

■ Introduction – Marek Pawlik ..... 1

## News

■ Presentation and transfer of Siemens locomotives for DB Cargo in Żmigród ..... 2

■ Monographic publications of the Railway Research Institute ..... 2

■ Participation of the Railway Research Institute's researchers in the 24th International Conference TRANSCOMP 2021 ..... 2

## Articles

■ Railway Research Institute's Activities in the European Year of Rail – Agata Pomykała ..... 3

■ Methods and Procedures Used to Assess the Acoustic Performance of New Brake Blocks – Piotr Tokaj ..... 4

■ Calibration of Devices for Measuring Wheelsets in Scope of Accreditation – Andrzej Aniszewicz ..... 5

■ Flagship Areas of Europe's Rail Joint Undertaking – Eliza Wawrzyn ..... 6 - 7

■ 20th Anniversary Jubilee Conference "Modern technologies and management systems for rail transport" NOVKOL'21 – Renata Barcikowska ..... 8

## Editor's

### Marek Pawlik

*Deputy Director for Railway Interoperability, Railway Research Institute*



#### Dear Readers,

the 28th IK Newsletter is just in your hands. It is summing up the fourth quarter of the pandemic year 2021. Many events were cancelled. Some were moved to later months after Covid-19, but as you can see, reading this issue of the newsletter, employees of the Railway Research Institute were working for the benefit of the railway transport despite the challenges of the pandemic time.

Our test track in Żmigród was working in two shifts and sometimes even at night. Fortunately, it is an open area and therefore not so problematic from the virus' hazards point of view. The biggest event which took place in Żmigród recently was dedicated to the presentation and transfer of Siemens locomotives for DB Cargo. The biggest railway conference in Poland took place in December in Zakopane. Organisers, the Polish Association of Transport Engineers and Technicians (SITK RP), Section Cracow have decided to run the conference in Polish mountains accepting only vaccinated participants. During NOVKOL'21, "Modern technologies and management systems for rail transport" experts from the Railway Research Institute were active as usual. Ten presentations devoted to different technical areas were given as you can read on the last page of the newsletter. You will find also information about our active participation in the 24th International Conference TRANSCOMP 2021, "Computer Systems Aided Science, Industry and Transport" organized by Pulawski University of Technology and Humanities. Moreover, in this issue of the

newsletter you will also find information about the Railway Research Institute involvement in the celebration of the European Year of Rail, which was also well present and developed despite Covid-19.

Research and certification works were also on-going. You will find short information about new brake blocks acoustic performance assessments, which were conducted by our Rolling Stock Testing Laboratory and about extension of the scope of accreditation of the Metrology Laboratory on the basis of the wheelsets measuring devices constructed by our experts, and protected by the Patent Office. As new research and development perspective is starting we have decided to include in this issue a description of the "Flagship Areas" of the Europe's Rail Joint Undertaking in preparation of which our experts are involved in cooperation with the Polish State Railways PKP S.A. Last but not least, I would like to inform our readers, that as officially the Railway Research Institute was founded in 1951 we issued in the year 2021 many monographs celebrating our 70th anniversary. You can find in the newsletter information about five monographs issued recently. Some monographs in 2021 were intentionally published in English to ensure wider audience for anniversary publications like: "Hazards in the Railroad Structures", "Overview of the key electromagnetic compatibility issues in high-speed rail direct-current traction operation" or "Railway safety, security and cybersecurity, comprehensive approach to safety of the guided transport systems". However, the celebration of the 70th anniversary of the Railway Research Institute and the 25th anniversary of the Test Track Żmigród have been moved due to Covid-19 and will take place in March 2022, and therefore will be described in the 29th IK Newsletter.

*mpawlik@ikolej.pl*

## Presentation and transfer of Siemens locomotives for DB Cargo in Żmigród

**O**n 25 November 2021, a presentation and transfer of 4 multi-system Siemens Vectron MS locomotives for DB Cargo Poland was held in the Test Track Centre of the Railway Research Institute in Żmigród. The vehicles were purchased

through the Centre for EU Transport Projects (CUPT) as part of the EU project supporting the development of intermodal transport.

## Monographic publications of the Railway Research Institute

**A**s part of the publishing activities, the following scientific monographs were issued in 2021:

- The role of the Test Track Centre of the Railway Research Institute in testing rolling stock and railway infrastructure, edited by Andrzej Massel, Ph.D. Eng. - a compendium of information on the Test Track Centre of the Railway Research Institute in Żmigród, a testing ground for rail transport.
- Andrzej Soczówka, Ph.D., Ivan Rudakevych, Transformation of urban electric transport in Ukraine after 1991 - a comprehensive study indicating the causes and effects of these transformations that took place on urban electric transport networks in Ukraine.
- Marek Pawlik, D.Sc., Eng. Railway safety, security and cybersecurity. Comprehensive approach to safety of the guided transport systems - the monograph defines a comprehensive approach to cybersecurity covering six areas with sixteen groups of functionality from security through business and railway information systems to operational systems related to safety, security and management of digital rolling stock equipment.
- Scientific research for development of railway transport. Young researchers of the Railway Research Institute in the implementation of research projects, collective work edited by Jarosław Moczarski, D.Sc. - results of projects in the field of rail transport realised by young researchers of the Institute, which were presented at the Young Talents Symposium of the Railway Research Institute - SYMTA 2021.
- Andrzej Białoń, Ph.D. Eng. and Prof. Victor G. Sychenko, Ph.D. Eng., Overview of the key electromagnetic compatibility issues in high-speed rail direct-current traction operation - general problems of electromagnetic compatibility of DC traction systems, results of experimental research on electromagnetic compatibility of electrified DC railway lines during operation of high-speed rolling stock, construction of electromagnetic interference models in interoperable DC traction systems and control-command and signalling devices are presented.

## Participation of the Railway Research Institute's researchers in the 24th International Conference TRANSCOMP 2021

**O**n 06-08.12.2021, the Railway Research Institute researchers actively participated in the International Scientific Conference "Computer Systems Aided Science, Industry and Transport" - TransComp 2021 organised by the Faculty of Transport, Electrical Engineering and Computer Science of the K. Puławski University of Technology and Humanities in Radom. The papers presented current research problems from the work carried out at the IK, in particular industrial research, development work, modern techniques and research opportunities, as well as the implemented project on the standardisation of interfaces project entitled "Standardization of selected interfaces of railway traffic control equipment and systems" POIR.04.01.01-00-0005/17, created as part of the BRIK (Research and Development in Railway Infrastructure) joint initiative and co-financed by The National Centre for Research and Development and PKP Polskie Linie Kolejowe S.A. (Polish Infrastructure Manager).

- D. Adamski, Ł. Zawadka "Selected research capabilities of the Railway Research Institute Test Track Center in Żmigród on the example of Eurobalise"
- J. Furman, K. Ortel "Influence of the metal mass distribution in a railway vehicle on the performance of axle counters"
- J. Furman, K. Ortel "Analysis of regulations on conformity testing of railway vehicles with train detection systems used in Poland"
- J. Młyńczak, M. Gołębiowski "New requirements for point machines in Poland"
- J. Młyńczak, M. Gołębiowski "Methods of controlling turnouts adapted to high-speed run in Poland"
- A. Toruń, L. Sokołowska, M. Gryglas "Standardisation of selected interfaces of command-control and signalling equipment and systems - simulation study on IXL-LB interface"
- A. Toruń, L. Sokołowska "Standardisation of selected interfaces of command-control and signalling equipment and systems - Interface model IXL-LB"
- K. Białek, P. Wetoszka, J. Paś "Impact of an unintended magnetic field in the very low frequency range ELF generated by selected components of an EMU on the surrounding environment and electronic systems"

## Railway Research Institute's Activities in the European Year of Rail

### Agata Pomykała

Senior Specialist, Project Coordination and International Cooperation Unit, Railway Research Institute



**R**ecognising that railway plays a significant role in achieving the objectives adopted in the European Green Deal strategy, particularly in the field of transport and mobility, 2021 was declared the European Year of the Rail. The overall objective of this initiative was to encourage efforts by the European Union, Member States, regional and local authorities and other organisations to increase the share of rail transport, both passenger and freight, in the transport

market [1]. EUR 8 million was earmarked for the implementation of the planned measures. One of the most interesting events of this undertaking was the passage of a special Connecting Europe Express train, which left Lisbon on 2 September 2021 and travelled through 26 EU Member States in 36 days. In Poland, it travelled the following route Muszyna (19.09.21) - Warsaw (20.09.21) - Gdańsk (21.09.21) - Białystok (21/22.09.21) - Cracow (22/23.09.21) - Zbrydowice (23.09.21).

The coordinator of the European Year of the Rail in Poland was the Office of Railway Transport. Among activities undertaken was the organisation of a number of scientific conferences to promote the railway profession and to disseminate knowledge about railways. The TRAKO International Fair, organised for the 14th time, provided an opportunity to organise a debate co-hosted by the Railway Research Institute.

Employees of the Railway Research Institute, in this particular year, took part in several significant international conferences, which due to the pandemic were held online, including:

- Renewable energy and energy efficiency in the 21st century. National Technical University of Ukraine, 28.05.2021,
- 2nd Electric Power and Renewable Energy Conference (EPREC-2021), 28-30.05.2021, India,
- International Conference on Electrical, Communication, and Computer Engineering (ICECCE), 12-13.06.2021 Kuala Lumpur, Malaysia,
- From Dream to Hyperloop Reality, 24.06.2021,
- 1st International Workshop on High Speed Rail Socioeconomic Impacts, Naples, 14-15.09.2021, UIC Alliance of Universities,
- Transport Means 2021 25th International Scientific Conference, Kaunas, 6-8.10.2021,
- XXIV International Conference TransComp, 6-8.12.2021.

The Railway Research Institute, as an entity operating in the area of railways and rail industry, has been conducting research and scientific work of local, national and international range since the beginning of its existence, contributing to progress and development. Its activities are perfectly in line with the objectives of the European Year of Rail. In 2021, 1039 scientific and research and technical works were carried out, which is an increase of nearly 2% compared to the previous year. Significant potential of the Institute was engaged in research related to safety and reliability, quality of railway services and adjustment of the railway transport system to international standards, including those resulting from EU regulations. Research carried out by the Institute was performed for the benefit of entities, both domestic and foreign, in particular:

- manufacturers of rail vehicles and their components,
- manufacturers of rail transport infrastructure components, particularly for railways and metros,

- railway undertakings,
- railway infrastructure managers,
- public administrations.

A large number of studies concerned new types of rail vehicles being placed in service on the Polish market.

IK staff carry out their own work and projects related to the creation and development of new research methods, techniques and tools, as well as the development of technical and economic analyses and research programmes; 84 of these were carried out in 2021.

Over 25% of the Institute's staff employed in scientific, research and engineering positions are young people. They actively participate in research work carried out in teams led by experienced employees, acquire the necessary knowledge and skills and often carry out interesting scientific tasks on their own. The Institute also organises internships and work placements for university students.

To fulfil its mission, the Railway Research Institute cooperates with many foreign entities and is active within Union internationale des chemins de fer (UIC), the European Rail Research Network of Excellence (EURNEX), the European Conference of Transport Research Institutes (ECTRI), NB Rail Association, the European Rail Research Advisory Council (ERRAC), and the Community of European Railway (CER).

An important contribution to the development of science and knowledge in the field of railways is IK's publication activity. In 2021, 5 compact publications (monographs) were published:

- collective work edited by A. Massel - The Role of Test Track Centre of Railway Research Institute in Research of Rolling Stock and Railway Infrastructure,
- A. Białoń and V.G. Sychenko - Overview of the Key Electromagnetic Compatibility Issues in High-Speed Rail Direct-Current Traction Operation,
- A. Soczówka and I. Rudakevych - Transformation of Urban Electric Transport in Ukraine after 1991,
- Collective work edited by J. Moczarski - Scientific Research for the Development of Railway Transport - Young Researchers of the Railway Research Institute in the Implementation of Research Projects,
- M. Pawlik - Railway Safety, Security and Cybersecurity. Comprehensive Approach to Safety of the Guided Transport Systems.

In addition, the following were issued:

- 4 issues (190-193) of the periodical Problemy Kolejnictwa (Railway Reports) (ISSN 0552-2145), containing 24 scientific articles (each in Polish and English),
- 2 issues (167,168) of Prace Instytutu Kolejnictwa (Papers of Railway Research Institute) (ISSN 0551-214X), which disseminate knowledge about activities of Institute's employees,
- 2 issues of Communications of Standardisation, containing information on standardisation activities in the field of rail transport of Polish Committee for Standardisation, CEN, CENELEC and UIC,
- 4 issues (24-27) of the newsletter popularising scientific, research and technical achievements and current activities of the Railway Research Institute.

[1] Decision (EU) 2020/2228 of the European Parliament and of the Council of 23 December 2020 on the European Year of Rail.



## Methods and Procedures Used to Assess the Acoustic Performance of New Brake Blocks

Piotr Tokaj

Expert Laboratory of Brakes Rolling Stock Tests Laboratory, Railway Research Institute



The latest revision of the TSI Noise, Commission Implementing Regulation (EU) 2019/774, 2019. (TSI NOI EU 2019/774, 2019) introduced the term 'low-noise brake blocks'. The purpose of this change was to differentiate between brake blocks due to the noise they generate during passage. A distinction is made between traditional cast iron blocks (which increase the roughness of the wheel surface and therefore cause more noise) and brake blocks made from composite

materials (LL and K blocks which smooth the wheel running surface). However, it remains an open question which methods and procedures should be used to assess the acoustic properties of the brake blocks under certification. This point awaits the new version of the TSI, which is to be announced to be issued in 2022.

TSI changes regarding "low-noise brake blocks" were discussed at the UIC workshop held in March 2019 in Paris. Due to the Covid-19 pandemic, work on rail noise has been suspended and in order to continue it, an online workshop was organised to discuss the results of the work carried out in various research centres.

On 28 January 2021, a research project was presented at such a workshop organised by the German Rail Traffic Research Centre in cooperation with the Federal Railway Office and DB Systemtechnik GmbH: "Acoustic certification of new composite brake blocks". Another online meeting organised by the UIC took place on 23-24.02.2021 where, among other things, a status report on the implementation of changes according to the revision of the TSI Noise was presented.

The article summarises the project work to date and explains the basic information on the development of research methods that should be included in order to present the proposed changes in an comprehensible manner.

The new certification procedure for brake blocks should be reliable, easy to evaluate and more user-friendly for manufacturers in view of the time and costs involved in testing the pass-by noise of prototype freight wagons used up to now. These conditions can be met by a new certification procedure based on the assessment of the wheel roughness obtained with a particular brake block. The correlation of wheel roughness with the TSI limit value for noise can be established by comparative, one-off tests for a specific brake block material authorised in the ERA or UIC list (Annex M of UIC leaflet 541-4) without having to repeat the noise tests for newly built freight wagons. The reference values for rail roughness shall be taken in accordance with the standards in force (ISO 3095).

Existing methods for measuring rolling stock noise based on wheel surface roughness shall be considered and analysed, using measurement data from tests on actual railway vehicles which include both wheel roughness data, pass-by noise levels and other parameters affecting rolling noise such as rail roughness and track condition.

One of the aims of the project is to carry out tests with different brake block materials on a test stand for friction pairs of railway brakes. These tests will allow checking if it is possible to obtain adequate roughness of a railway wheel in laboratory conditions and if the wheel roughness produced on the test stand is adequate to define acoustic properties of new brake block materials in comparison with the results obtained in field tests.



Fig. 1. Measurement of the running surface roughness of a railway wheel (the author's own material)

Noise tests carried out in the Rolling Stock Research Laboratory of the Railway Research Institute show a high correlation between noise generated during runs on different types of tracks as well as depending on the environmental conditions of the track, including weather conditions.



Fig. 2. Noise tests carried out on the IK test track in Żmigród (the author's own material)

The project work can be divided into two parts. The first part is the analysis of the collected results of the tests carried out under real conditions, which are used to validate the procedure and to identify parameters or factors that may influence the assessment limits of new brake blocks.

The second part of the project collects the results of noise measurements obtained using a test stand for testing brake friction pairs in relation to wheel surface roughness. These tests were divided into three stages. In the first stage, it was investigated how the wheel surface roughness develops on the stand and which braking programme (according to UIC leaflet 541-4) is suitable for this. The second stage involved repeating the tests with a new wheel and the same brake block to assess the repeatability of the results. In the third stage, other types of brake blocks are tested to investigate how wheel roughness develops with different materials and whether it is possible to achieve a characteristic roughness that corresponds to that particular type of brake block (e.g. K and LL).

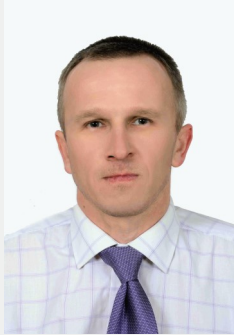
The discussed way to certify new brake blocks according to the EC implementing regulation (TSI NOI EU 2019/774, 2019) and the test results presented at the workshop on 28 January 2021 will be further developed and consulted. If the Covid-19 pandemic does not prevent further work in laboratories and working groups, the final results of the work on the approval procedure for new brake blocks will be presented in 2022.

ptokaj@ikolej.pl

## Calibration of Devices for Measuring Wheelsets in Scope of Accreditation

**Andrzej Aniszewicz**

Engineering and technical specialist, Metrology Laboratory, Railway Research Institute



**R**ailway wheelsets are one of the most important moving elements. During operation, wheelsets interact with the brake system and rails and are subject to controlled wear. The degree of wear is checked using specialized measuring instruments (Fig. 1).

These measuring instruments include:

- a calliper to measure the wear of the wheel running surface (Fig. 2), allowing to measure the Sh, Sd, qR parameters,
- a diameter measurement device on a circle with a two-point contact (Fig. 3), to measure the D parameter,
- a device for measuring the distance of internal wheel body surfaces (Fig. 4) to measure the AR parameter.

These instruments are calibrated in the Metrology Laboratory of the Polish Centre for Accreditation (PCA) in accordance with the requirements of PN-EN ISO / IEC 17025: 2018-02 (Fig. 5). The current scope of accreditation of the Metrology Laboratory can be found on the website <https://pca.gov.pl/en/accredited-organizations/accredited-organizations/calibration-laboratories/ap%20024,file.html>

Table 1 List Calibrated instruments, Measurement Ranges, Uncertainty of measurement and Measurement methods.

Calibrated instruments	Measuring range	Uncertainty for CMC measurement	Measurement method
Callipers for measuring the wear of external monoblock wheel body and rim of wheelsets (analogue reading)	Sh, Sd (0 – 45) mm	0.07 mm	PP-LMM-17
	Qr (0 – 25) mm	0.13 mm	
Instruments for measuring wheelsets running diameter (double-point contact)	(800 – 1050) mm	0.04 mm	PP-LMM-18
Instrument for wheelsets clearance measurement	(1330 – 1465) mm	0.20 mm	PP-LMM-19

Table 1. List of calibrated instruments together with measuring ranges, measurement uncertainties and identifiers of measurement methods

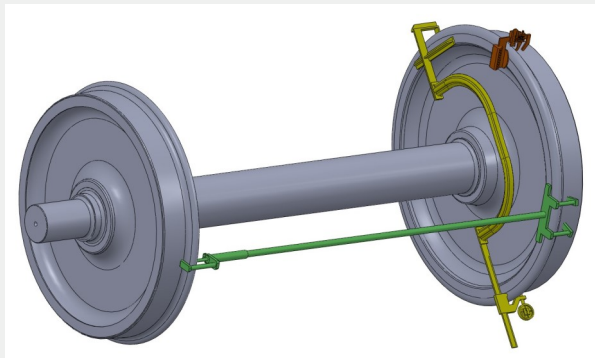


Fig. 1. Manual railway measuring instruments on the wheelsets



Fig. 2. Callipers for measuring the wear of wheel running surface

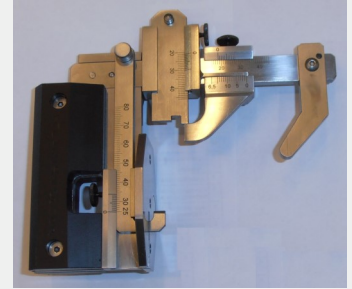


Fig. 3. Instrument for wheelsets rolling diameter measurement



Fig. 4. Instrument for wheelsets clearance measurement



Fig. 5. Accreditation certificate of the Calibration Laboratory of the Polish Centre for Accreditation

[aaniszewicz@ikolej.pl](mailto:aaniszewicz@ikolej.pl)

## Flagship Areas of Europe's Rail Joint Undertaking

**Eliza Wawrzyn**

*Scientific Assistant, Railway Research Institute*



**W**ork on establishing a successor to the Shift2Rail Joint Undertaking in the new Horizon Europe financial perspective is underway. Europe's Rail Joint Undertaking will build on the successful results of Shift2Rail's work to speed up the development and deployment of innovative technologies. It will focus on digital innovation and automation to achieve the radical transformation of the rail system needed to deliver on the European Green Deal objectives. By improving competitiveness, it will aim to support European technological leadership in rail. Research and Innovation activities are planned to be structured around 7 key Flagship Areas (FA) and cross-cutting activities:

– **FA1** Network management planning and control, and mobility management in a multimodal environment,  
 – **FA2** Digital and automated up to autonomous train operations,  
 – **FA3** Intelligent and integrated asset management,  
 – **FA4** Sustainable and green rail system,  
 – **FA5** Sustainable competitive digital green freight services,  
 – **FA6** Regional rail services / innovative rail services to revitalise capillary lines,  
 – **FA7** New or emerging technologies for land transport.

- Cross-cutting activities:** digital data and activators
- FA1** is to cover the following sub-areas:
- capability to deliver network management processes and methods with decision support and automation, using simulation, optimisation and artificial intelligence;
  - combining operational rail traffic planning and maintenance using real-time feedback, capacity planning using improved visualisation and information exchange;
  - highly automated real-time planning and conflict prediction and resolution, efficient dispatch of coordinated operations and accurate forecasts;
  - ERTMS macro and micro simulations and pilot implementations to support the transition to C-DAS, ATO and ERTMS, capacity effects with further digitisation of the traffic control and signalling system;
  - developing the capacity for secure information exchange between the TMS and other transport-related entities (e.g. ports, airports, authorities and other transport modes) - organising and optimising traffic at EU level;
  - real-time forecasting of transport demand, prediction of flows on the rail network and at railway stations based on historical data, sensors and targeting of mobility support;
  - predicting disruptions, managing timetables using various data sources, historical data, real-time passenger and freight flows across all modes of transport;
  - improving the accessibility and attractiveness of railways (especially for people with reduced mobility) by offering

flexible and convenient mobility services and personalised customer experiences.

**FA2** is to cover the following sub-areas:

- more automated railway operations (Go3-4), in combination with non-automated traffic with defined rules and safety aspects and based on approved standards;
- ATO solutions for all types of applications and segments including advanced railway automation and automatic route assignment capability;
- technologies enabling automated and autonomous operation such as safe environment perception, signal reading, virtual certification, obstacle detection using artificial intelligence;
- development of connectivity, e.g.: FRMCS or 5G and cooperation and interaction with autonomous cars, other level crossings, employees;
- safe and precise positioning and identification of trains;
- the capability of remote control of trains at the depot, on low-traffic lines and in emergency situations, as well as the automated shunting of freight and passenger trains;
- new solutions adapted to automation such as the possibility of controlling automotive freight wagons and the integration of new solutions for freight transport.

**FA3** is to cover the following sub-areas:

- the capability to share information across the supply chain to design, manufacture, converse, operate, renew, recycle and dispose of rail assets;
- the capability to make decisions in an advanced, automated, centralised and holistic way with the integration of operational and IoT data and enabling cooperative diagnostics between assets;
- use of predictive data analysis for maintenance and renewal and modular design in a design-to-maintain model;
- visualisation using BIM and GIS through various techniques such as augmented reality;
- capability for automated and non-invasive self-diagnosis and intervention using various techniques such as: unmanned robotics, checkpoints, drones, satellite inspection, additive manufacturing, self-repair techniques;
- optimised lifetime and clearly measurable, lower cost, higher resource availability;
- harmonised decision support data and secure information exchange between the existing TMS and an intelligent asset management system.

**FA4** is to cover the following sub-areas:

- alternative energy solutions for rolling stock;
- a holistic approach to energy in rail infrastructure (production, use and intelligent management);
- sustainability and resilience of the rail system as part of a holistic approach to asset management, providing greater value;

Continued on page 7



## Flagship Areas of Europe's Rail Joint Undertaking (continued from page 6)

- improving systems, including electromechanical components, for low wear, low emissions, low noise and low vibration;
- a healthier and safer railway system;
- attractiveness of railways.

### FA5 is to cover the following sub-areas:

- intelligent freight trains (including digital automatic couplers - DAC) and fully digital rail freight operations;
- digitalisation in support of seamless transnational traffic (without stopping at borders). Innovative and integrated rail services in the freight logistics chain;
- digital capacity management and freight train traffic management solutions to support the automation and digitisation of freight train and intermodal terminal operations based on real-time data;
- digital interfaces and customer services (extended routes, information and booking of multimodal services, real-time tracking) to offer new services to customers and enable real-time management;
- platforms for the exchange of freight data between railway undertakings, infrastructure providers, all other actors in the logistics chain with a view to achieving smooth, easy and transparent access to information;
- automation, data collection and digitisation of freight trains (including automotive freight wagons) and intermodal terminal operations using automation for autonomous operation.

### FA6 is to cover the following sub-areas:

- a systemic approach in order to develop economical and cheap regional rail (integration of infrastructure, traffic management and vehicles);
- autonomy (ATO), including remote control-command and signalling, as a breakthrough in the economic sustainability of regional railways;
- innovative, cost-effective and highly safe infrastructure, including level crossings;
- low-cost drive systems;
- solutions for passengers and freight on regional railways, including the interconnectivity of rail freight lines;
- an economically sustainable and efficient service, providing access to an improved passenger experience on a regional line;
- better connectivity to the road mode through the potential integration of ITS solutions;

### FA7 is to cover the following sub-areas:

- energy-efficient hyper-speed systems designed to cope with climate change adaptation;
- unconventional rail transport systems - as cable cars, maglev or fully automated monorail systems, to complement existing urban public transport systems;
- development of autonomous rail vehicles with sensor systems that meet all the operational and certification requirements of railways, full situational awareness supported by perception and communication, including enhanced TMCS;
- developing innovative solutions for railway operations in terms of measures to improve cost efficiency and delivery times for rail services such as vertical loading, wireless systems and autonomous and virtual couplers;

- multi-functional and modular wagon and container, including improving the efficiency and safety of wagons for combined transport, improving dynamic behaviour and enabling automatic loading;
- analysis and case studies of the different interfaces, regulations and standards for the different modes of transport (trains, cars, buses, trucks, cable cars, ships, helicopters, aircraft, drones).

### Cross-cutting activities will deal with:

- high quality common sets of data within federated distributed data spaces, characterised by privacy by design, federation, distribution and decentralisation, user friendliness and simplicity;
- powerful tools and services for data analysis and processing, including a tool for integrating historical data and artificial intelligence, including machine learning best practices, and "implementing enhancements and improvements";
- ensuring availability and quality of data;
- using the data to evaluate processes and components of the railway system throughout their life cycle;
- use of interconnected services and infrastructure to ensure open exchange between online services;
- forecasts and visualisation of the state of the system (services, production processes, operations and assets) including prediction of passenger and freight flows;
- automated and optimised design of railway assets and processes (use of artificial intelligence).

Instytut Kolejnictwa (Railway Research Institute) is actively cooperating with the Research and Development Office of PKP SA within the framework of works on the establishment and direct membership in the European Railway Partnership "Europe's Rail". On the initiative of PKP SA, cyclical workshops are held to discuss the subject matter and scope of projects planned for implementation in the above-mentioned flagship areas. The proposals will be presented to the EC and assessed whether the proposed activities are consistent with the assumptions of the currently emerging Master Plan, which will define the principles of operation of Europe's Rail. The workshops will cover the following selected thematic issues: control-command and signalling, diagnostics, construction and modernisation of track infrastructure, level crossings safety, noise reduction, energy on rail routes, management and diagnostics of rolling stock, innovative rolling stock and its components, automation of railway operations, cyber security, transferring transport from road to rail.



On 29 December 2021, after signing the "Letter of Commitment" by the Board of the PKP Company, PKP S.A. became the 25th Founding Member of the new railway partnership under Horizon Europe - EU - Rail. Under the signed

declaration of cooperation with PKP S.A., IK actively participates in the work on detailing the tasks planned to be implemented in the Flagship Areas.

[ewawrzyn@ikolej.pl](mailto:ewawrzyn@ikolej.pl)

## 20th Anniversary Jubilee Conference "Modern technologies and management systems for rail transport" NOVKOL '21

### Renata Barcikowska

Head of Project Coordination and International Cooperation Unit, Railway Research Institute



On 1 – 3 December 2021, Zakopane hosted the 20th Anniversary Jubilee Conference organised by the Association of Engineers and Technicians of Transportation of the Republic of Poland Branch in Cracow in cooperation with Cracow University of Technology - Department of Road, Railway and Traffic Engineering, PKP Polskie Linie Kolejowe S.A., the Małopolska Regional Chamber of Civil Engineers in Cracow and the National Railway Section of SITK RP. The conference sessions were held in the Nosalowy Dwór Resort & Spa Hotel. The conference was held under the Honorary Patronage of Andrzej Adamczyk, the Minister of Infrastructure; Łukasz Kmita, the Governor of Małopolskie Voivodship; Witold Kozłowski, the Marshal of Małopolskie Voivodship; Ignacy Góra, the President of Office of Rail Transport; Ireneusz Merchel, the President of PKP Polskie Linie Kolejowe S. A.; Adam Wielądek - Honorary President of UIC; Andrzej Gołaszewski - Honorary President of SITK RP Senior; Janusz Dyduch - President of the Association of Engineers and Technicians of Transportation RP.



Fig. 1. NOVKOL2021 Conference, Plenary Session  
Source: SITK o/Cracow base

Presented speeches concerned mainly modern technologies in design, construction, maintenance, diagnostics and operation of rail infrastructure and rolling stock for passenger and freight transport. Ten papers delivered by specialists from the Railway Research Institute during the conference included:

1. Renata Barcikowska: "Possibilities of financing research and development works in the area of rail transport on the example of projects carried out by the Railway Research Institute"

2. Przemysław Brona, Marta Rogowska-Jędra: "Analysis of the influence of turnout parameters on the capacity of track junctions and high-speed railway lines based on simulation tests"
3. Jerzy Cejmer, Adam Dąbrowski, Krzysztof Ochociński: "Preventing degradation of the railway surface in the area of undesignated crossings by stabilising the ballast with resins"
4. Paweł Gradowski: "Meeting the interoperability requirements of comprehensive networks"
5. Iwona Karasiewicz: "Safe integration in the risk management process from the point of view of the inspection body".
6. Robert Kruk, Beata Piwowar, Krzysztof Ochociński: "Intermodal transport as an alternative to dispersed wagon transport"
7. Magdalena Kycko, Jacek Kukulski, Marek Pawlik: "Challenges to the introduction of RSC and ESC compatibility testing"
8. Andrzej Massel: "The use of modernised railway infrastructure in Poland"
9. Agata Pomykała: "Changes in the transport market in the Covid-19 era: the first year of the pandemic"
10. Grzegorz Stencel, Ivana Martincevic, Andrzej Gibek: "Geometrical and kinematic parameters of selected turnouts used on high-speed lines".

Articles were presented in the following six substantive sessions: Session I Infrastructure and transport, II Infrastructure and technologies, III Control-command and signalling, IV Superstructure and substructure, V Control-command and signalling infrastructure, digital railway, VI Power engineering, rail vehicles.

Articles prepared for the conference were published in *Zeszyty Naukowo-Techniczne Stowarzyszenia Inżynierów i Techników Komunikacji Rzeczpospolitej Polskiej Oddział w Krakowie*, series: Conference Materials No. 2 (123)/2021 (457 pages) containing 28 peer-reviewed articles and 2 non-peer-reviewed articles.

About 560 people participated in the conference. The conference participants were the representatives of companies of PKP S.A. Group, universities, Railway Research Institute, design, production and executive companies from Poland, Austria, Belgium, France, Lithuania and Germany dealing with the issues of implementation of new technologies on the railways.

[rbarcikowska@ikolej.pl](mailto:rbarcikowska@ikolej.pl)

#### Editors:

dr Renata Barcikowska, Editor-in-chief  
Agata Pomykała  
Jolanta Olpińska  
Jolanta Cybulska-Drachal  
Andrzej Szmigiel

#### Contact:

IK - Railway Research Institute  
04-275 Warsaw, Poland  
[www.ikolej.pl](http://www.ikolej.pl)  
E-mail: [ikolej@ikolej.pl](mailto:ikolej@ikolej.pl)

Copyright © 2022 IK - Railway Research Institute  
All rights reserved