerned, restoration is with no doubt a complex interdisciplinary field, but in the last two centuries (at least in Europe) it has been somewhat framed in a theoretical debate which lead to the definition of several shared charters. The redevelopment of public spaces is instead a no man’s land, working on gaps among buildings and trying to fill gaps among city planning, restoration, design, transports management. In this field, sustainability is also becoming an important issue, not only from the economical and energetic points of view, but also in relation with the climate changes and the people’s comfort. Starting from this awareness, a case study is here presented in which the design perspective is overturned: the bioclimatic analysis of the system of central squares of the small town in Sant’Ilario d’Enza (Italy) becomes the base for the design of a new liveable space among buildings of limited historical and architectural value. The ENVIMET fluido-dynamics software is used to assess the present outdoor comfort conditions in the different times of the year and to identify the critical elements to be modified. The indications for the insertion of new green spaces suggest a symbolic return to the rural past of the area, elaborated with a contemporary design, taking also into account the flexible uses nowadays required by these common spaces. Other recommendations are focused on the external face of the buildings, thus allowing to improve both the internal energetic balance and the effects on the external urban environment. The attempt is to insert some quantitative elements in a field – the redevelopment of urban public spaces – which is usually rather qualitative and subjected to personal judgment, improving at the same time the aesthetics, the usability and the liveability of these spaces in a sustainable way.

Key words: Redevelopment; urban public spaces; sustainability; outdoor comfort; bioclimatic analysis.

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Specific Session:

Applied Hydrotechnics: multidisciplinary research and future challenges

Convener: Assist.Prof.Dr. Rares Halbac-Cotoara-Zamfir

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Applied hydrotechnics: multidisciplinary research and future challenges

Halbac-Cotoara-Zamfir Rares *

Politechnic University Timisoara, Victoriei Square no. 2, Timisoara, 300006, Romania

ABSTRACT

Hydrotechnics is an ancient branch of science and technology. All major ancient civilizations used different water techniques to develop and to increase their life standards. Hydrotechnical measures and activities known different changes during centuries but permanently included knowledge from many other sciences and faced many challenges. This paper will debate only some hydrotechnical activities like: irrigation and drainage works, water supply and water sewage, flooding protection structures, water energy arrangements. However, all these mentioned works require multiple skills and knowledge considering the future challenges generated mainly by climate changes, an increased pressure on natural resources generated by the need for more space, food, energy, clean environment etc. Water, energy and food are essential for human well-being, poverty reduction and sustainable development. Global projections indicate that demand for freshwater, energy and food will increase significantly. The conceptual approach based on Water-Energy-Food nexus and the use of ecosystem services provided by different hydrotechnical arrangements will help stakeholders to better understand and systematically analyse the interactions between the natural environment and human activities, and to work towards a more coordinated management and use of natural resources across sectors and scales. The author would like to mention that the paper will have a focus on prioritising water-related development goals over others but without discrediting the other resource-based goals. A much more complex approach will also include the climate. Integrated water resources management should be an instrument to explore adaptation measures to climate change. Hydrotechnical measures represents the structural aspects of this management and should be focused on coordinating land and water resources management, recognizing water quantity and quality linkages, protecting and restoring natural systems, including consideration for the results and outputs of climate changes etc. The purpose of this paper is to provide an actual view on the role of applied hydrotechnics in the context of current and future challenges based on a multidisciplinary approach.

Key words: Hydrotechnics; water nexus; multidisciplinary approach; ecosystem services.

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Applied hydro-technical measures in sustainable land management: case study of Timis County (Romania)

Leucuta Gabriel Codrut *, Halbac-Cotoara-Zamfir Rares

Politechnic University of Timisoara, Victoriei Square no. 2, Timisoara, 300006, Romania

ABSTRACT

Sustainable land management (SLM) refers to practices and technologies that aim to integrate the management of land, water, biodiversity, and other environmental resources to meet human needs while ensuring the long-term sustainability of ecosystem services and livelihoods. According to Romanian scientific methodology, hydrotechnical measures also include land reclamation and improvement systems as irrigation, land drainage and soil erosion control works. The actual methodology in designing land reclamation works has an economic approach: reducing the effects/ removing the stress factors for maintaining/ increasing agricultural production at low costs. Unfortunately are not considered the potential impact on environment, adaptation to climatic variability, the possibilities of soil and water conservation, climate changes manipulation techniques using these types of works. The integration of land reclamation works in sustainable land management represents a new scientific approach especially regarding the problem from the point of view of ecosystem services provided by these works. This type of approach will overrun the interdisciplinary borders and will assume a stronger cooperation from planning to implementation. Moreover, a special attention must be granted to ecosystem services provided by land reclamation and improvement arrangement, approach which so far was much neglected. Reviewing the operation and designing criterions of irrigation and drainage works, in the frame of sustainable land management and under the pressure generated by climatic changes, should be made in correlation with identifying manipulation techniques of climatic changes using the infrastructure of land reclamation works. This paper will debate the feasibility and opportunity of integrating applied hydro technical measures like irrigation and drainage works in the frame of sustainable land management.

Key words: Sustainable land management; hydrotechnics; land reclamation and improvement.

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1D/2D numerical modeling of a high-water flow

Marie-Alice Ghițescu *, Gheorghe I. Lazăr, Albert Titus Constantin, Alina-Ioana Popescu-Bușan, Șerban-Vlad Nicoară

Politechnics University Timisoara, 1A George Enescu Str., 300022 Timisoara, Romania

ABSTRACT

As common circumstances, the urban developments, either for residential purposes or with economical destination, become to cover land areas initially outside town boundaries, which had the most a farming employment. If the targeted areas also represent the flood plains of a river course, protected or not by alongside embankments (corresponding to the former protection rank), the problem regarding the flooding possibility of future objects needs to be considered. The paper presents a numerical simulation of a special hydroflow on Timiș River lower course (West plain of Romania) along the given stretch from the Town of Lugoj towards the Coșteiu Hydrotechnical Arrangement. A specific high-water flow development was considered by configuring a hydrograph of outstanding values for this river, registered on the beginning of April, 2000. The flow simulation aims to estimate the water volumes possible to be discharged by over-spilling the side framing embankment, as well as to supply a graphic time development of a consequently flooding in the adjacent plain, an area engaged on the industrial business expansion of town outskirts. The simulation along the given stretch of the river flood plain was performed in a 1D model by HEC–RAS 4.1 and also by employing distinctive modules of HEC–GEORAS 4.3 (embedded in ArcMAP 9.3). As for the 2D modelling of the affected space aside the river course, there was defined a specific polygonal surface attached further on as a side structure and meshed by discrete elements. Following specific post-processing operations, the numerical results were overlaid to the 1D and 2D models geometrical data in order to be graphically interpreted by the help of RasMapper module.

Key words: River engineering; flow; flooding; water flow modeling.

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Monitoring the best available techniques implementation at the ash and slug landfill Utvin, Timiș County, Romania

Ioana-Alina Costescu *, Nemeș Nicoleta 2, Pelea George Narcis

Politehnic University of Timișoara, Faculty of Construction Engineering, Department of Hydrotechnic, 1A George Enescu Street, 300 022 Timisoara, Romania

ABSTRACT

The Ash and slug Landfill Utvin is a plain deposit occupying a surface of about 50 ha, with trapezoidal shape located at about 4,0 km west from the city of Timișoara in the western part of Romania. The landfill serves the electric thermal power plant Timisoara Sud where it is produced part of the heat required for supplying the urban consumers in the area of Timisoara and electricity for his own consumption and covers part of the demand registered in the National Energy System - SEN. For this purpose are used combustion plants for energy conversion of the chemical energy from coal (lignite) and natural gas into heat and through a turbine generator with counter pressure steam, it produces electricity. Due to the small calorific power of the lignite (approx. 2000 kcal/kg) and high content of non-combustible material falling in its composition (approximately 27% from the anhydrous), the amount of fuel required to produce thermal energy is high and thus the amount of solid waste results. The content of dust in flue gases from the combustion of coal is about 50 g/Nm³. To reduce the impact on the environment, these combustion plants were equipped with gas dedusting systems into the atmosphere. From burning about 300 000 t of coal will result a quantity of 100 000 tons of slag and ash and from the desulphurisation plant will result an amount of desulfurization by-product of approx. 50 000 t. The slag and transport and storage system has been changed and adapted to the requirements of EU regulation since it is forbidden to store "liquid waste". Therefore, the solution has been adopted in depositing dense self-hardener slurry, a technical solution specified in the implementation plan according of the 1999/31 / EC Directive. The purpose of the research presented in this paper are the objectives achieved by the landfill's administrator in applying the Best Available Techniques and to identify the impact of their implementation upon the environment.

Key words: Ash and slug landfill; best available techniques; environment impact; environment monitoring.

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Current management issues in exploitation and maintenance of irrigation systems in western Romania: case study of uniform application of irrigation

George Narcis Pelea *, Ioana Alina Costescu, Teodor Eugen Man

Politechnic University of Timisoara, Faculty of Civil Engineering, Hydrotechnical Engineering Department, 1A George Enescu Street, 300 022, Timisoara, Romania

ABSTRACT

The paper aims to present problems concerning the exploitation and maintenance of irrigation facilities in an operating local irrigation system in western Romania. The data were collected from a hydro ameliorative complex arrangement located in Aranca plain, Timis County, Romania. Irrigation facilities are relatively new and overlaps with Aranca drainage system, compartment IV. The main aspect taken into consideration is the application of irrigation analysing irrigation uniformity for different types of modern sprinkler irrigation systems in operation, respectively linear sprinkler irrigation installations and pivot sprinkler irrigation installations.

Key words: Irrigation facilities; local irrigation system; irrigation uniformity; linear sprinkler irrigation installation; pivot sprinkler irrigation installation.

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Applied hydrotechnics and water scarcity

Andrei Armas, Halbac-Cotoara-Zamfir Rares *

Politechnic University of Timisoara, Victoriei Square no. 2, Timisoara, 300006, Romania

ABSTRACT

Water scarcity is defined in many cases as the situation where water availability in a region presents values below water demands. Even there are significant opinions in drawing a typology of water scarcity, scientists agreed of defining water scarcity as a relative concept generated both by nature and humanity. Other concepts related to water scarcity are the water stress (an imbalance on medium term) and water shortage (which is defined only in terms of comparison (between minimum requirements and existing resources) without having attached a reference value). Using these terms (generally and mainly having a man-made character) in comparison with natural phenomenon (dryness, drought, aridity), we can define some links, from temporal point of view, between dryness and water shortage (short-time defined elements), between drought and water stress (medium term) and between aridity and water crisis as long time defined concepts. If we will pass in the social and economic sectors, water crisis may appear anywhere on scale time because in many areas, today, water crisis is not an issue of scarcity, but of access to fresh water. The hydrotechnical response (which consists mainly in works from rural area (irrigation systems, land and water resources management works)) to these phenomenon (and their attached effects) will represent the main subject of this paper. The problem is not just one of quantities but also one of qualities. Water harvesting, water recycling and re-use in irrigation, reducing water losses, improving crop water productivity are all based on principles of hydrotechnics and can be achieved with sustainable hydrotechnical measures. Integrated planning offers opportunities for enhanced management of water demand. This paper will review a series of technical options which can serve as a basis for developing a sustainable agricultural system in response to growing water scarcity.

Key words: Hydrotechnics; water scarcity; water management; water demand.

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Study on water source protection: case study of Lake Buhui – Anina City, Caras – Severin County (Romania)

Tămaş Marian, Man Teodor Eugen, Pelea George Narcis *, Beilicci Robert, Coccoceanu Adrian

Politehnica University of Timisoara, Faculty of Civil Engineering, Hydrotechnical Engineering Department, 1A George Enescu Street, 300 022, Timisoara, Romania

ABSTRACT

Planning for water sources protection is a necessity for complying with national legislation in the field of drinking water, namely the Water Law and European legislation - the Water Framework Directive. Adopting a coordinated approach to the protection and sustainable use of water resources, with the cooperation of all stakeholders, it ensures the sustainable use of water resources in long term for people, economy and environment. Buhui Lake is the first artificial lake in Romania, with an area of approximately. 11 hectares, built at an altitude of 640 m for water supplying the Anina city. In the Master Plan Water-Wastewater for Caras-Severin, Buhui Lake will provide the only source of potable water for Anina - Steierdorf agglomerations. Analysing in time the evolution and depending on atmospheric regime of the indicators for raw water quality provided by the lake, it resulted that turbidity and CBO5 are influenced by anthropogenic activity, due to controlled and uncontrolled forestry activities in the area. In these circumstances, the elaboration of the water source protection plan of the Lake Buhui is a necessity, because the activities carried out in the sanitary protection zone of water catchment area may have negative impact on the population. The integrated approach for sustainable management of water resources in the catchment area is a good practice of the European Union to be taken in case of water sources in the country. Through plans to protect water sources can be identified shortcomings and problems and can be set policy actions to address them together.

Key words: Water source protection plan; water catchment area; sanitary area protection; raw water quality; turbidity; sustainable management.

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Specific Session:

Urban planning revisited: new challenges, theories and methods

Convener: Prof.Dr. Dr. Luis Inostroza

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A reflection on the social implications of the physical transformation of multi-deprived neighbourhoods': urban renewal versus rehabilitation and a case of Fuencarral A, B and C social housing estates in Madrid (Spain)

Cristina Gallego Gamazo *

Politechnic University of Madrid, Avenida Juan de Herrera 4, CP 28040 Madrid, Spain

ABSTRACT

Nowadays, one of the main concerns in the urban agenda of the European Union and Member States is how to adopt an integrated approach to urban challenges and needs of the consolidated city, in particular, to address the complex condition of multi-deprived neighbourhoods'. Beyond the strategic integrated approaches based on economic interests perceived within the European Union, the disadvantage condition of multi-deprived areas requires an active and consistent implication of the diversity of urban players, including the affected communities themselves. This paper pursues to contribute to this challenge with a reflection about the social implications of massive remodelling or re-development operations of deprived localities in comparison with urban rehabilitation projects eluding the whole demolition-reconstruction process. For this purpose, the social housing estates A, B and C of Fuencarral in Madrid are taken as reference case studies. These social housing areas represent an important lesson of the recent history of the City and the Remodelling Operation of peripheral neighbourhoods in Madrid. Fuencarral A and B units, built as temporal settlements in the late 60s, have been included in the Remodelling Operation in the late 80s and have undergone a massive remodelling intervention that has lasted more than expected; in fact, some residents complain that it has not yet been concluded after more than two decades. While Fuencarral C, with somewhat higher standards, it is a protected area on the General Urban Development Plan 1997, declared as an Integrated Rehabilitation Zone (ZRI) in 2008, with a great implication of the community organized in a civic platform in 2015 called 'Los Pobladores'. Comparing the social and political implications of both types of intervention approaches, calls into question the validity of the instruments of protection and intervention being used to improve the quality of life of these neighbourhoods, and the contradictory situations that the different levels of protection or des-protection of the values of the neighbourhoods incites if one analyze all dimensions of the complex condition of these areas and not only the physical or spatial one. As a result, the review of the three cases provides some insights to better address the integrated regeneration of multi-deprived neighbourhoods considering each context specificities and the needs and demands of the affected communities. This raises for discussion the implications in real practice of a large scale demolition and reconstruction operation that must preserve the urban fabric like in the case of Fuencarral A and B, compared to urban areas with a strong level of protection which does not allow minor adaptations of the buildings to the needs of the population, like in the example of Fuencarral C, and the repercussion in the changes of the population profile and their involvement in the improvement of their habitat.

Key words: Urban regeneration; urban rehabilitation; remodeling; participatory planning; citizen engagement; heritage.

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Managing multiple ecosystem services for landscape conservation enhancing human well-being: a green infrastructure in Lombardy region

Andrea Arcidiacono ¹, Silvia Ronchi ^{*1}, Stefano Salata ²

¹ Politecnico di Milano, Department of Architecture and Urban Studies, via Bonardi 3, 20133, Milano, Italy

² Politecnico di Torino, Interuniversity Department of Regional and Urban Studies and Planning, Torino, Italy

ABSTRACT

One of the major benefit derived from Ecosystem Services (ES) analysis and mapping is the possibility to integrate Landscape planning with additional values, as regard the ones that directly contributes to human well-being. The state of Ecosystems depends on the interaction between the natural environment and human pressure and landscape is the framework in which this interaction occurs. The concept of ES raised attention because its interaction with planning disciplines is evident: when ES are accounted into urban planning discipline the regulation of land uses is much more oriented to efficiency, using trade.-off among different ecosystem functions as a proxy for sustainability; moreover, when ES are used for landscape planning relations with human well-being are easily established because people are considered as a part of the landscape in a multifunctional context. Such multifunctionality emerges from interactions between different types of ES, such as food production, water provision, maintenance of biodiversity and habitat species, improvement of livelihood opportunities, and the cultural and aesthetic potential. Within this premises, the purpose of research is to deep the methodological framework to define and spatially represent the Regional Green Infrastructure (RGI) in Lombardy Region (north-west of Italy) as the mayor landscape contents of the new Regional Landscape Plan. Nowadays, the RGI is promoted only as a guideline in the normative framework of the Plan. It has not a prescriptive content, and it has not a physical definition that could be shared, rather than included at lower administrative levels (provincial or municipal). The methodological approach is focused on multiple ES assessment to estimate the current and expected trends in ES supply and thus promote strategies of ES provision using RGI as a green framework for landscape policy over the Region. The methodological framework defines RGI adopting a multidisciplinary approach considering three fundamental ES: Natural quality in terms of biodiversity integrity, Cultural and recreation potential and, finally, Landscape value considering the Scenic view and the characters of the anthropic landscape. The three functions give a preliminary structure to RGI recognizing its multifunctionality. Furthermore its spatial definition is necessary for framing prescriptive purpose and, in turn, to provide planning guidelines for landscape management at lower levels according to the main regional strategic target which is to improve the human well-being. The uses of multiple ES evaluation and mapping for landscape planning purposes is the fundamental way for the definition of strategies for the sustainable land use management to be included in spatial disciplines. The research tents to demonstrate that when integration between ecological functions and landscape planning purposes are together embedded on Regional planning tools, direct effect on human well-being can be directly assessed and monitored and thus also social health and quality of life are improves with a better management of landscape natural resources.

Key words: Ecosystem service; landscape; spatial planning; Green infrastructures; multifunctionality.

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Learning for parallel virtual urban workshop: an innovate method for teaching planning

Isabel Gonzalez García *, Ester Higuera García, Francisco J. Lamiquiz Dauden

Universidad Politécnica de Madrid, Departamento de Urbanística y Ordenación del Territorio, Escuela Técnica Superior de Arquitectura de Madrid, Av. Juan de Herrera, 4. 28040 Madrid, Spain

ABSTRACT

Since 2012 a Parallel Virtual Urban Workshop (PVW) has been developed at the Department of Urban and Regional Planning (School of Architecture of Madrid, UPM). It was created by a group of professors in the framework of the Postgraduate Program. In 2014 this project became a Group of Educational Innovation called Urban Net-Working Workshop. The initial targets of this workshop were: improving international cooperation among academic institutions based on a virtual network, and the implementation of a professional practice approach on urban regeneration projects and the development of a comprehensive methodology to manage complex urban issues in diverse urban contexts. Up until today, there have been five workshops: in 2012, a joint workshop between UPM (Madrid) and MIT (Boston); in 2013 and 2014, a collaborative workshop between UPM (Madrid) and UCL (London); in 2015, between UPM (Madrid) and KNG (London); currently, a parallel workshop in progress between UPM (Madrid) and AF (Zagreb). Even though, every edition of the Urban Parallel Workshop has been rather unique, it can be asserted that initial targets have been overcome throughout successive workshops. ITCs and digital tools have been gradually incorporated. The project is enough mature to move forward to implement advanced networking tools. Following this concept, during this edition, a new methodology based in collaborative work through Moodle platform (Modular Object-Oriented Dynamic Learning Environment) has been incorporated, using digital tools as GPS Mapping or Google My Maps functionalities to create a common work space. This virtual workspace becomes wide opportunities to exchange experience between students and teachers to improve innovative initiatives in urban planning education.

Key words: Educational innovation; postgraduate courses; virtual workspaces; new methodologies for urban planning; comprehensive approach; international parallel workshop.

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Measuring climate change impact on urban microclimate: a case study of Concepción

Irina Tumini *¹, Carlos Rubio-Bellido ²

¹ Universidad del Bío-Bío, Planning and Urban Design Department, Faculty of Architecture, Concepción, Chile

² Universidad del Bío-Bío, Department of Building Science, Faculty of Architecture, Construction and Design, Concepción, Chile

ABSTRACT

Climate change has become increasingly recognized as one of most challenging environmental issues for humanity. Climate adaptation is an urgent priority for both developed and developing countries. Urban areas play a crucial role in managing carbon emissions by means of their adaptation to global warming. Cities, due to the concentration of population, economic activities and built infrastructures, are high-risk and potential damage areas in a scenario which is expected to aggravate. The urban areas have distinctive climate condition compared to surrounding rural areas, mainly due to differential solar wave exchange between urban environment and atmosphere. The increase of temperature, changes to wind direction and speed as well as to hydrology pattern, are some results of the altered surface cover of the urban area. This effect in high-density urban areas may be an important risk factors due to health disease and mortality, especially for more vulnerable sectors of population. On the other hand, the unfavourable microclimate condition in outdoor spaces can affect quality of life and the use of them. Climate change will amplify these distinctive features. This paper presents an evaluation of climate change impact on cities, by simulating the thermal behaviour of outdoor spaces, using different climate scenarios. The Plaza de Armas of Concepción (Chile) has been used as case study, and climate conditions at 2020, 2050 and 2080 have been produced for the acknowledged A2 'medium-high' emissions Greenhouse Gases GHG scenario, according to Intergovernmental Panel on Climate Change IPCC. To simulate the urban microclimate, the ENVI-met v4 software, a three-dimensional numerical model based primarily on models of fluid dynamics and thermodynamics, has been used to estimate interaction between surfaces, plant and atmosphere at the micro-scale. The comparison between different scenario and discussion about results are presented as well. The results and discussion are a first step to advance on the knowledge of climate change impact for proposing adaptation strategies in the urban context.

Key words: Climate change; urban microclimate; microclimate simulation; CFD.

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OPPTA methodology for intervention in areas affected by risk in Latin America

Irene Pérez López *, María del Carmen Varela Martínez

Observatorio Panamericano de Paisaje, Territorio y Arquitectura OPPTA, C/ San Bernardino 2, 3º Dcha, 28015, Madrid, Spain

ABSTRACT

In the period between 2011 and 2014, Observatorio Panamericano de Paisaje, Territorio y Arquitectura OPPTA simultaneously worked upon risk in five Latin American cities under the topic Emergency Interventions caused by natural and anthropogenic risk phenomena. To do so, the organization developed a concurrent methodology of research, proposals and action which helps analyse and compare processes, methods and ways of approaching infrastructural, architectural, landscape, social and economic issues relating to risk, natural disasters, changing climate and human pressure on the environment. It settled mechanisms and processes that allow to work through a multidisciplinary and transnational network. In the process, this network involves researchers, professionals and institutions from the public and private sector. A preliminary diagnosis based on data collection and specific studies analyzed twelve locations as candidates in Latin America. Among the candidates, five sites have been selected for the implementation of proposals. OPPTA conducted intensive research background while located strategic partners (universities, public institutions, civil society, and others). The proposed methodology is based on the development of five programs: Active Debates, OPPTA Competition, Priority Action, WikiPan and Publications, which deal respectively with research, specific architecture and landscape proposal, project implementation and finally the creation of an open database and the publication-dissemination of results. The aim of research includes the study of risk and its associated problems to, simultaneously, identify patterns, concurrencies and differences at the technical, infrastructural, urban and territorial sustainability social, public policy and governance in Latin America. The particular context and specific problems to each site allowed approaches (from different perspectives) on emergencies resulting from natural or anthropogenic risk phenomena. This raises the common search for solutions, from urban to territorial management, sustainable development, infrastructure design and architectural and landscaping excellence, that minimize vulnerability and strengthen the flexibility and resilience of the people affected by the impacts of emergencies- present and future-, often recurrent. As a result of the studies, the proposals resulting from OPPTA Competition and Active Debates technical, solutions for each of the communities involved are proposed, with particular emphasis on those where it has been possible to develop the Priority Action Program, which incorporate sustainable and resilient development plans, going from the promotion of new forms of tourism to the design of public infrastructures, networks of green areas and other communal spaces, and the organization of educational programs and citizen participation in urban agriculture, waste management and water management, and the management of decreasing programs and the incorporation of production bases to ensure mitigation and endangered environment preservation.

Key words: Latin America; risk, resilience; architecture; landscape; methodology.

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Measuring urban informality in Latin America: spatial assessment of informal urban development using census data and GIS in Santiago de Chile

Luis Inostroza ^{*1,2}

¹ Technical University of Dresden, Institute of Photogrammetry and Remote Sensing, D-01062 Dresden, Germany

² Universidad Autónoma de Chile, Chile

ABSTRACT

Santiago the capital of Chile has been experiencing a tremendous and fast urban development, adding more than 1,300 hectares per year to the continuous urban area. Under a generally weak urban development legal framework a portion of this fast urban development is informal, contrary to the common belief of authorities and planners. This means that, despite the improvements in housing policies developed during the nineties, still an important portion of this fast urban development is taking place outside of the planning systems and standard urban planning practices, thus challenging urban governance, and in absence of an adequate monitoring. Effective methods for understanding, monitoring and quantifying informal urban development (IUD) are needed to better supporting policy making. In this paper a spatial characterization of IUD was developed in Chile, focusing in the Santiago metropolitan area. Levels of IUD were characterized by performing a census-based analysis for the entire country using the census tracks, the lowest available spatial unit for aggregated census data. To ascertain the overall levels of IUD while dealing with the complexity of the socio-economic data and avoiding co-linearity a principal component analysis (PCA) was performed. A selected group of variables depicting specific material features of housing and neighbourhoods were selected. Therefore the aims of this study are twofold: 1) to quantify and map levels of IUD at city scale by examining the socio-economic conditions of population according to the census data base for the entire country and 2) in deep analysis of such levels of IUD at intra city scale, looking at those physical features in an specific urban area: Santiago. The results show that IUD has specific and differentiated spatial patterns, where their material expression is context specific. Strong differences in terms of levels and spatial location were found. Such differentiated spatial process depends on territorial and local socio-economic specificities. However, the emergence of general patterns was also observed and discussed. This singular/general contradictory behaviour shows that more effective quantitative measures are needed to adequately inform policy making.

Key words: Informality; informal urban development; urban planning; GIS; Latin America; Santiago de Chile.

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Urban flood risk reduction by increasing green areas for adaptation to climate change

Erik Zimmermann ^{1*}, Laura Bracalenti ², Rubén Piacentini ³, Luis Inostroza ⁴

¹ National University of Rosario, Hydraulic Department. Fac. Ex.Sc. and Eng., CONICET. Rosario, Argentina

² National University of Rosario, Centre of Environment Studies. Fac. Architecture, Planning, and Design, Rosario, Argentina

³ National University of Rosario, Lab. of Energy Efficiency, Sustainability and Climatic Change, Fac. Ex.Sc. and Eng., Rosario, Argentina

⁴ Technische Universität Dresden, Institute of Photogrammetry and Remote Sensing, Germany

ABSTRACT

Enhanced green infrastructure (GI) in urban areas, such as green roofs, parks and green spaces can make a significant contribution to increasing the provision of fundamental ecosystem services (ES), through nature-based solutions. These positive effects include increasing the interception capacity due to increasing vegetation cover, increasing of storage capacity and infiltration of the soil, thus reducing storm water runoff, producing substantial improvements in the urban drainage system, whose infrastructure is very difficult and expensive to be modified. In this paper an indicator based on the runoff coefficient, which allows quantifying the impact on runoff due to increase of GI is presented. In a second step, a way for relating the indicator with the risk of flooding is proposed. The complete methodology was applied on an urban basin located in the north of Rosario city, Argentina. Four scenarios were evaluated: baseline scenario (current scenario), and three hypothetical (future) scenarios, considering a moderate and severe waterproofing situation respectively, and one green scenario with increased GI. The results show that the moderate and severe waterproofing scenarios produce an increased risk of flooding from 1.9 times to 3.5 times, respectively. This implies a necessary reinvestment in urban storm water infrastructure in order to keep the original security levels. The green scenario does keep the runoff coefficient, even considering the major increases in population and urbanization. Improving the GI constitutes a strong strategy to adapt to climate and urban changes, to cope with upcoming increases in precipitation and urbanization.

Key words: Risk assessment; hydrology: urban; climate change.

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Informal urban development in the Greater Buenos Aires Area: a quantitative-spatial assessment based on households' physical features and legal tenure status

Luis Inostroza ^{*1,2}, Julia Tábbita ^{3,4}

¹ Institute of Photogrammetry and Remote Sensing, Technische Universität Dresden D-01062 Dresden, Germany,

² Universidad Autónoma de Chile, Chile

³ Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Centro de Investigaciones Hábitat y Municipio, Facultad de Arquitectura, Diseño y Urbanismo, Universidad de Buenos Aires, Intendente Güiraldes 2160, CP1428, Buenos Aires, Argentina

⁴ U.M.R. Géographie-cités, Université Paris Diderot, Site Olympe de Gouges, Case postale 7001, 5 rue Thomas Mann, Paris, France

ABSTRACT

Informal urban development (IUD) is a key driver of urbanization in Latin America, which is challenging urban planning and governance. According to the last national census of 2010, in Argentina more than a fifth of households of the Greater Buenos Aires Area (GBA) live in inadequate housing conditions, in the most densely populated urban agglomeration in the country. The situation has worsened compared to the years 1991 and 2001. This IUD lacks recommended minimum housing standards and is thus outside urban planning regulations. An updated assessment that quantifies and characterizes existing levels of IUD is needed to support policy measures to improve households living conditions. This paper analyses the spatial distribution of IUD in the GBA on the basis of the census data 2010. To characterize and measure key dimensions of informal urban development, households' housing physical features (material and infrastructural) and legal tenure status were analysed. The aim was to consider the level and weight of each dimension in average overall urban informality, as well as establishing their correlations and spatial concentrations in the area. For this purpose a principal component analysis (PCA) was performed at country level to ascertain the behaviour of IUD in GBA in the context of the country. In a second step such IUD levels were mapped and analysed to assess and understand their spatial distribution. The results show that even though the legal dimension prevails in the informality discourse of planners and authorities, its weight in terms of the quantitative analysis vis a vis material and infrastructural dimensions is weak. More quantitative research is needed to provide strong empirical evidence for policy making, especially when the focus is still in entitling programs which cannot improve the living conditions of informal inhabitants.

Key words: Informal urban development; Greater Buenos Aires Area; spatial assessment; legal tenure status.

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Green infrastructure systems to face fragmented cities in Latin America: the case of Santiago, Chile

Alexis Vásquez ^{1*}, Carolina Devoto², Emanuel Giannotti ³, Paola Velásquez ³

¹ University of Chile, Department of Geography, Chile

² University of Chile, Department of Architecture, Chile

³ University of Chile, Department of Urbanism, Chile

ABSTRACT

During the last decades, the urban growth in Latin America has produced fragmented cities, with increasing levels of social and urban segregation. At the same time, the highly dynamic urban development has created conflicts with the protection of nature, due to the necessity to satisfy multiple social needs. Reach a balance between these factors is probably one of the main challenges of territorial planning. Santiago, the capital city of Chile, is the 7th largest major city of Latin America with almost 8 million inhabitants and by far the largest and important city of Chile, since it concentrates 42.7 % of the Growth Domestic Product and 40.3 % of the national population. As a consequence of this high demographic importance and economic dynamics, Santiago has almost doubled its size during the last thirty years, from 34,792 in 1975 to 65,543 ha in 2004, replacing previous agricultural lands, native forests and shrubs with urban land uses and occupying river beds and streams. These land-use and land-cover changes have had dramatic environmental consequences. The mentioned urban dynamics produced a city in constant collision with the natural system, including negative impacts on the state, structure, and flow of matter and energy characteristic of the dominant geographical conditions. This structural disarticulation produces many environmental problems such as an increase of sealed surface and consequently of atmospheric temperatures, an accelerated disappearance of vegetated areas, a major interruption of wind/ventilation corridors, of sediment and water flows, and finally, increasing exposure of the local population to environmental hazards. All problems mentioned above put the long-term environmental sustainability of Santiago into question and point out the urgent need to restore and improve the link between natural and socio-urban systems. This necessarily involves recognizing and properly valuing green and open spaces that provide critical environmental services in urban environments. Maintaining an interconnected network of proper functional ecosystems based on key landscape elements —such as wetlands, forests, creeks, lakes, rivers, and others— would ensure the provision of ecosystem services aimed at preserving or restoring landscape integrity. If compared to approaches based on the conservation of vast regions in highly dynamic environments, the elaboration of an approach to land planning based on the planning and conservation of an essential network of green spaces intended for territorial cohesion would render highly effective and efficient results. This paper presents the identification of key green components within the metropolitan landscape of Santiago and the assessment of a set of ecosystem services at three spatial levels; (1) region; (2) city; and (3) neighbourhood (local). Such an approach evolves into the proposal of a priority green infrastructure network that should be preserved and restored, thereby guiding and providing the basis for land planning within the region.

Key words: Green infrastructure; Latin America; Santiago; urban planning; urban fragmentation.

* Corresponding Author

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Structural health monitoring system of civil structures

Piotr Klikowicz *, Marek Salamak, Grzegorz Poprawa

Silesian University of Technology, Gliwice, Poland

ABSTRACT

The review of structures with Structural Health Monitoring System (SHM) was made in this paper. Most interesting examples of structures are described in terms of what sensors are they containing, most common reasons of application SHM and benefits from it. Authors want to answer the question what is most important parameters that can be easily, accurately and undoubtedly measure?

Key words: Structural Health Monitoring System; SHM; bridges; maintenance.

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Re-localization of a low income citizen suburb of Rosario (Argentina) affected by climate change impacts

Rubén D Piacentini ^{*1,2}, Marcelo Vega ^{1,3}, Natalia Feldman ¹, Sofía Garro ³, Daniela Mastrángelo ³, Luis Inostroza ^{4,5}

¹ Laboratorio de Eficiencia Energética, Sustentabilidad, Cambio climático (LESyC), IMAE, FCEIA, Universidad Nacional de Rosario, Rosario, Argentina

² Area Física de la Atmósfera, Radiación Solar y Astropartículas, Instituto de Física Rosario, CONICET - Universidad Nacional de Rosario, Rosario, Argentina

³ Subsecretaría de Medio Ambiente, Municipalidad de Rosario, Argentina

⁴ Institute of Photogrammetry and Remote Sensing, Dresden University of Technology, Germany

⁵ Universidad Autónoma de Chile, Chile

ABSTRACT

Climate change (CC) is one of the most important environmental problems challenging current urban planning and management. The impacts of CC will affect dramatically urban areas and their populations in different places of the world. In Latin America the spatial scope, magnitude and intensity of CC impacts are still lacking adequate policies and implementation in planning practice. In the Central-Eastern region of Argentina, the intensity of rains increased significantly in the last decades, producing large floods and consequently citizen displacements from houses placed near rivers. We present a project for re-localization of low income persons living in a suburb with high flood risk of Rosario city, Argentina. Since climate change plays a significant role as a source of this problem, the Municipality of Rosario is leading actions in the region, related to the mitigation of global warming and consequently is developing the present project based on sustainability criteria. Taking into account these criteria, we investigate the replacement of conventional (non-renewable) energy by sustainable (renewable + efficiency) energy and the reduction of greenhouse gases (GHG) emission to the atmosphere. We present results for the estimation of indicators related to the reduction of: 1) Conventional energy use and GHG emission due to increase in sustainable energy use in construction, operation/maintenance and demolition/ recycling/reuse of new habitats, 2) Energy use and GHG emission due to mobility, 3) GHG emission due to compost production from city organic waste produced in this city suburb and 4) GHG emission due to other contributions. All indicators are determined per year and in the whole life cycle of the habitats.

Key words: Re-localization; city suburb; Rosario; Argentina; climate change.

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Specific Session:

**Historic structures of production areas as a development
potential**

Convener: Assoc.Prof.Dr. Eva Kralova

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(In)Visible elements of the city: Military architecture in the context of urban structure development

Laura Pastoreková *, Peter Vodrážka

Faculty of Architecture SUT, Námestie slobody 19, Bratislava, Slovakia

ABSTRACT

This paper explains the importance of barrack objects and campuses and their role in forming the urban structure of the city. Military have always been an inseparable part of human history. Nowadays we are aware of a number of warfare, which determined and formed the journey of our civilization. But only few people realize, how big was the influence caused by the army interventions on the civil population in the peacetime, which were also one of the key factors of subsequent city development. In 18th century, during the process of demolition of city fortifications that previously functioned as a military accommodation, army focused their building activity on construction of several military schools, command buildings, military hospitals or barracks. Army barracks, first as single objects, subsequently as spacious campuses, were located in various positions of urban structure, many times occupying the most significant parts of the city. At close quarters, soldiers took another void spaces for marching and military parades. Army contracts for food, clothes, arms and other supplies attracted to garrison towns craft men and industry, which repeatedly led to further urban growth and created a plenty of new job opportunities. Furthermore, bigger cities could subsequently offer more development, supply and cultural possibilities for army. But how exactly looked these “military cities”, situated in civil cities, strictly protected from public? We discovered, that their architecture has its own specifics, which meets the connection of universal design and clear system of space composition, with exact amount of void space between buildings. Each building function it’s projected in its specific shape. Nowadays, the termination of military service and its transformation to the professional army few years ago reduced an amount of buildings used by the army. Especially barrack campuses, designed for permanent military accommodation, became in a short time just a heaps of neglected shelters and just now we can uncover their real image and role in city organism. Although we can’t not include barrack campuses in the field of industrial production areas, which recently became an important integrant of modern heritage protection, we can see that they are sharing a lot of common urban signs in the modern town structure. Moreover, understanding their nature and values can help us to redefine their significance and reincorporate them in the life of the contemporary Slovak cities.

Key words: Military architecture; barracks; heritage protection; urban development; city.

* **Corresponding Author**

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Interdisciplinary cooperation in the virtual presentation of industrial heritage development

Vladimír Hain *, Robert Löffler, Viliam Zajíček

Slovak University of Technology in Bratislava, Faculty of Architecture, Námetie Slobody 19, 812 45, Bratislava 1,
Slovakia

ABSTRACT

The issue of industrial heritage conservation respectively its new use is worldwide hot topic for a longer period. Industrial heritage provides one of the most important records of urban development and progress of human civilization in the last two centuries. Monumental industrial buildings reflect the extraordinary technical and economic development and the progress in science and technology. Even after the termination of their original function, industrial heritage buildings with their architecture are still significantly participating in the atmosphere of each city. The electricity industry played a key role in the life of mankind. Electricity and electrical currents are intangible symbols of the creative use of the natural forces by man, also a real driving force for technological progress and extensive development of human knowledge. The young generation takes it as an automatic and common, with no interest in learning about its causal impact and context. A global problem is the decreasing interest of young people in studying natural sciences and engineering, which is a prerequisite for further technological progress and socio-economic development of the life of inhabitants. This lack of interest is justified by the high abstraction and lack of clarity in the scientific and technical fields which are torn from people's everyday lives. Therefore the current trend nowadays is developing an interactive virtual model of presentations - those are able to make more attractive museums and allow the inspirational use of this rich source of knowledge and experiences. The article "Interdisciplinary cooperation in the virtual presentation of industrial heritage development" is aimed to explore opportunities for collaboration between theoretical research, monument preservation, virtual reality and architectural practice. It deals with the identified key factors that conditionally affect the quality and efficiency of architectural design process within the cooperation in the conservation process. As well as it deals with the opportunities of transfer the research results from futuristic disciplines those operate separately up to now. For this purpose, the paper examines case study "the reconstruction of old Power plant in city Piestany" and describes one of the possible solutions on the basis of the operational research model so-called "Educational polygon." This model is used as a tool for industrial heritage research and it also serves as an effective communication and educational instrument throughout the active development process. The results confirms that through the interdisciplinary collaboration in the process of creating virtual reality presentation it is possible not only efficiently learn about the industrial heritage but also explore new scientific values and options of architectural designing at the same time.

Key words: Architecture; industrial heritage; electricity industry; operational research; virtual reality; augmented reality.

* **Corresponding Author**

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Losting spaces meinstream places

Katarína Boháčova *

Slovak University of Technology in Bratislava, Faculty of Architecture, Námestie slobody 19, Bratislava, Slovakia

ABSTRACT

Revitalization of unproductive brownfields has become a big important issue for local governments as well as for real estate developers. Brownfields were often in inner city locations, with very good connection to the traffic systems. Redevelopment of these brownfields into the greenfield gives properties to protect the environment, reuses existing infrastructure, and minimizes urban sprawl and support economic opportunities. We are asking provocative question... It is possible to transform the Istrochem areal in Bratsialva of brownfiled into the areal of world exhibition EXPO?

Key words: Expo; brownfield; public spaces.

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Uncovering of industrial architecture values

Ľubica Ilkovičová *, Yakoub Meziani

Slovak University of Technology in Bratislava, Faculty of architecture, Námetie slobody 19, 81245 Bratislava, Slovakia

ABSTRACT

In connection with architecture it is necessary to see the time and space relationship. They are dimensions that fix and specify architectural piece in temporal and spatial frameworks and at the same time they allow a conversion. The conversion of architecture does not have to be only physical. The conversion happens also in the area of its perception. The aim of the research is to point at relevant values of industrial architecture that has to be perceived within the context. The parameter of time has got an exceptional meaning. Uncovering of the original value can become an inspiration for origin of new values in new connections. The end of old and the beginning of new can be perceived as time antipoles that in their way attract each other. The paper deals with „time cascades“ when after the beginning there is an end, something new is built „on the end“ etc. The conversion concept comes from time sequence – the following layer starts with generalisation of the previous one. This continuity and temporality is a part of a creation method and an aspect that is acquired by an architect in terms of a building, construction and detail. Connection to surroundings, space and time has got big importance in decision process. The result is applying of methodology based on different industrial architecture in rural surroundings and of modern industrial ruin. Methodology underlines the meaning of time, space and surroundings for purpose of pointing at architecture potential. Then the objects undergo the basic method of evaluation for determination of their characteristic identity values. Conclusions of research consist of answers to the questions: When will the new solution evaluate the original one? What are the reasons for substantial keeping of an area, building, construction or an item of industrial architecture? Are these reasons different at industrial architecture in comparison with other typological kinds? What is the relative scale of materiality and temporality in setting the development potential?

Key words: Industrial architecture; conversion; surroundings; values; space; temporality.

* **Corresponding Author**

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Value fields of detail in industrial architecture

Ján Ilkovič *1, Gabriela Rolenčíková

Slovak University of Technology in Bratislava, Faculty of architecture, Námestie slobody 19, 81245 Bratislava, Slovakia

ABSTRACT

Sustainability of architecture depends on its value. Defining criteria and factors of architecture values and its detail in aesthetical, construction and practical level is a basic premise for setting regulators of keeping architecture. Value is an interdisciplinary category. It is valid in full range also for industrial architecture where some specifics, coming out of the function, occur. The aim of the report is to present results of research in area of uncovering value frameworks of architectural detail in industrial architecture focusing on their constructional and aesthetical meaning. Detail is generally understood as delicacy, miniature of part of the unit. The results of the research come from a basic hypothesis in searching the value field of detail in architecture, to what extent is valid the hypothesis that a detail is a part of a unit and a unit is a summary of details. It also asks the question when this axiom expires in conditions of industrial architecture. Production premises offers us a great amount of unknown values on the interface of exterior and interior of production premises in the form of building – architectonic and technological artefacts. These results of the research are presented by general possibilities of detail transformation in case of conversion of industrial objects in context of defining their values. Perceiving and evaluating of detail in industrial architecture can be in different positions: a) Primary – detail can be observed in „contact sequel“, its value and potential is presentationally dominant, and detail shows constructional, aesthetical and historical qualities. b) Secondary – detail can be discovered following a detailed reconnaissance of the object, architectonic piece and sometimes there can be a so – called hidden detail. c) Tertiary - detail obtains added value by transformation after the change of the object.

Individual positions are connected with qualities of detail. Categories of qualities are determined by a type of the object, kind of space, time of origin, penmanship of the author, material choice. Results are also supported by detail comparison of buildings from different typological kinds, comparison of details in different positions and by different methods (measuring, modelling, scanning, observation...). Results of the research focus on potentials of quality detail for strengthening of its place in architecture at production transformation.

Key words: Sustainability; industrial architecture; conversion; detail; value; technology.

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The ports of Slovakia as territorial potential

Katarína Mackovičová *, Eva Kráľová

Slovak University of Technology, Vazovova 5, Bratislava, Slovakia

ABSTRACT

In the present, the industrial heritage creates the identity of the contact area and the city. Also, it is an essential development potential. Many of these complexes include not only material capacities but, also the intangible values. Their volumes and surfaces represent the economic potential for a development. Several of these spaces can be capitalized (sold or rented) so they form the territorial capital which can be economically used. Although a lot of spaces of the industrial heritage have such potential often these objects are abandoned or destroyed without acceptance of the significant values. The ports in Slovakia – Bratislava, Komárno and Štúrovo are located on a river Danube linking several European countries. They have performed not only as a station route but mainly as a source of innovation and economic incentives on this important a traffic artery. An industrial activity is reduced by changing the social and economic situation in the State. The plans of an owner are to modernize the production activities and move them from city centres to the periphery. Abandoned areas and buildings are unloaded for other uses. Bratislava's port is the biggest and the most remarkable harbour in Slovakia, with a long history and several a National Cultural Monuments. The paper will present the values and potentials of Danube ports in Slovakia that are useful for the development of the city/region. Also, it will present the possibility of initiating tourism activities in the zone of the Winter Harbour in Bratislava through the study of architectural reconstruction of the Boatmen house. This building is the National Cultural Monument with significant values. In this case, a tourism means the progress of passenger river cruises and sightseeing-recreational activities for the public in accordance with the city development programs.

Key words: Industrial heritage; port; territorial capital; Danube; reconstruction; potential.

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The harbour of Bratislava (Slovakia) – International contexts

Martin Dubiny *

Slovak University of Technology, Faculty of Architecture, Institute of History and Theory of Architecture and Monument Restoration, Námetie Slobody 19, 812 45 Bratislava 1, Slovakia

ABSTRACT

Significant role in developing and shaping the city of Bratislava played Danube River. Since 1830 introduced a regular shipping service for people and goods. The Harbour of Bratislava began to grow. At the turn of the 19th and 20th centuries, next to cargo harbour built a new part Winter Harbour. The harbour experienced a golden age between the world wars. In the 1st half of the 20th century belonged among the biggest inland river harbours in Middle Europe. The Czechoslovakia was one of the largest export countries in Europe. At that time, there were also held the International Danube Fairs. The harbour was almost destroyed during the Second World War. In the post-war period the function of the port revived and modernized. Currently consists of Passenger Harbour, Winter Harbour and innovative parts of the cargo harbour built lower downstream. From the beginning Harbour of Bratislava was built as internationally, enabling investment and implementation of activities of enterprises of different countries. According to available sources, we know that in harbour worked except to Slovakia, respectively Czechoslovakia, French, Austrian, Hungarian and German shipping company. In the past, the city with harbour was growing, presently with growing city the harbour decreases. Landing stages and the surfaces of Winter Harbour are taken for the new residential and commercial construction; the historical harbour buildings are demolished. In the past we kept pace with Europe, sometimes we even set an example. At this time is the question whether we would nowadays not take example from Europe. The paper will present a summary of the known, but especially the lesser known international contexts of Bratislava harbour. It shows a vision of which direction could move into its development, particularly with regard to its history and unique value which remained.

Key words: Harbour; Bratislava; international contexts; winter harbour; Danube; International Danube Fairs.

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Contributions of brownfield redevelopment to walkable city transformation: chance of greyfield reduction

Tomas Hanacek *

Slovak University of Technology, Faculty of Architecture, Námetstie slobody 19, 812 45, Bratislava 1, Slovakia

ABSTRACT

Brownfields refers to locations, which representing the abandoned city spaces with the varied history of industrial production. In many cases, these areas are located close to city centres with specific connections to the rivers, railways and other urban infrastructure. There were many high-quality brownfield conversions, reflecting the wide range of heritage values. However, there are numerous negative examples, where the industrial heritage structure was demolished according to the purely economic approach superficially. Thus obtained empty addresses change dramatically the inner area program such as negative external urban connections. The question is how the flexible development patterns behave to the neighbourhood within the fixed wide urban framework? In addition to the brownfield conversion approach, there are assigned some bluefield strategies and greyfield reduction principles in the invisible layers. In this article, I review the role of the brownfield space structure in the walkable city transformation. The brownfield structures provide specific typology of urban spaces and exterior constructions: unformal streets, corners, nooks, platforms, pipe holders, urban balconies and multispaces. Specifically, I have focusing on the greyfield reduction possibility in these spaces. The common denominator of the research becomes the human scale retention in the historic structures of production with regard to microclimate improvement. I have narrowed down a number of ideas in the tree case studies that will help to demonstrate the impact of the research in the practice. I have isolated the matrix of public space connectivity, which refers to the better cross- city movement. I believe that brownfield soft redevelopment could support the walkable city transformation in the wider context and to find the specification of public space typology in the smaller urban scale.

Key words: Brownfield; walkability; connectivity; matrix; greyfield; reduction.

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Analysis of industrial architectural heritage – iron and steel plants as a development potential

Eva Belláková *

Slovak University of Technology in Bratislava, Faculty of Architecture, Námestie Slobody 19, 812 45, Bratislava 1, Slovakia

ABSTRACT

The urgency of recording and preserving the physical evidence of Slovakia's disappearing industrial heritage is prompted by the recent dramatic demolitions of many production buildings and even whole industrial sites. Accompanying architectural discussion confirmed the lack of systematic mapping and evaluation of our industrial heritage and furthermore that the traditional heritage conservation approaches does not offer sufficient tools to preserve and evaluate this remains of our industrial history. This study is focused on the industrial architecture of historical iron and steel plants that were in operation in the territory of Slovakia between the years 1800 – 1948. The aim of this paper is to analyse the architectural and urban characteristics and common features of observed historical ironworks as a support for the for protection and interpretation activities. The paper is divided into several parts: 1. A description of the architectural and urban development of the iron industry in our country with regard to the development of technical and technological processes. 2. A categorisation and an analyses of typological characteristics. 2. A report on the current state of 132 historical locations of iron production. 3. Analyses of industrial architectural heritage on the example of the former production building in Hronec, Slovakia. For many centuries, iron production contributed to social and economic development of the whole of contemporary state formations in our country. Although the history of this industry in Slovakia is relatively well explored and published, the architectural and urban characteristic of these industrial sites is practically unknown. Nowadays, the abandoned buildings and sites of this production sector are new attribute of our settlements. All offer the opportunity for reuse. The potential of their successful urban reintegration is subject to the understanding of their historic and heritage values accompanied by the complex research.

Key words: Metallurgy; industrial architecture; industrial heritage; ironworks.

* **Corresponding Author**

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Effects of aerogel paint insulation coating on a historic brick facades

Michal Ganobjak *

Slovak University of Technology, Faculty of Architecture, Námetie slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

Increasing the sustainability of buildings is being attempted in practice by reduction of energy demands. The challenge of reduction of energy consumption focuses mainly on building envelope refurbishment by substitution or addition of new material. A special type of refurbishment is conservation of historical building. The preservation of historic buildings permits, in addition to the original materials, deployment of innovative methods and materials if their effects are known and the gained experience ensures their beneficial effect. In the market there are new materials with the addition of silica aerogel products in various forms. They are also potentially useful in conservation of monuments. The effects of aerogel application in such cases are not known. For refurbishment is commercially available additional transparent insulation paint - Nansulate clear coat which is containing aerogel and can be used for structured surfaces such as brick. In the experiments were examined thermo-physical manifestations of an ultrathin insulating coating of Nansulate clear coat containing silica aerogel in applications on brick facade. In the experiments of active and passive thermography were observed effects of application on the small-scale samples of the brick façade of protected historical building. Through a series of experiments were measured thermal insulation effect and influence on the aesthetic characteristics such as changing colour and gloss. Applied samples were compared to a reference surface. Measurements has shown no thermal-insulating effects of the recommended three layers of insulation paint. Three layers recommended by the manufacturer does not affect significantly the appearance of the brick facade. Colour and gloss was not significantly changed. Results did not show the any thermal insulating effect of Nansulate transparent coating. Providing thermal insulation effect of the layer is likely to require more applications, which may be unacceptable for use in the heritage conservation in terms of number of applications, time and money consumption. The effects of multiple layers for heritage attributes should be studied. Extrapolating the measured results, it can be expected that the application of more than three layers of paint can significantly affect the aesthetic characteristics of the monument such as gloss and colours of historic brick facade. Due to specific material consistence of historic architecture and new insulation paint materials on market, it is recommended to provide independent laboratory testing and on-site tests on facade of historic building in cooperation with the Monuments Board.

Key words: Aerogels; coating; historical; brick facades.

* **Corresponding Author**

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From planning to smart management of historic industrial brownfield regeneration

Lubomir Jamecny ^{*1}, Milan Husar ²

¹ Slovak University of Technology in Bratislava, SPECTRA Centre of Excellence EU, Vazovova 5, Bratislava, Slovakia

² Slovak University of Technology in Bratislava, Institute of Management, Vazovova 5, Bratislava, Slovakia

ABSTRACT

Development of urban systems is permanent process of its adaptation for the realization of dynamically changing human activities and of responses to external disturbances resulting in the changes in urban functional and spatial structure. These changes can be seen as the permanent innovations in urban socio-ecosystems reacting dominantly on innovations in the production sectors, as initiating phenomenon. In many cases the internal power driving permanent innovation process in urban structures absents and external intervention is needed to re-start the natural processes of permanent adaptive transformation and safeguarding their sustainability (Finka et al., 2013). Especially historic industrial brownfield are facing the problems of degradation, underuse, free-riders or conflicts between actors (Finka, Ondrejicka et al., 2014). Their management process, including planning, reflects social dilemmas being confronted with the real or seemingly contradictions between individual and collective interests on fictional and other parameters of urban structure. The main objective of the paper is to demonstrate the potential of new conceptual framework to improve the processes of brownfield regeneration and to develop efficient and sustainable management strategies under existing complexity, multiple actors and levels in the decision making. Paper is contribution to the Cost Action IS 1309 INNOGOV and national grant scheme Vega 2/0038/14 and project SPECTRA+ No. 26240120002 "Centre of Excellence for the Development of Settlement Infrastructure of Knowledge Economy" supported by the Research & Development Operational Programme funded by the ERDF.

Key words: Industrial brownfield regeneration; smart management.

*** Corresponding Author**

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Old industrial sites – conversion to parks: potential of Bratislava (Slovakia)

Katarína Kristiánová *, Katarína Gécová, Eva Putrová

Slovak University of Technology in Bratislava, Faculty of Architecture, Institute of Landscape and Garden Architecture,
Námestie slobody 19, 812 45 Bratislava, Slovakia

ABSTRACT

Old industrial sites, areas which lost their former production, transport or infrastructural functions, brownfields in urban structure of the cities, possess strong development potential. At the same time they often hold important historical and cultural values, but in many cases also environmental burdens. Their conversions to the new functions reflect various factors. Many examples of successful conversions of urban brownfields and historic urban industrial complexes towards green spaces, from the cities all over the world, exhibit both social benefits and environmental gains. The benefits of regeneration of the former industrial areas and brownfields to green spaces include for example the provision of space for play and recreation in urban environment, enhancing the scenic beauty and neighbourhood appeal, improving the healthy urban environments, raising property values, provision of ecosystem services, habitats for wildlife, fostering adaptation to climate change and many other. The research examines the former historic production areas in Bratislava and analyses their conversion potential towards green space development. The factors influencing the greening of urban post-industrial landscapes and the conversion of old industrial sites to urban parks in Bratislava are discussed. The results of the research show that there are several former historic industrial areas in the urban structure of Bratislava that are suitable for green space development, and where their conversion towards green space can improve the quality of life and bring social and environmental benefits for urban structure. Local government, local communities and other stakeholders are able to influence the decisions on the future use and development of these post-industrial sites as potential locations for green space.

Key words: Post-industrial landscape; urban post-industrial green space; green infrastructure; brownfield conversion.

* **Corresponding Author**



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