

*Andrzej Aniszewicz: FEM numerical analysis of the shape bow cross-section for the rigidity of the wheelset measuring device*

The article shows the results of a computer simulation using the Finite Element Method (FEM) in order to analyze the influence of bows geometry cross-section for the rigidity of the instrument measuring the rolling circle diameter of the wheelset wheels. Two types of bow cross-section were considered, a rectangular shape and a shape of four thin pipes welded together. The considered measuring instruments should fulfil the requirements of the standards ZN-00/PKP-3509-09 and BN-82 3509-13. FEM simulation analysis of the instrument models reveals insufficient instrument rigidity and indicates the need to introduce changes in the construction of the existing measuring instruments for measuring the rolling circle diameter of the wheelsets wheels.

*Keywords:* rolling circle diameter, measurement, reliability, wheelset, finite element method, FEM

*Katarzyna Dybeł, Arkadiusz Kampczyk: Symbols and Codes Used in the Cartographic Documentation of Railway Areas*

The cartographic documents covering railway areas require additional specific cartographic symbols and codes because of the diversity of the existing railway infrastructure elements. Cartographic symbols represent objects featured in maps and schematic plans, according to their attribute characteristics and the scale of a given map. A cartographic code is a designation assigned to cartographic symbols featured in maps in scale ranges of 1:500 to 1:5000. The main purpose of the conducted study was to determine the extent of uniformity of cartographic symbols and codes used in railway areas in the light of the relevant applicable legal regulations, technical standards, industry-specific manuals, and the perception of space as presented in the cartographic documentation of railway areas. The condition of cartographic symbols and codes has been analysed, taking the characteristics of the target audience of cartographic documents as well as the intended use and content of such documents into consideration. The paper describes the patterns behind the processes of coding real elements of railway infrastructure in cartographic documents, and offers tables including findings of comparative analyses of cartographic symbols and codes according to the following requirements:

- GK-1 of the technical standard “Organisation and performance of measurements in railway land surveying”,
- Regulation of the Minister of Administration and Digitization of 2 November 2015 on the topographic objects database and the principal map,
- Ig-10 (D-27) instruction on developing and updating schematic plans.

The conducted studies have revealed a lack of consistency and discrepancies among the cartographic symbols and codes used and adopted in railway areas. These symbols should be consistent and harmonised with other symbols and elements of cartographic documents in order to function as a harmonious whole. It has also been found that there are no definitions for characteristic cartographic symbols and codes found across railway infrastructure elements. The paper offers new original cartographic symbols and codes for those elements which have not been defined so far. New definitions cover: animal protection device and stabilised fixed points of reference for observing the areas susceptible to creep of rails in a continuous welded track. The findings of the conducted studies contribute to the subjects raised in the contemporary domain of civil engineering and railway transport. The article

contains author's insights and conclusions. The paper has been developed as part of AGH's statutory research no. 11.11.150.005.

Keywords: cartographic symbol; cartographic code; graphic symbol; map; railway area, railway surveying

*Paweł Gradowski:* **Upgrading the railway infrastructure technical parameters using the example of the Control-Command and Signalling subsystem with the EC verification certificate**

The financial resources allocated for upgrading the railway infrastructure in Poland over the last decade have brought measurable benefits in the length of railway lines with increased speed. In addition to the upgrade of railway tracks with supporting infrastructure, electrical power equipment and networks or control-command and signalling equipment, further railway lines are equipped with ERTMS/ETCS track-side equipment. All upgraded or retrofitted railway lines are subject to a certification process in accordance with European or national law. Among these lines with the A-Class system and the EC certificate of verification, there are cases where action should be taken to improve the performance of the railway infrastructure. Analysing various investment processes, the article looks at the impact of the tenders for ERTMS/ETCS track-side equipment, which legitimize the validity of the issued EC verification certificates, and whether they have authorisation for placing in service issued by the President of Urząd Transportu Kolejowego (Office for Railway Transport).

Keywords: authorisation for placing in service, certificate, declaration of conformity, ERTMS, ETCS

*Tomasz Nowakowski, Mateusz Motyl, Artur Babiak:* **Simplified Diagnostics of Drive Systems in the Operation of Railway Vehicles**

A special case of rail vehicle failures, often related to maintenance levels with partial disassembly of components, include damage to the drive system components, which is only manifested during driving. These cases are difficult to detect with standard stationary methods. The use of selection methods or diagnostic advanced for the location and identification of these failures can contribute to a significant increase in the service cost, which measurably affect the overall cost of vehicle operation. In such a case, it becomes necessary to minimize them, by determining only the degree of disruption to the functioning of individual elements of the vehicle's propulsion system. This will allow for locating the area of damage and take further service decisions. This article presents the results of the test implementation of a simplified control diagnostics of drive systems in the operation of a selected type of rail vehicle. The results of experimental studies based on vibration measurements of drive system components are presented. Based on them, it is possible to develop standard indicators of disturbance of the vehicle's propulsion system components for use in rolling stock control diagnostics.

Keywords: diagnostics, rail vehicle, vibrations, drive system

*Janusz Poliński:* **Gap Between the Coach and Platform – Solutions for Improving Train Accessibility**

Easy access from platforms to trains is limited by the free space between the platform edge and coach floor, named the gap. The standard definition of the gap is described together with a description of all the difficulties affecting passengers, arising from different platform heights and different passenger vehicle floor placements over the rail head. The gap is a cause of accidents. The article describes techniques which are used to reduce the gap's influence on passenger safety (metro, railway), which may relate to the infrastructure, technical solutions associated with vehicles or platforms, as well as organizational solutions related with appropriate information.

Keywords: rail transport, accessibility, gap

*Jan Raczyński, Agata Pomykała, Tomasz Bużalek:* **Optimization of Railway Connections in the South-Western Part of the Łódzkie Province, with the City of Łódź**

The article presents the results of analyses of the economic and transport links between the south-western part of the Łódzkie Province and its capital, the city of Łódź, carried out for a study prepared by the Railway Institute. Railway net-work deficiencies preventing the efficient use of railway transport of passengers and cargo are outlined. An analysis of the potential utilization of the fact that the TEN-T runs through the province is carried out and a program of the necessary infrastructural projects is also proposed. Improving the accessibility of the region is analyzed in view of the multimodality of railway, bus, and private transport systems in combination with a system of interchanges and parking lots. This approach allows the synergy effects of the particular elements of the transport system to be evaluated.

Keywords: transport, railway, multimodality, regional development

*Iwona Wróbel:* **Improving the Accessibility of Rail Transport for People with Disabilities**

The subject of the article concerns the issue of transport accessibility, due to the special needs of disabled persons and persons with reduced mobility. The disability related to the state of health is presented numerically for Poland, including the dysfunctions occurring and also in relation to the population of Europe and the world. The presented values indicate a significant size of problems that cannot be ignored or downplayed in the context of the policy of equal treatment of all citizens. On the basis of European and Polish legal regulations, the issues of rail transport accessibility in relation to meeting the requirements specified in the technical specifications for interoperability are discussed. The conditions specified in the PRM TSI for the "Infrastructure" and "Rolling Stock" subsystems are presented in detail, including the obligation to create registers: railway infrastructure and rolling stock and requirements for the development of strategic documents, such as national implementation plans and access strategies to passenger infrastructure and access strategies to passenger rolling stock. Following the National Implementation Plan of the PRM TSI, a diagnosis of the condition and assessment of the accessibility of Polish railways for people with disabilities was discussed, as well as the functioning principles and actions taken by infrastructure managers and railway operators to eliminate existing barriers.

The article also indicates the internal project carried out in the Railway Track and Operation Department of the Railway Research Institute, concerning the development of a method facilitating the preparation of a strategy guaranteeing full access to passenger infrastructure in accordance with the requirements of the TSI PRM. The proposed method uses

the questionnaire of the facility, which covers all aspects related to the accessibility of the railway station for people with dis-abilities. This project is an offer for rail infrastructure managers who are required to have a strategy for each passenger station and are part of the state policy implemented to improve the accessibility of public space.

Keywords: railway transport, availability, technical specifications for interoperability, Passengers with Reduced Mobility subsystem