



## Abstracts Vol. 2 No. 3

**Sławomir BIRUK, Piotr JAŚKOWSKI**

*Assessing efficiency of latin supercube sampling method in construction project network simulation*

Monte Carlo simulation is a popular tool that supports planning projects affected by risk. Analysing the results of computer simulations enables the planner to formulate and verify hypotheses on distribution type and parameters of schedule event occurrence and the project duration. Accuracy of estimates obtained by means of simulations can be improved by increasing the number of replications, or by applying variance reduction methods. The latter may consist in change of the way the random numbers are generated. The paper analyses how the method of variance reduction affects simulation results in terms of standard error of estimated project duration mean value. The considered methods were: Latin supercube sampling and its combination with antithetic variates method. The object analysis was based on network models with task durations of triangular distribution. This type of distribution is commonly assumed in modelling the effect of random occurrences on organisation of construction works.

**Orsolya BOKOR, Tamás KOCSIS, Gabriella SZENIK**

*New tools in project scheduling. Challenges of the construction project planning*

The traditional (e.g. Gantt chart) and modern (network modeling) scheduling techniques reach their limits quite soon in case of large projects. In case of thousands of activities, the current methods do not provide an effective evaluation. This paper would like to show tools that can solve the above-mentioned problem. We have several options for handling these matters effectively. For example: fine scheduling based on resource and cost use, innovative solutions for printing of complex schedules. The latter includes the poster-like presentation of several plan details. These applications can be considered novelties in project planning methodology.

**Andrzej CZEMPLIK, Michał IRZYK**

*Feasibility evaluation of construction methods specified in design documentation*

The evaluation of building design documentation is usually limited to consideration of cost and duration of works needed to execute a designed object. However, factors as safety of works, extent of mechanization of works, and other good or bad sides of construction methods needed to be implemented as per the analyzed design, are also considered, but normally without any measures. The method presented in this paper allows to evaluate the construction methods, as specified in the analyzed design documentation, using the points assigned to seven defined evaluation criteria. The final, total number of points represents the technological quality and feasibility of the construction processes and materials specified in the evaluated design documentation.

**Dorota DWORZAŃCZYK-KRZYWIEC**

*The influence of recycled aggregate content upon selected concrete properties*

The paper presents problems related to production of recycled aggregate and devices for production of this type of aggregate. Determination of the influence of recycled aggregate content upon selected properties of concrete was the aim of this work. Four concrete mixes with different content of recycled aggregate in two granulations were designed. The following features were tested: concrete mix consistency and volume density, concrete compressive strength and freeze resistance. Derivatographic examinations of hardened cement pastes separated from concretes were made and calcium hydroxide, bound water and calcium carbonate contents were determined. The influence of recycled aggregate content upon selected concrete properties is considered in the conclusions.

**Mirosław DYTCZAK, Grzegorz GINDA, Beata GOTOWAŁA, Nina SZKLENNIK**

*Application potential of DEMATEL method and its extensions for analysis of decision problems in civil engineering*

Decision Making Trial and Evaluation Laboratory (DEMATEL) is robust universal analysis tool for identification of cause-effect relationships. It is well suited for including both tangible and intangible factors. Vital extensions introduced into the method make it possible to utilise it as the multi-criteria decision analysis tool. Despite of undoubtedly interesting features, applications of DEMATEL in civil engineering are rather rare. Possibility of wider application of the method with regard to decision problems in civil engineering is discussed in the paper. Presented examples of applications prove usefulness of the method

**Mirosław DYTCZAK, Waław PRZYBYŁO**

*Dematel-based multi-criteria evaluation of public transportation systems for Cracow*

Multi-criteria evaluation of perspective public transportation systems for the city of Cracow and Cracow agglomeration is dealt with in the paper. Four distinct system alternatives are included. A little known multi-criteria decision analysis method, namely extended DEMATEL is applied with this regard. Its utilisation makes validation of outcomes of original AHP-based analysis of the same problem possible. It also extends analysis results providing decision maker with additional information with regard to relations between considered decision making alternatives.

**Valeriy EZERSKIY, Małgorzata LELUSZ**

*Kinetics of hydration process of cement composites with fly ash addition*

In the paper the results of laboratory investigation concerning the influence of: the water-cement ratio, the cement class and the time of curing on compressive strength of air-entrained cement mortars is presented. The range of changeability factors was determined:  $X_1$  factor (W/C ratio) – from 0,5 to 0,6;  $X_2$  factor (the cement class) – 32,5, 42,5 and 52,5;  $X_3$  factor (the time of curing) – from 28 to 180 days. On the basis of the results a mathematical model was elaborated  $Y = f(X_1, X_2, X_3)$  and the character and the influence grade of each factors were analysed. The factor space was examined for occurrence of extrema. The optimum factor values assuring maximum compressive strength were given. They are for the following factor values:  $X_1 = -0,104$ ;  $X_2 = 0$ ;  $X_3 = 0,715$ , i.e.: W/C = 0,54 from the cement of 42,5 class and after 149 days of curing.

**Marcin GAJZLER**

*Zagadnienie wyboru lokalizacji z wykorzystaniem metodyk data mining*  
*The issue of choosing location with the use of data mining techniques*

The paper presents the issue of choosing the location of the investment – a residential building. The potential locations were reduced to the city of Poznan and towns situated nearby. The case study is connected with an enterprise which was operating in the field of building trade – industrial building, and as a result of the lack of works – is forced to consider different operation and development strategies. One of these strategies is to start the activity in the development sector. Based on various data related to real estate market, the enterprise considers different locations wishing to achieve the best result when it comes to price and sales period of the planned investment. In such a decision situation and in order to develop a forecast the use of data mining techniques was suggested. It led to conclusions concerning the usefulness of these techniques in the analysed problem and also possibilities of other applications.

**Jacek GOŁASZEWSKI, Grzegorz CYGAN**

*Influence of VMA admixtures on early shrinkage of the cement mortars*

In this paper, an experimental research into the effect of viscosity modifying agents on the early shrinkage of mortar is reported. Early shrinkage was qualified in temperature 20°C and the relative humidity of the air 60%. Two types of VMA admixtures is used in research. The results confirmed that the use of VMA admixtures reduced the value of the early shrinkage.

**Jacek GOŁASZEWSKI, Michał DREWNIOK**

*The effect of calcareous fly ash on the efficiency of air entraining additives*

This article discusses the effect of the addition calcareous fly ash as Type II addition in structural concrete on the efficiency of some air entraining additives (AEA) and admixtures with AEA and superplasticizer (SP). The paper presents the methodology and results of air content of cement mortar with the addition of calcareous fly ash. Methods for assessing the effectiveness of aeration additives were: pressure method and foam index method. The influence of the following factors: the type of calcareous fly ash (4 different delivery), 10, 20 and 30% replacement by weight of cement, ash activation by milling (without and with milling), the type of AEA (3 admixture of various chemical-based), the type of SP (2 types). Results show that the presence of calcareous fly ashes reduces the amount of air in the mortar. The effectiveness of additives in the presence of aeration depends on milling calcareous fly ash addition.

**Jacek GOŁASZEWSKI, Aleksandra KOSTRZANOWSKA**

*Rheological properties and a content of air entrained in fresh concrete for self compacting high performance concrete*

The significance analysis of the fundamental composition factors on the air entrained in fresh concrete for HPSCC as well as a mathematical model influences the rheological properties of fresh concrete on the air entrained in fresh concrete for HPSCC are presented and discussed in the paper. Rheological parameters are measured using technical test (slump-flow test). Air entrained in fresh concrete is measured by concrete air entrainment tests.

**Jacek GOŁASZEWSKI, Tomasz PONIKIEWSKI**

*The influence of high calcium fly ash and fibres on chosen characteristic of self-compacting concrete*

The methodology and test results are presented and discussed in the paper. The influence of high calcium fly ash and fibres on workability and mechanical properties of Self-Compacting Concrete (SCC) are analysed. The rheological parameters of SCC – behaves as a Bingham body, their rheological parameters yield value  $g$  and plastic viscosity  $h$  were determined by using new kind of rheometer BT2 to mortar and concrete mix research. The mechanical parameter of SFRSCC – the cube compressive strength were presented as well. In the research, an experimental verification of a significance of an influence: type and volume fraction of fibres on rheological properties of SFRSCC was investigated. The length of fibres has the significant influence on yield value  $g$  and plastic viscosity  $h$  of SCC. The significant influence of the length of fibres on plastic viscosity  $h$  of tested polypropylene 25 mm fibres in SCC was only observed.

**Mahmoud HSINO, Jerzy PASŁAWSKI**

*Introduction of flexibility in the quality management system based on concreting example*

The introduction of quality systems in the construction industry by developing appropriate standards (procedures, instructions, etc.) contributed to clarifying the existing rules of operation, and the introduction of clear responsibilities. Having a quality management system also ennobles the company in the market, makes a more reliable supplier of goods or services. Unfortunately, too rigid rules of operation may lead to difficulties by limiting the proper functioning of the initiative and creativity of workers, the bureaucratic rules of operation, etc. The use of flexibility in the procedures of quality management can contribute to enhancing the effectiveness and efficiency through capacity of variant proceedings in order to adapt to changes in the environment.

**Henryk JAROS**

*Location of the main emitters of pollutants in the urban planning arrangement of the city of Białystok, Ostrołęka and Elk and their influence on surrounding areas*

In developing cities, large emitters of pollutants were out of town but now they are surrounded by residential buildings, or transmitted by them pollutants are taken out to new districts. Studies are available for verification of city building developments and assess the impact of pollution emitters in built-up areas. The problem was analyzed on the example of Białystok, where the biggest emitter Białystok Power Plant, is located in the northern part of the city and West Thermal Power Station in the south-west of the city. In the northeastern part of Ostrołęka, there is a power station, which is the largest emitter of pollution in this part of the country. The Elk operates Special Economic Zone which brings together



26 industrial plants within the city limits. Research shows that the CHP Białystok adversely affects districts in the northern part of the city, while the Heat pollution from the West, is taken out into the city. Particulate matter emitted from power plants Ostroleka, settles across the city, while the emitted gases cause acid rain formation, whose effects are visible at a distance of 20 km from the plant. In the absence of data, one cannot unambiguously assess the impact of Special Economic Zone in Elk, the adjacent built-up areas.

### **Monika JAROS**

#### *Variation in the structure of green areas of the city Białystok*

The structure of the city urban area consists of housing, services, leisure and recreation areas, industry and communications. Prerequisite for rapid economic growth as rapid urban development. Rising land prices are forcing cities to create a dense multi-storey buildings. After completion of the neglect of the enforceable in accordance with the draft land of greenery, which is important for city residents. Tall buildings are becoming the eye-catching dominant and define the urban space. An important problem is to define the importance, quantity, quality and distribution of green areas in the urban layout of the city. For example, Białystok research was conducted, which set out the number and size of green areas. Acts of vandalism can be minimized if, in each district would reside park, square, or green square. The development strategy of green areas would facilitate the process of creating the ring of the natural system of Białystok, where the presence of the Biała River is important.

### **Lucyna KORONA**

#### *Innovative technology of lost framework*

In a world of fast growing data transfer, as well as integration movements within European Union, transfer of technology becomes also faster. Lost framework can be a good example, since for the last 20 years its meaning was enlarged because of its multiple usage, thanks to the variety of material, construction and technology solutions in offer. Referring to these processes, the article includes: meaning and range of lost framework usage, new classification of lost framework considering multiple criteria, short technical characteristics of chosen lost framework systems.

### **Andrzej KOZAK**

#### *Risk analysis in industrial facilities*

This article presents the methods of risk analysis of an industrial facility during its whole lifetime cycle. The document describes a decision diagram which is used in risk analysis and provides with suggestions concerning different methods applied in risk analysis. The article also explains a correlation between risk analysis and land-use planning.

### **Michał KRZEMIŃSKI, Paweł NOWAK**

#### *Johnson Algorithm cost modification for scheduling of construction projects*

The paper presents cost modification of the Johnson Algorithm (JA). JA optimizes scheduling of construction projects by checking the shortest possible time of operations of two machines on unrestricted number of section of the building / construction object. Algorithm could give many "optimal answers" for different time of the machine work. Suggested modification helps to choose the optimal solution with taking cost of works under consideration, without mathematical complication of the algorithm.

### **Barbara KSIT, Józef JASICZAK, Rafał KOTLARZ**

#### *Beam-ceilings according to Polish Standards and Eurocodes – difference analysis on specific examples*

The paper aim was to analyse the differences occurring in the way of calculating the beam-ceilings by comparing Polish Standards and Eurocodes. The calculations were performed on example of Akerman, Teriva Nova and Baumat BT-2 ceilings. Obtained results of the analysis are presented in the table.

**Janusz KULEJEWSKI, Nabi IBADOV, Bogdan ZIELIŃSKI**

*Application of fuzzy set theory to schedule construction works by the critical chain method*

The paper presents a new approach to the problem of scheduling of construction project by the critical chain method. Novelty of the method is to include inaccurate information about the parameters of probability distributions of durations of works. In order to identify the critical chain and schedule buffers, fuzzy set theory and the modified rules for the arithmetic of fuzzy numbers is used. To determine the non-fuzzy buffered schedule, the concept of  $\alpha$ -cuts of a fuzzy number is used. The correctness of the presented approach is demonstrated on the basis of the results of the simulation.

**Dorota MAŁASZKIEWICZ, Aneta JURGUĆ**

*The influence of cement type and curing conditions on mortars adhesion to concrete base*

The aim of the study was determination of the influence of cement type and curing conditions on adhesion of cement and cement-lime mortars to concrete base. The following cements were used: CEM I 32,5, CEM II/B-V 32,5 and CEM III/A 32,5. Mortars were applied on concrete base and cured in different temperatures and relative humidity: series I in natural conditions in temperature  $+20^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and relative humidity  $60\% \pm 5\%$ , series II in temperature  $+30^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and relative humidity  $40\% \pm 5\%$  and series III in temperature  $+7^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . Adhesion was tested according to the procedure described in the standard PN-EN 1015-12:2002. Addition of lime increased adhesion of mortars to concrete base regardless the applied cement type and curing environment. The least favorable conditions had specimens in series II. Cement CEM I turned out to be the most sensitive to varying curing conditions

**Aleksander Kazimierz NICAŁ, Marcin GRABOWSKI**

*Checking the accuracy of parameters of the pre-tensioned HC slabs production process with reference to chance variations*

The aim of the paper is to determine by means of the Monte Carlo simulation method the influence of random distributions of aggregated production activity durations, within the production process of pre-tensioned HC slabs using the Spiroll production system, on the production parameters. A sequence of technological activities is illustrated in the techno-functional diagram. The sample durations for production activities are shown on an operational schedule. Additionally, causes of the diverse durations of production activities have been defined. Depending on the degree of mechanization of production activities, the dispersion around the expected value of the assumed probability density functions can be larger or smaller. Obtained on the basis of the research results reveal that the production parameters, assumed at the beginning, are highly likely to achieve.

**Zygmunt ORŁOWSKI, Nina SZKLENNIK**

*Scope of building modernization – as a result of diagnostic analysis of facility*

The paper presents the design methodology of modernization works. Process of changes in performance characteristics of building during its operation is presented. The method of performance characteristics evaluation of an object by diagnostic measures is proposed. The diagnostic measures relate to the so-called basic requirements which are specified in the building law. The properly conducted diagnosis is the basis for determining the scope of modernization works and for developing methods for their implementation. In the final part of the paper the authors present the concept of an algorithm for determining the degree of building operational wear which helps to determine the scope of modernization works.

**Anna OSTAŃSKA**

*Assessing the possibilities of improving living conditions in prefabricated housing: the residents' point of view*

Effective management of housing estates involves the manager's accounting for the social conscience of the residents. This conscience, even if limited to the level of small local communities, can give rise to decisions on rationalizing energy use and finding the ways of looking for economies in maintenance costs. In order to investigate the local community opinion on the most important maintenance and repair actions, the author conducted a survey among the residents of a large housing estate in Lublin, the estate being a rather typical example of prefabricated housing of the ninety-seventies. The survey itself aroused the inhabitants' interest in participating in property management decisions in their

community. The actions proposed in the questionnaires were aimed at maintaining the material fabric of the buildings in good condition and adding improvements to the buildings so that living conditions could be enhanced. Moreover, measures aimed at cutting maintenance costs by introducing energy-efficient solutions were put forward. These may contribute to turning the existing housing stock into zero-energy buildings.

### **Edyta PAWLUCZUK**

#### *Shaping of interfacial transition zone between aggregate and cement paste in recycled concrete*

The paper presents results of experiment with two different factors, like: order of adding of concrete mix components and level of recycled concrete saturation before adding it to concrete mixture. Determination of the influence of this two factors upon selected properties of concrete was the aim of this work. The following features were tested: concrete compressive strength, water absorbability and sorption water coefficient. Essential changes of concrete features under the influence of two factors were explained by examination of interfacial transition zone between recycled aggregate and cement paste. To this aim scanning electron microscopy was used.

### **Mieczysław POŁOŃSKI**

#### *Algorithm for optimal equalization employment diagram with graph network*

The paper describes a new algorithm for determining optimal employment equalization diagram when one have to bear costs of both exceeding required demand for analyzed resource and changing employment level. It was assumed that both cost-changing functions do not need to be linear and that employment needs to be fulfilled and can not be stored. Algorithm of solution determines necessary employment for every analyzed day, seeking out a solution which combines minimal total costs of both exceeded required demand and changed employment level. A solution based on graph theory was used in the algorithm.

### **Kamil PRUSZYŃSKI**

#### *Time buffer consumption monitoring concept in the schedule construction*

The paper presents one of elements for Method of scheduling building project including time buffers – matrix risk of time buffers usage. Its proper usage allow for full control of project implementation course in building site. Appropriate monitoring of time buffers and later proper decision result most of all in finishing all building project in fixed term.

### **Barbara SADOWSKA-BURACZEWSKA**

#### *New generation concretes as a strengthening layer in beam bending elements*

The paper summarises the experimental analysis of flexural capacity and deformability of structural concrete beams prepared as composite members consisting of two concrete layers made of reinforced normal concrete and high-performance concrete (HPC). The reinforced concrete composite beams used in the tests were prepared in modelling scale with the rectangular-section of 80 x 120 mm and the effective span of 1100 mm. The basic samples were composed in two layers consisting of high-performance concrete as the top layer, and normal strength concrete.

### **Gabriella SZENIK, Miklós HAJDU, Orsolya BOKOR**

#### *New possibilities in visualization of project plans*

The Gantt chart is the most widespread project planning method. Due to the development of project management applications, more and more data can be assigned to the project plan. The options for handling new information have changed the purpose of creating a Gantt chart in many aspects. Moreover, we would like to manage all data in one place in the planning and in the tracking phases as well. As a result new aspects of analysis could also be introduced.

In this paper, the Gantt chart is discussed from a brand-new point of view and novel methods are suggested in order to improve the management and understanding of the visual display.

**Andrzej TOMANA**

*Integration of design costing using BIM platform*

In the paper the idea of CAD and estimation cost systems were considered where BIM technology in multidimensional design was applied. The exchange between various CAD systems using IFC format were depicted. Two methods of cost calculations were presented – estimated and detailed. The new system ZuziaBIM showed automated process of taking off based on directly imported models from various branch applications. The example of detailed cost calculation was included.

**Marek WIRKUS, Ryszard TRYKOSKO**

*Properly preparing construction project – the main factor its success achievement*

This paper presents the results of the analysis of key success factors for implementing large construction projects funded from public funds. It bases on example of project of building football stadium construction in Gdansk-Letnica (Poland) for EURO 2012 Championship. It is focused on setting up phase (from the main initiation – which can be dated to the turn of 2005 and 2006 – to signing a contract with the general contractor). During analysis events and task were identified, divided on subject areas and placed on timeline, in background of consequent processes which happened during the project. Following subject areas were analyzed: preparing project documentation and obtaining further authorization, and presenting rules for the preparation and implementation of tenders for selection of contractors construction. The analysis was also focused on organizational solutions, which were used in project. The summary contains the number of guidelines for future management of this kind of projects, to ensure success in the future.

**Piotr WOYCIECHOWSKI, Konrad HARAT**

*Roller-compacted concrete as a road pavement under traffic load category KR1-KR2*

The technology of roller-compacted concrete (RCC) was developed in cooperation of the Harat's PRD's s.j. and Department of Civil Engineering and Building Materials for road pavements under traffic load category KR1 and KR2. The paper presents basic design principles for the composition of roller-compacted concrete (RCC) and discusses the technology of making the road pavement, applied in autumn 2010, when Polish first implementation of a RCC took place in Miastko (Pomeranian).

**Bogdan WRÓBLEWSKI, Andrzej BOROWY**

*New fire resistance classifications of suspended ceilings made of gypsum plasterboards*

The basic properties of gypsum plasterboards related to their behavior in fire conditions, fire resistance classifications of suspended ceilings determined in accordance with the withdrawn classification standards, the new fire resistance test methods for suspended ceilings, fire resistance classifications determined in accordance with the classification standard PN-EN 13501-2+A1:2010, requirements of the new standard PN-EN 520+A1:2010, results of the new fire resistance tests as well as the new fire resistance classifications of suspended ceilings determined on the basis of these tests were presented in the paper.