

*Lukasz Gołębiowski , Marcin Siwek , Marcin Ciesielski , Andrzej Zagórski ,
Sławomir Krauze , Radosław Majewski: **Modelling and Validation of the Composite Shell
of a Train Seat***

The subject of the modelling work and the conducted experiments is the composite shell of a train seat. The activities carried out involved designing the geometry, planning the material structure, and selecting the materials to be used. The shell was built using polymer matrix fibrous composites (i.e. FRP – Fibre Reinforced Polymer – composites), which are lighter than steel and comply with the relevant standards for strength and safety at the same time. This was followed by creating a computational model for the shell and conducting a strength analysis in accordance with the guidelines of the relevant industry standard and strength hypotheses adopted for FRP composites. The calculations were conducted using ANSYS Composite PrepPost software based on the finite element method. The article offers a strength analysis of an optimised composite shell of a train seat. Based on the guidelines obtained as a result of the conducted modelling work, a physical prototype (validation model) of the seat was created. Hot vacuum lamination technology was applied in the production process. The experimental validation of the model, producing a positive result, was conducted using a test stand owned by S.Z.T.K. TAPS – Maciej Kowalski.

Keywords: train seat structure, FRP composite, FEM modelling, experimental validation

*Władysław Koc: **Speed of Trains Running on Parallel Track Connections Using Curved
Turnouts***

The issue of connecting parallel main tracks located in a circular curve by means of curved turnouts is discussed in the paper, focusing on determining the achievable train speed. Selected geometries are used in the analysis. The curved turnout diverging track radii and the corresponding train speeds are determined. An analytical notation is used, thereby creating greater options in specific applications. It is shown that the speed of trains running on parallel track connections depends on the type of basic turnout subjected to curving (i.e. mainly on the radius of this turnout), while the second very important factor is the value of the track cant used. In each case, the determined speed resulting from the diverging track radius is lower than the speed on the main tracks. While discussing the general principles of constructing parallel track connections in a circular arc using curved turnouts, it is pointed out that in some situations the speed of travel must be further reduced due to the need to connect the ends of the diverging tracks with a circular arc.

Keywords: railway turnouts, turnout curving, speed analysis, connecting diverging tracks

*Małgorzata Ostromecka , Andrzej Aniszewicz: **Material and Geometric Aspects of SB4
Spring Clips Affecting Their Performance***

The article describes the requirements for SB4-type rail spring clips applied for railways before the spring clips are officially approved for use. Two basic aspects of spring clips are discussed: i.e. the material aspect (chemical composition, heat treatment, microstructure, and decarburization) and the aspect of geometric shape. Both of these aspects have a major impact on the performance of the end product. The article features examples of measurement results concerning selected dimensions of a batch of spring clips that did not meet the applicable requirements. It is an introduction to a series

of publications presenting research on the influence of material composition and geometry of a product on its clamping force, stiffness, elasticity curve, and assembly strength.

Keywords: rail fastening, spring clip, dimensional measurements, hardness tests

Paweł Podleśko: **Assumptions for a Financing Model for Maintaining Railway Station Buildings in Poland**

The aim of this article is to present a potential financing model for the maintenance of railway stations (station buildings) with public funds. The article points out that this is an issue that needs to be solved due to the nature of the existing system of fees in the entire transport sector. This issue is also important in the context of the decisions made by the Polish Office of Rail Transport (ORT) with respect to the fees charged by infrastructure managers and operators of infrastructure facilities from railway carriers. The article also describes the current situation of railway station operators in relation to the sources of financing their activities, the ownership structure of operators, and the categories of trains commissioned by public transport organizers of different levels. The directions of the EU transport policy concerning the principles of creating a system of fees providing for a level playing field in terms of inter-branch competition are also presented. The article presents solutions in terms of financing the maintenance of station facilities (including station buildings) in the EU Member States with the longest railway networks (excluding the UK, i.e. Germany, Italy and France). The summary of the article highlights some suggestions of possible solutions to this problem within the framework of the Polish legal and financial system.

Keywords: railway station, station building, rail yard, maintenance of infrastructure facilities, public aid, organization of rail transport

Janusz Poliński: **Measurements of Structure Gauge Limits on German Railways**

Knowledge of the gauge limits on operating railway lines is essential for safe railway traffic, as defined by the train time-table. The article presents, from a historical perspective, the development of diagnostic measurements. The first designs of measuring vehicles, which systematically reduced the time for diagnosing railway lines, including tunnels, are also presented here. The engineering and technology progress allowed the development of new surveying methods, successively implemented by upgrading diagnostic vehicles. Such measures simultaneously affected the quality of measurements, allowed measurements to be taken at increasing speeds, as well as to automatically create a gauge limit database on the DB AG network. This data is used, inter alia, for the codification of railway lines for the purposes of intermodal transport and special shipments.

Keywords: rail transport, DB AG railways, structure gauge, measuring wagons

Jan Procházka, Petr Novobilsky, Dana Procházková: **Cybersecurity of Railway Network Management and Partitioning**

The railway transport infrastructure ensures the transfer of large numbers of people and cargo every day. The importance of the railway in terms of ensuring the serviceability of the territory makes it a critical infrastructure. We can observe the development of the use of IT technologies on railway, as in all areas of the human system. The management of the railway as a physical system needs to be superseded by management of the railway

as a cyberphysical system. The railway infra-structure has a large area of attack in both, physical space and cyber space.

Multiple Independent Levels of Security (MILS) can meet the high system security requirements. The MILS is a high-assurance security architecture based on the concepts of separation and controlled information flow. The article discusses the possibilities of using the MILS platform in the data communication system and the control system of the railway.

Keywords: Cyber Physical Systems, Critical Infrastructures, Multiple Independent Levels of Security