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IN THIS ISSUE

Editor's

Jarosław Moczarski
Scientific Secretary of the Railway Research Institute

The main task of the Railway Research Institute's Scientific Secretary is the cooperation in formulating priority research directions, supervising the quality of scientific, research and development projects and implementation work carried out in the Institute, disseminating their results and creating conditions for the research staff development. As the Scientific Secretary I am involved in the organization of competitions for scientific and research positions, I also issue opinions of applications for scholarships and participate in organization of competitions for research and development projects and other tasks connected with them aiming especially at young researchers' development. I monitor timely data input into the Integrated System of Information on Science and Higher Education POL-on as well as work concerning the preparation of the Questionnaire of parametric assessment of a scientific entity. I also hold the position of Editor-in chief of *Prace Instytutu Kolejnictwa* quarterly which aims at dissemination of information on the Institute's and its employees' activities, promotion of its research potential and creative achievements. In the articles and information materials that we publish, the Institute's employees research achievements, the departments and laboratories potential (accreditations, authorities, research procedures, laboratory test stands, measurement apparatus), as well as particular specialists' scientific and professional areas of interest are presented. Moreover there is included information concerning accomplished research projects, obtained patents, extending employees' qualifications, undertaken research and organizational initiatives, national and international cooperation, publishing activity (monographs and articles) and also the participation in conferences, symposia and seminars organized by the Institute. I also run doctoral seminars for the Institute's employees who deal with research and scientific work and offer support and expertise for the employees writing their PhD dissertation. I am the chairman of Commission on assessing application for IK internal projects and reports of their implementation. I also monitor scientific conferences, seminars and trainings as well as apprenticeships organized in the Institute. I am responsible for running monthly open scientific seminars during which IK employees present the latest research achievements. I substantively support actions aiming at acquiring funds to carry out research and development works. At the same time I work on research and scientific projects relating to maintenance of the traffic control and signalling systems operation and the identification of rolling stock elements with the laser sensors application.

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„Sustainable public transport" panel

On 8 February, Dr. Andrzej Żurkowski chaired a discussion panel **„Sustainable Public Transport"** at Polish Infrastructure and Construction Conference. The panelists also included Renata Kaznowska, Deputy Mayor of Warsaw, Dr Libor Lochman (The Community of European Railway and Infrastructure Companies - CER), Bresch (PKP Polish Railway Lines), Dariusz Arnold Kostaniak (Warsaw Metro), Jerzy Obrębski (Szybka Kolej Miejska), Dariusz Grajda (Koleje Mazowieckie). The extension of the second underground line as well as the development and modernization of railway network were discussed.

Photo Executive-club

V European Rolling Stock Forum

The Fifth European Rolling Stock Forum was held in Warsaw on 21 March. The conference organizers invited the Railway Research Institute's delegate – Jan Raczyński to present the assessment of the rolling stock needs for the future central airport operation. The speech covered solutions in terms of railway services for airports applied or planned in the world. A special category of railway services are lines dedicated to operate to/from airports situated far away from city centers, such as the new Polish airport will be. Examples of such solutions and potential rolling stock parameters in Polish conditions were presented.


Photo TOR Publishing House

Railway Research Institute's delegate - Jan Raczyński

Transport Research Arena (TRA) 2018

The Transport Research Arena TRA'2018, the 7th edition, was organized in Vienna on 16 – 19 April 2018. This European research and technology biennial conference on transport and mobility, in accordance with the European Commission's intentions, is a leading conference in transport area connected with European projects (currently 8th FP UE, H2020). On the second and third day of the conference there were held poster sessions, during which delegates from the Railway Research Institute presented their posters, i.e. Dr. Artur Rojek „Electric Energy Storage in DC Traction Power Supply Systems" and Dr. Andrzej Massel „Infrastructure and Operation – Research on Utilisation of the Maximum Train Speed Profile".

Photo IK

Railway Research Institute's delegate - Artur Rojek

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We have been working for disabled people for over 30 years

Janusz Poliński
Railway Track and Operation Division – assistant professor

Krzysztof Ochociński
Head of Railway Track and Operation Department

Free movement of disabled people and persons with reduced mobility (PRM) requires a broadly understood accessibility from railway transport for all travellers. It should concern both the infrastructure and the rolling stock as well.

The amendment of the Transport Act, passed in 1994, for the first time in the Polish transport legislation included a provision in Art. 14 that "The carrier should undertake activities facilitating the use of public transport, check-in stands, stops and platforms for disabled persons, including the wheelchair users".

Due to earlier support for PKP in the area of the accessibility improvement and systematically gained experience, the Railway Research Institute was asked to prepare "The programme of PKP adaptation for people with disabilities", comprehensively referring to the entire railway network.

Despite the above mentioned programme, the Institute was involved in another system activities, e.g. the programme to use 611A type passenger – cargo wagons to transport people with disabilities. The 90s is also a period of first adaptations of carriage compartments for wheelchair users and a lift facilitating overcoming the platform-carriage barrier (e.g. 111Apn type carriage).

As then there were no publications concerning activities to improve infrastructure accessibility, in 1997 the Railway Research Institute drew up construction guidelines for objects and facilities used by disabled people.

Photo 1. A set of ramps to reach Niepokalanów station platforms - E20 line

The Institute has also contributed to shaping the European law concerning the disabled. The Railway Track and Operation Department, through its representative, participated in creating the EU law connected with railway transport accessibility for disabled persons. Specific problems of conventional rolling stock and infrastructure designated for the travellers were connected with 01/16-MA02 EN04 mandate granted by the Association for Railway Interoperability. They dealt with developing technical specifications for interoperability related to the European Union's railway system accessibility for the disabled and people with reduced mobility. This led to issuing the Commission Decision (2008/164/WE).

Photo 2. Extendable ramp in Koleje Mazowieckie EMU

Another problem that appeared together with the necessity to comply with TSI PRM requirements was tactile marking for the blind and visually impaired people. Domestic regulations relating to this issue did not exist at that time.

The Warsaw Metro commissioned the Institute to draw up technical conditions to use tactile elements for the metro infrastructure. Thanks to the cooperation with blind people, the study defined basic sizes of truncated domes and markings on the metro platforms. These principles were included in the appropriate regulation for the metro (Journal of Laws 2011, no.144, item 859).

Basing on the gained experience, the Institute was involved in issuing recommendations for railway platforms which were included in the regulation concerning railway objects and facilities (Journal of Laws 2014, item 867).

Among many expert works, analyses, studies developed by the Railway Research Institute, two are specially worth mentioning, i.e. a study drawn up for PKP PLK entitled "TSI-PRM implementation strategy in Poland relating to adapting railway infrastructure for persons with reduced mobility" (2010) and a study for the Ministry of Infrastructure entitled "Range of activities connected with adapting railway transport for persons with reduced mobility in the perspective by 2015" (2011).

The Railway Track and Operation Department of the Railway Research Institute is issuing EC certificates of verification for TSI PRM and TSI Infrastructure subsystems.

A crucial document for the Polish railways was developed in the Railway Research Institute in 2017 entitled „National Plan of Implementation of TSIs relating to the EU railway system accessibility for the disabled and persons with reduced mobility (TSI PRM)" which contains a range of foreseen activities relating to infrastructure and rolling stock by 2015.

The issues concerning broadly understood accessibility of railways for people with disabilities were presented by the Railway Research Institute's employees in numerous articles published in professional national and foreign journals. Moreover, two monographs have been published, i.e. "Universal Design – Adaptation of Railways for Disabled Persons" (2012) and "Tactile Elements for the Blind – Kinds, Solutions and General Requirements" (2012).

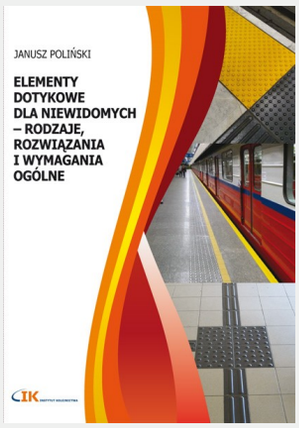

Photo 3. Railway Research Institute's monographs connected with the problem of railway accessibility for the disabled

Further actions to improve the railway accessibility are expected to be carried out also within the government programme *DOSTĘPNOŚĆ PLUS* [Accessibility plus].

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Tests and placing to service railway vehicles specially designed for construction and maintenance of railway infrastructure in Poland

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On track machines (OTMs) can be placed into service in Poland according to the following modes:

- issuing a certificate (attestation) - in compliance with Art. 22f of the Act of Law on railway transport of 28 March 2003 (i.e. Journal of Laws 2017 item 2117).

The scope of technical tests necessary to issue a certificate of placing to service of a railway vehicle type is included in § 14. item 1 (for all railway vehicles types) and item 5 (additionally for special vehicles) of the Regulation of the Ministry of Infrastructure and Development of 13 May 2014 on placing to service certain kinds of constructions, equipment and railway vehicles (Journal of Laws 2014 item 720).

Photo 1. Dynamic track stabiliser DGS 62N

These provisions apply to railway vehicles specially designed for operation:

– on railway sidings,
– on private infrastructure,
– on narrow gauge railway infrastructure,
– in the metro,
– on railway network which is functionally distinguished from railway system and designated for conducting regional and local transport.

Photo 2. Tamping machine UNIMAT 09-4x4/4S Dynamic

- permission mode as vehicles in complete conformity with TSIs, according to Art. 23b of the Act of Law on railway transport. In this mode there are two paths of placing a vehicle into service:

– the first permission (certificate) of placing a railway vehicle into service in compliance with TSI (Art. 23b item 3 of the Act of Law on railway transport referring to Art. 23e item 1),
– additional permission (certificate) of placing a railway vehicle into service in compliance with all TSIs, placed into service in any of the European Union Member States (Art. 23f of the Act of Law on railway transport) excluding those vehicles which have already received permission to be placed into service in any other Member State of the European Union, if TSIs regarding vehicles do not determine open points and specific cases and the vehicle operates exclusively on railway network compliant with TSIs which do not determine open points and specific cases. Such a situation itself would guarantee the vehicle's safe operation. Due to, inter alia, limited scope of network fully in compliance with TSIs in the Republic of Poland, a railway vehicle which was placed into service in another Member State should receive the permission basing on the provisions of Act of Law on railway transport.

Photo 3. Tamping machine DUOMATIC 09-32 CSM

Railway vehicles compliant with TSIs undergo verification including the following tests:

– compliance with respective technical specifications for interoperability: TSI LOC&PAS COMMISSION REGULATION (EU) No 1302/2014 of 18 November 2014 concerning a technical specification for interoperability relating to the 'rolling stock — locomotives and passenger rolling stock' subsystem of the rail system in the European Union), TSI NOI (COMMISSION REGULATION (EU) No 1304/2014 of 26 November 2014 on the technical specification for interoperability relating to the subsystem 'rolling stock — noise' amending Decision 2008/232/EC and repealing Decision 2011/229/EU), TSI SRT (COMMISSION REGULATION (EU) No 1303/2014 of 18 November 2014 concerning the technical specification for interoperability relating to 'safety in railway tunnels' of the rail system of the European Union), TSI CCO (Commission Regulation (EU) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the 'control-command and signalling' subsystems of the rail system in the European Union),
– compliance with national technical specifications and standardization documents defined in the letter of the President of the Office of the Railway Transport (UTK) of 19 January 2017 (Table 6 referring to the 'control-command and signalling' subsystems and Tables A2 – TSI LOC&PAS, A5 – TSI NOI and A6 – TSI SRT relating to rolling stock subsystem) applicable for open points and specific cases defined in TSIs,
– compliance with railway network, particularly in compliance with the vehicle technical and operational characteristics,

Tests and placing to service railway vehicles specially designed for construction and maintenance of railway infrastructure in Poland

– with infrastructure and fixed installations – according to the national technical specifications and standardization documents defined in the letter of the President of the Office of the Railway Transport (UTK) of 19 January 2017 (Table A7).

According to point 7.1.1.3 TSI LOC & PAS, the implementation of this TSI in reference to rolling stock specially designed for construction and maintenance of railway infrastructure is not compulsory i.e. with regards to on track machines (OTMs) and infrastructure inspection vehicles.

Photo 4. Profiling machine USP 2000 C2

- permission mode as vehicles non compliant with TSIs, according to Art. 23b of the Act of Law on railway transport. In this mode there are two paths of placing a vehicle into service:
  – the first permission of placing into service vehicles non compliant with TSIs (Art. 23b item 6 of the Act of Law on railway transport referring to Art. 23e item 2),
  – additional permission of placing into service vehicles non compliant with TSIs, previously placed in service on the European Union's territory (Art. 23g of the Act of Law on railway transport).

Railway vehicles non compliant with TSIs are subject to verification including the following tests:

– of conformity with national technical specifications and standardization documents defined in the letter of the President of the Office of the Railway Transport (UTK) of 19 January 2017 (Table B), as referred to Art 25d item 1 i.e. the regulation of the Minister of Transport, Construction and the Maritime Economy of 27 December 2012 with regards to the list of relevant technical specifications and standardization documents the implementation of which allows meeting essential requirements to achieve the interoperability of the rail system (Journal of Laws 2013 item 43),
– of conformity with railway network, particularly relating to the compliance of the vehicle technical and operational characteristics with infrastructure and fixed installations – according to the national technical specifications and standardization documents defined in the letter of the President of the Office of the Railway Transport (UTK) of 19 January 2017 (column no. 10 "compliance with Polish infrastructure in Table B – marked with symbol "x"),
– of the vehicle parameters to be inspected in order to be placed in service (the list of parameters is included in Annex no.4 to the regulation of the Minister of Infrastructure and Construction of 21 April 2017 on the interoperability of the rail system (Journal of Laws 2017 item 934).

Photo 5. Ballast cleaning machine RM85-750

These provisions apply to vehicles intended to circulate on the entire railway network situated on the territory of the Republic of Poland.
In order to assess railway vehicles specially designed for construction and maintenance of railway infrastructure the following standards are used:

- PN-EN 14033-1:2017-07 - Railway applications - Track - Railbound construction and maintenance machines Part 1: Technical requirements for running,
- PN-EN 14033-2:2017-07 - Railway applications - Track - Railbound construction and maintenance machines Part 2: Technical requirements for travelling and working,
- PN-EN 14033-3:2017-07 - Railway applications — Track — Railbound construction and maintenance machines — Part 3: General safety requirements.

Photo 6. Ballast profiling machine USP 2010 SWS-U

The Rail Vehicles Department of the Railway Research Institute has recently issued opinions of the following on track machines DGS 62N, DUOMATIC 09-32 CSM, UNIMAT 09-4x4/4S Dynamic, USP 2000 C2, RM85-750, USP 2010 SWS-U. Some of these vehicles have already been granted certificates of placing in service of a type of railway vehicles not compliant with TSIs issued by the President of UTK in Warsaw, part of them are being issued.

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Accessibility of technical equipment used to remove failures of track superstructure

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The main railway infrastructure manager in Poland is PKP Polskie Linie Kolejowe S.A. [Polish Railway Lines]. Their duty is to provide appropriate technical condition of railway infrastructure, including its main element, i.e. the track (permanent way). The track quality has a direct influence on technical and operational parameters and railway safety. Therefore ensuring the right track quality is fundamental to carry out diagnostics as well as possible emergency and maintenance works which require appropriate technical equipment.

The track is a complex structure, thus its various elements could be damaged due to affecting it loads.

As a rule, sudden track damage results from insufficient maintenance means. Track maintenance involves keeping definite parameters of track superstructure in assumed (acceptable) limits.

The catalogue of track failure is broad, however, the most common failures are directly connected with track superstructure. Over 40% of emergency works are related to rail cracks. A significant part of these repairs include the exchange of turnouts or switches elements or sleepers. Other failures are not so frequent.

Photo 1. Railway motor trolley

Railway motor trolleys are used for work involving repair of cracked rails. Therefore their number and technical condition are particularly important for repairs of this type. In spite of advanced age and wear out of this equipment, it is maintained so as to be used in further operation. However, raising costs of their further repair are expected due to, inter alia, limited accessibility to spare parts. The increased frequency and extending time of their repair will affect the efficiency and time of emergency works as well as limit diagnostic work.

Consequently, it might be expected that there will appear the necessity of some equipment decommissioning.

This will translate into the lack of carrying out a full range of tasks and maintaining appropriate safety level.

It must be stressed, however, that the time of performing emergency repairs and diagnostic work plays a vital role. This time is required to be as short as possible as it directly disturbs the railway traffic and consequently translates into high compensations paid to railway operators. The coefficient of equipping railway lines plants with railway motor trolleys and trolleys with a crane calculated on 100 km of track ranges from 0.59 Skarżysko-Kamienna and Bydgoszcz plants (1 railway motor trolley per approx. 170 km of track) to 2.24 in Sosnowiec plant (1 railway motor trolley per approx. 45 km of track).

The technical equipment currently used for repairing emergency track failures, due to its age, may be less accessible because of its wear out and necessity of frequent repairs. This, in turn, can translate into the extension of emergency work time and consequently smaller accessibility of railway infrastructure for railway operators. Moreover, due to the technical equipment age, its maintenance costs may increase. It must be added that each technical device has a defined life (maximum time of exploitation) that cannot be prolonged without decreasing the safety level of this device exploitation. Therefore it is necessary to purchase new equipment for emergency works connected with railway superstructure which will allow increasing the repair efficiency and shortening of its time and consequently will rationalize costs, improve the quality of repairs and replace some human physical work by more efficient machines. Due to newer equipment, the number of mechanized technologies processes is expected to increase which will allow more efficient track maintenance work and shorter track closures.

The needs relating to equipment exchange and its further complementing are substantial and require considerable funds.

The Railway Research Institute in Warsaw supports Polish Railway Lines' activities to acquire state of the art equipment for emergency works by drawing up a series of studies and pre-project studies commissioned by them.

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Risk in Railway Infrastructure Investments

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The issues of risk assessment in railway transport in Poland have gained importance in recent years. Polish railway network is undergoing intensive modernization, i.e. the track superstructure elements are exchanged, technical projects and their extensive documentation are appearing. Contractors and investors as well as clients, i.e. infrastructure manager, should assess the risk on different stages of the project in all possible areas. This will allow decreasing the risk of errors that could lead to unwanted and sometimes catastrophic consequences.
The contemporary notion of risk is difficult to determine as it practically refers to all human activities. Risk is mostly defined as uncertainty, a situation that causes danger or a possibility that something wrong may happen.
Risk management involves looking for areas where a problem could emerge, identifying its sources and causes, then minimizing its likelihood and effects of its occurrence. Finally, plans to counteract and monitor the risk are drawn up for which risk analysis is used that includes two elements:

– Risk assessment which means the assessment and identification of threats, vulnerability of the system under analysis to these threats and likelihood of occurrence of effects of threats identified earlier. Risk assessment is also connected with its acceptability which should be appropriately defined. Risk should be lowered to its minimal level and at the same time rationally justified, e.g. by social, technical or economic factors.
– Assessment of risk tolerance where possible losses are compared with costs borne to present threats. This tolerance varies depending on the threat as it is easier to accept some solutions than other.

Two areas of risk analysis can be found in investments undertaken in railway transport infrastructure. The first area is external where risk results from the impact of the environment, the second one is internal where the risk originates from the project itself.
In the external area there could be differentiated the following kinds of risk:

– political risk – most often connected with political changes and their consequences; structural investments are long-lasting projects, therefore political instability increases the risk of their accomplishment;
– legal risk has its source primarily in provisions of contracts signed; legal environment in which a given investment is carried out is crucial – infrastructure building requires gaining numerous permissions: of completion, environmental, project approval, contract to supply energy, decision of compliance with spatial planning;
– social risk which appears in two variants: risk for the society (objective) relates to deterioration of life conditions resulting from limited access to certain facilities, e.g. local traffic disturbances as well as risk from the society (subjective);
– environmental risk appears when a given investment has a negative impact on natural environment – noise, problems with population movement, pollution of water, soil, air and landscape;

– financial risk including credit, currency, interest and accounting liquidity, investor's insolvency risks,
– risk of financial delays appears in case of changing conditions of financing projects or problems resulting from difficulties to obtain funds to accomplish the investment,
– market risk results from fluctuations on the market in prices of commodities, construction materials, supplies, rolling stock, machines and equipment used for building or modernization,
– risk of *force mejeure* related to natural phenomena.

Various kinds of risks may also appear within the internal area in which the risk results from the way a given project is conducted:

– project risk results mostly from deficiencies within consecutive stages of the project;
– construction risk refers to physical accomplishment of infrastructure investments, e.g. improper management, inaccessibility of materials, the building site is not adapted to requirements determined for a given investment, shortage of personnel or their inappropriate/insufficient qualifications and competence, interpersonal conflicts;
– risk of unforeseen occurrence of events that appear as a result of random and unexpected side effects of some activities that impact the investment, e.g. an accident during construction;
– technological risk refers to appropriate infrastructure design so as it could retain its functionality for several years.

Photo 1. Works on the railway line no 8

Risk assessment is vital in infrastructure investments. Therefore it should be carefully checked what can pose danger for people and environment and what preventive measures should be taken. Infrastructure is greatly important for safety, thus it must be operationally reliable and durable. Risk assessment could be applied both in big and small projects.
Costs borne for risk analysis are much smaller than the losses that project errors may lead to. Drawing attention in the proper time to the technical correctness and completeness of projects will allow avoiding many failures during the construction and further operation of railway infrastructure.

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The Railway Research Institute present at the 1st UIC Global Conference on Signalling – The Evolution of ERTMS

Andrzej Toruń
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On 26 – 28 March 2018, the 1st UIC Global Conference on Signalling, focused on The Evolution of ERTMS, was organized by the International Union of Railways (UIC), in close co-operation with Ferrovie dello Stato Italiane (FS Group), which followed the long successful history of ERTMS Conferences. It was dedicated to legal, technical and organizational issues aiming at the accelerations of ERTMS implementation, particularly in the EU Member States. The conference was a unique opportunity to exchange experience in this area, but primarily it enabled ERTMS experts' meeting.

The thematic panels were grouped into thematic sessions of different character:

1. ERTMS in the world: the Founding Challenges – there was presented an overview of the challenges for financing railway investments connected with the installation of ERTMS, the main adopted strategies worldwide and the new opportunities.
2. ERTMS today, the return of 20 years long experience world wide, there were discussed particular European countries' experiences concerning several-year ERTMS operation as well as CTCS system in China.
3. The EU regulatory context for ERTMS and Global opportunities for CCS deployment and development, there were discussed problems regarding responsibilities of particular organizations (UE, ERA, UNIFE etc.) mutually cooperating to implement ERTMS as well as issues connected with the biggest possible standardization of produced equipment.
4. Game Changer: ATO & ATS integration, there were presented currently run projects concerning integration of ERTMS with the Automatic Train Operation system (ATO), as well as the integration with the Automatic Train Supervision (ATS), which aims to optimise the rail traffic and the reduction of maintenance costs at the same time.
5. Game Changer: the Future Railway Mobile Communication System, there were presented proposals of state of the art communication systems based on LTE, even 5G, technologies for ERTMS to replace GCM-R system in the future.
6. Game Changer: The synergy between Level 3 and Satellite integration, there were presented experiences and plans connected with the application of geo-localisation technologies while implementing train traffic movement in ERTMS L3 system and data transmission.
7. "Cybersecurity" & "Safety" issues, there were identified main threats that the railway IT network is exposed to by various kinds of hacking and terrorist attacks. There were shown examples of such attacks and methods to avoid them by raising the level of security, new approach to IT network design and improving the personnel's cybersecurity competence.

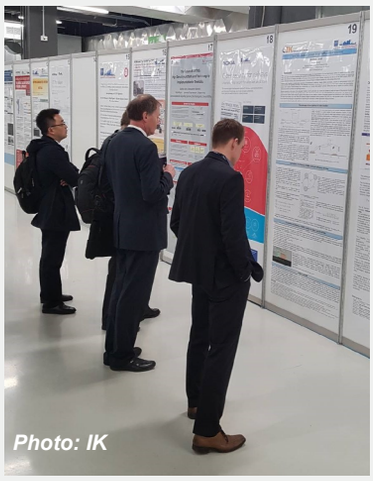
Photo: IK

An additional element of the conference was the poster session and exhibition of leading providers' ERTMS and GSM-R systems equipment which showed the latest technical solutions proposed for both systems. The Railway Research Institute's delegate Dr. Andrzej Toruń presented a paper referring to session 6 issues entitled „New train location concept for rail traffic control processes". The presentation was met with great interest of conference participants as an alternative use of GNSS class systems in order to improve fluid traffic flow and capacity on the existing railway lines without the necessity to interfere in existing infrastructure.

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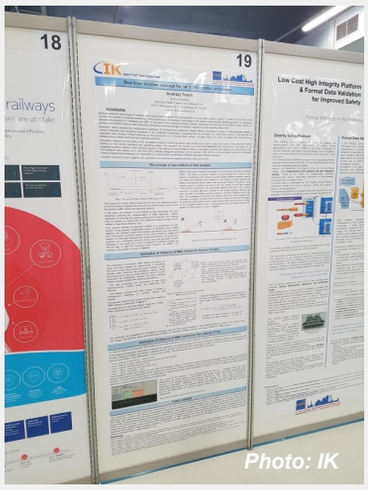

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