

STRESZCZENIA

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MONITORING, EARLY WARNING AND SUSTAINABLE MANAGEMENT SYSTEM FOR LODZ WASTEWATER TREATMENT PLANT AS A WATER PROTECTION TOOL

Municipal wastewater treatment plants are exposed to the inflow of toxic substances, which may hamper or even preclude their proper functioning, especially of the biological part. In the case of combined or hybrid sewer systems, additionally, in wet weather, there may appear a rapid inflow of a mixture of domestic and industrial sewage, and stormwater in an amount exceeding the capacity of the devices, causing the need to discharge parts of not fully treated wastewater through the bypass channel, which may reduce overall treatment effects. In such situations, the receivers are exposed to an inflow of increased amounts of pollutants, which on the one hand causes a threat to the aquatic environment, on the other, may result in administrative fines for the treatment plant resulting from non-compliance with the conditions of the water permit, as well as costs of removing the effects of failure. The article presents the concept of a monitoring, early warning and sustainable management system for the Lodz wastewater treatment plant, which will allow minimizing pollutant emissions to the aquatic environment. The system will be based on data from the municipal pluviometer network, measurement of flows in combines sewer overflows and newly built sewage quality monitoring stations equipped with on-line probes. The resulting data will allow to predict quantity and quality of inflow to the treatment plant, which will allow for an early warning about the dangers. In consequence decision-making to improve the safety of its operation will be possible.

Keywords: sewer system, sewage treatment, water protection, predictive model, toxicity

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HEAVY METAL CONTAMINATION IN SEDIMENTS OF RZESZÓW RESERVOIR (POLAND)

Sediments of Rzeszów Reservoir were characterized by a higher content of zinc compared to other heavy metals (Cu, Cr, Ni and Cd). The strongest correlations between pairs of heavy metals were Cr–Ni, Ni–Zn, Cu–Ni and Cr–Zn, while there was also a clear relationship between the total chromium and nickel content and the pH value, as well as the percentage of organic matter in the sediments (Cr, Zn, Cu, Ni). The content of chromium and copper occurred at levels exceeding the geochemical background, and the sediments could be classified as of purity class 2 (according to the PIG criterion) or class 3 (according to the Müller's classification). Ecotoxicological criteria indicate that levels of chromium, nickel and cadmium could affect

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aquatic life. However, the heavy metals differ in mobility and bioavailability. The highest percentage of ion exchangeable fraction was recorded for nickel, and the lowest for chromium. This means that sediments have a greater ability to release nickel into the water column, as a result of which they are a secondary source of pollution for the aquatic ecosystem.

Keywords: sediments, heavy metals, bioavailable fractions

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INTERNAL HEAT LOADS IN LUNARES ANALOGUE PLANETARY BASE – A CASE STUDY

This case study work focuses on recognising and quantifying internal heat sources in the first European analogue planetary base: the recently constructed Polish LUNARES habitat. The paper explains the necessity of conducting analogue space missions prior to an actual manned exploration of the Moon and Mars. Notions of internal heat loads and gains have been elaborated along with their significance for developing space building physics. This paper presents the results of thorough inspection of all internal heat sources, conducted by one of the authors during ICares-1 Mars analogue mission aboard the LUNARES base. Three main sources of internal heat loads were identified and carefully studied; the habitat's electrical equipment, the crew body heat and their personal appliances. These heat loads were calculated and total internal heat load of the base was established and discussed. The results of this study may serve as a baseline for predicting internal heat loads aboard actual planetary bases.

Keywords: space building physics, internal heat gains, analogue space station, metabolic heat generation

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USING THE WEIBULL ++ SOFTWARE IN WATER SUPPLY NETWORK FAILURE ANALYSIS

The water supply network is a basic element of the water distribution subsystem and its task is to provide consumers with water of appropriate quality, in the required quantity, under appropriate pressure, at any time and at an acceptable price. To fulfil these tasks, the water supply network should have an appropriate level of operational reliability. The paper presents an analysis of the causes of water pipes failures using the Weibull++ software. The analysis was based on the operational data from 2018 obtained from the water supply company. The data included the failure book specifying the date and place of the failure, the cause of the failure, diameter and material of the damaged pipe. The probability density function for the failure of water pipes and its cumulative distribution function have been determined. The impact of individual types of failure causes on the failure of the water supply network was determined. The results provide information about the probability of failures of the water supply network depending on their cause. These results can be used in further analyses of the reliability and safety of water supplies to consumers.

Keywords: failure, reliability, water supply, Weibull++

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NUMERICAL ANALYSIS OF CABLE NET STRUCTURE WITH APPLICATION OF DIFFERENT PRETENSIONING METHODS

Tension roofs based on cable systems are suitable for covering long span buildings. Such structures are considered to be economic, modern and aesthetic solutions in various multi-functional arenas. Development of materials and construction technologies resulted in an increased number of applications of cable systems in recent years. However, the origin of such structures dates back to 1953, when the cable net supported roof over Raleigh Arena in North Carolina was completed. Designed as self-balanced, the system was eventually pretensioned in order to provide greater stiffness. This implementation became an indispensable part of cable nets construction. A unique method of pretension was applied in one of the first and most recognizable Polish examples of tensile structure, which is the cable net roof over the open-air theater in Koszalin. The system was pretensioned through the outward rotation of simply supported edge arches, which induced tensile forces in roof cables. This simple and effective concept became an inspiration for the introduced study, which focused on the numerical application of such a solution. In this paper, the results of comparative finite element analysis of introduced cable net structure with different methods of pretensioning are presented. The investigation was preceded by the analysis of net shape, concentrated on the value of cable sags in the saddle point of parabolic hyperboloid surface. Effectiveness of the presented solutions was assessed through comparison of internal forces distribution and model deformation. Numerical verification of consecutive concepts led to a gradual reduction of directly prestressed members from 16 suspension cables to 6 cable stays in the analysed roof.

Keywords: tensile structure, parabolic hyperboloid, long span roofs, structure shaping

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RENEWAL OF SELECTED FRAGMENTS OF RZESZÓW BASED ON THE LOST SYMBOLS AND FUNCTIONS OF PLACES AS A MEANS OF STRENGTHENING THE CITY'S IDENTITY

The article discusses the method of revitalizing public space, consisting of recreating local stories, after which no artefacts have survived, and telling them to pedestrians by means of innovative interactive objects of small architecture and urban furniture. The method is based on literature research, as well as observation and descriptive analysis of the surrounding landscape. Development plans for two fragments of the center of Rzeszów are described in detail: the crossing of Grunwaldzka and Bernardyńska streets and the part of Mickiewicz street. In the first location, the sculpture presenting life-size figure of photographer Edward Janusz, whose atelier functioned near-by at the turn of the 19th and 20th century, is planned to be placed. One of the elements of the sculpture is to be an old-fashioned camera with a digital camera inside, which will take photos of interested persons, and insert the contemporary photo into the photo taken from this place by Edward Janusz. The reference to cultural heritage in the Mickiewicz street restoration project comes down to recalling non-existent buildings in an augmented reality environment, as well as to reminding Two Pump Square, a former meeting place for residents coming for water. The function of former water pumps will be realised with the use of two bicycle wheel pumps and movable seats will be located in the vicinity.

Keywords: public space, city's identity, cultural heritage, innovations

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