Henryk Bałuch: **Determinants of Replacing Railway Superstructure** (Determinanty wymian nawierzchni kolejowej)

Replacing track superstructure is supposed to meet several objectives: ensure appropriate durability and safety, enable achieving specified train speed, reduce operational costs, improve the riding quality etc. Obtaining complete durability of superstructure, expressed with transferred load, is the fundamental goal whose reaching requires performing all works provided in the technological process. This task is particularly important in relation to a large range of superstructure replacement expected in upcoming years and great expense of the works. The examples cited in the article demonstrate that encountered defects in workmanship of replacing track sub-structure cause essential shortening of maintenance cycles and incomplete use of the superstructure durability. Obtaining the required superstructure durability also demands appropriate accuracy of building a new track. This accuracy is often measured by standard deviation of vertical track irregularities. The article presents the developed models of the impact of accuracy defined in this way on the length of the cycle from the completion of the track replacement to the next track repair which comprises tamping and leveling. It has been shown that the standard deviation vertical irregularities of new track should not exceed 0,6 mm. Further researches on examining the quality of replacing railway structure has been signaled.

Keywords: track works, quality, durability

Stanisław Gago, Mirosław Siergiejczyk: **Analysis of the UIC Recommended Radio Coverage Measurement Methods in GSM-R Systems** (Analiza zalecanej przez UIC metody pomiaru pokrycia radiowego w systemach GSM-R)

The article presents the UIC recommended radio coverage measurement method in GSM-R system, which is the basis for correct data transmission for ETCS needs. The most important principles of this method for radio frequency coverage are analyzed. According to the authors, the measurement method adopted by the UIC has many shortcomings and therefore they propose another method of measuring radio coverage for data trans-mission in the GSM-R system.

Keywords: method, radio coverage, transmission, GSM-R system

Magdalena Garlikowska: **Use of Time While Travelling by Passenger Trains – Requirements and Needs of Passengers** (Wykorzystanie czasu podczas podróży pociągami pasażerskimi – wymagania i potrzeby pasażerów)

The article presents results of survey, conducted among passengers in 2016, concerning the time spent while travelling by train. Passengers were asked how they spend time in train during business trips and private journeys, on short and long distances. There were presented reasons of taking the trips in different age groups. Based on observation and collected answers there was shown how people actually spend time in trains and how they would like to spend this time, but for various reasons they have no such an opportunity. Factors that influence passengers' well-being and factors that cause stress were characterized.

Keywords: passengers' behaviour, trip by train, time in train

Mateusz Jüngst, Wojciech Sawczuk: **Evaluation of Surface Crack Propagation of Railway Brake Discs** (Ocena propagacji pęknięć powierzchniowych kolejowych tarcz hamulcowych)

The system of railway disc brake, because of transferring high dynamic and thermal loads during the exploitation process, undergoes various wear processes especially in the area of the friction pair. Ones of the most com-mon defects to the disc surface are surface cracks. They vary in length and usually appear much faster than linear wear on the friction ring caused by cooperation with brake lining. Their occurrence usually enforces a faster replacement or regeneration of the disc, which generates additional costs for the operator of a railway vehicle. The aim of the article is evaluation of the surface cracks of railway brake discs in terms of estimation of their depth.

Keywords: exploitation, railway vehicle, disc brake, surface cracks

Władysław Koc, Piotr Chrostowski, Katarzyna Palikowska: **The Analysis of Prospects in Elongation of the Railway Transition Curves** (Możliwości wydłużania krzywych przejściowych w układach geometrycznych torów)

In the presentation, an analysis of the problem of transition curves extension has been discussed. For this purpose an analytical design method was implemented. The basis for the analysis was numerical calculations which were carried out for a wide set of parameters characterizing the standard geometric layout: transition curve – circular arc – transition curve (asymmetrical version). Obtained differences between the existing horizontal layout and the system of extended transition curve has been presented. For this purpose, suitable theoretical relations within the layout (for each geometrical zone) were formulated, keeping the radius of both the initial constant arc and the modified one. Moreover, an influence of the constant arc's radius value and the value of an intersection angle on the obtained results of this process has been evaluated. Based on theoretical assumptions, efficient numerical algorithm enabling the analysis of transition curves extension has been developed. By the use of the algorithm the set of track displacement's distributions have been investigated. The possibility of modeling of the track position differences distribution by varying the output radius of the arc was considered. In the paper a method of determining the new value of radius by optimization was proposed. For this purpose the indicators for assessing the process as well as restrictions determining the possibility of the implementation the design variants have been defined.

Keywords: railway track, geometrical layout, transition curve extension, horizontal ordinates analysis

Dariusz Kowalczyk, Robert Bińkowski: **Analysis of the Causes of Wheel Set Damage Using Finite Element Method** (Analiza przyczyn uszkodzeń zestawów kołowych z wykorzystaniem metody elementów skończonych)

The article discusses and demonstrates modern construction solutions applied in wheel sets. The authors also present examples of wheel sets damage and their probable causes. The Finite Element Method (FEM) was used to develop the expertise. FEM calculations have shown that, for a given type of axle, a wheel set produced in an appropriate technology, the operating and exceptional stresses are maximum to 200 MPa and are significantly below the yield point.

Damage to the wheel set axle resulted from improper manufacturing technology. The second case of axle (wheel set) damage, crack in the wheel abutment was also subject to FEM calculations. FEM analyses have shown that there is a high amplitude of compressive and tentile stresses in the abutment area. Moreover, the stresses connected with wheel-to-axle loading and axle surface (no damage, no defect) also affect the process.

Keywords: cracks and damage to wheel sets, safety in transport, FEM

Andrzej Lewiński, Tomasz Perzyński, Paweł Ukleja: **Possibility of Use the Wireless Communication in Protection of Rail Traffic on the Regional Line** (Możliwość wykorzystania łączności bezprzewodowej w zabezpieczeniu ruchu pociągów na liniach regionalnych)

The paper concern new generation systems for the control and management of rail traffic, with particular taking regional lines into consideration. The current railway infrastructure of such lines enables the implementation of new telematics technologies, including open radio transmission standards for the control and monitoring of rail vehicles. The paper presents a mathematical analysis based on Markov processes, which is consistent with EU standards and recommendations.

Keywords: communications in rail systems, safety, modelling

Vitalij Nichoga, Ivan Prudyus, Liubomyr Vashchyshyn: **Process of Building Artificial Neural Network for Automatic Detection of Signals from Transverse Cracks in the Rail Head**

In this article the process of building artificial neural network (ANN) for automatic detection signals from transverse cracks in the rail head is described. Selection details and real signal samples (for ANN training) are also presented.

Keywords: defect, transverse crack, artificial neural network

Janusz Poliński, Krzysztof Ochociński: **Tactile Graphics at Railway Stations – an Important Source of Information for Blind and Visually Impaired Travelers**

Efficient movement of blind people at the railway station is associated with knowledge of the facility, location of important architectural elements as well as knowledge about hazards and dangerous places. The source of information in this field are tactile graphics being a plan of the facility. To fulfil their role, the tactile graphics must be made according to the same principles and allocated at appropriate and accessible places of the station. The article presents an analysis of this topic based on the conducted studies and evaluations. Final conclusions on the tactile guide system were clarified and they are addressed mainly to the station infrastructure managers and designers.

Keywords: information for the blind people, railway station, tactile graphics

Michał H. Rudowski: **Challenges in IT of the Polish State Railways and Main IT Trends**
(Współczesne rozwiązania i trendy IT a aktualne wyzwania w PKP)

IT has a number of solutions that increase productivity while lowering both investment and operational costs allowing also to improve the effectiveness of business. Using these solutions allows the formation of new operational and commercial processes, including the relations with the environment adapting those processes to the needs of customers. The leading role is played by systems operating in the cloud in data centers working in Software Define Infrastructure (SDI) model. These technologies allow you to deliver complex IT services in all locations with direct access to the Internet, while maintaining the simplicity and flexibility of configuration, high performance and security of information processing. Big Data it is the trend, which is the implementation of data analysis with the different data structures from the different data sources. Another important trend is the Internet of Things (IoT) – using the possibility of embedded computers in a variety of machines and equipment for both professional and consumer use. Thanks to an internet connections the devices can be controlled from the outside or they can control other devices or transfer information automatically to other systems. Next trend is Bring Your Own Device (BYOD) – possibility of using private equipment of employee for business. Big Data is the trend, which is the implementation of data analysis with the different data structures from the different data sources. Use of all these trends is a prerequisite for implementation of the digital transformation, which allows to achieve a competitive advantage over „old style" companies. The aim of the study is to present the necessary conditions and the concept of IT development for polish railways, which will effectively take ad-vantage of digital transformation of operators and infrastructure managers. This concept takes into account the needs and possibilities of public entities operating in the polish railways. The author pointed out the need for changes in the field of information technology and organization in the polish public railway companies, which will improve the economic efficiency of IT and will satisfy the needs of business.

Keywords: Cloud Computing, Software Define Infrastructure, Big Data, Internet of Things, Bring Your Own Device, Service Oriented Architecture, digital transformation, Industry 4.0