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IN THIS ISSUE

Editor's

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Accredited Materials and Structure Laboratory (AB 369) performs mechanical, physical and chemical tests of materials and objects used in railway superstructure, rail vehicles and electric traction as part of research work and post-accident expert reports. At the same time, employees are involved in legislative processes at the European level (including TSI SRT, EN 45454) as well as in certification processes at the Railway Research Institute. Therefore, the changes introduced in the TSI specifications in the year 2019 are being analyzed on an ongoing basis. They aim primarily at increasing the coherence of the European rail system by improving these specifications and adapting them to the so-called fourth railway package, adopted by the European Parliament and currently implemented in national law of the Member States. The Commission Regulation (EU) No 1303/2014 of 18 November 2014 on the Technical Specification for Interoperability in the scope of the aspect of 'Safety in railway tunnels' of the rail system in the European Union has also been subject to revision. The new edition of the document contains changes in the "editorial" nature, such as the updating of reference documents and the unification of the terms relating to the network of the EU railway system, evacuation and rescue operations. However, in terms of content, the most crucial changes include:

– introduction of CSM (Common Safety Methods) for risk estimation to meet the essential "Safety" requirement applicable to the "Infrastructure and Energy" subsystems,
– removal of requirements for underwater tunnels and tunnels that may cause collapse of important neighboring structures,
– changing the requirements for the location of fire fighting points,
– changing the requirements for electric cables used in tunnels,
– adding points for all tunnels with a length greater than 1 km: "Electricity supply for emergency services", "Reliability of electrical systems", "Communication and lighting in switching points",
– shortening the length of tunnels from more than 5 km to more than 1 km, for which the requirements regarding segmentation of the contact line are obligatory,
– introduction of the requirement to submit the prepared emergency plan to railway undertakings intending to use the tunnel,
– specification of requirements regarding the modernization, renewal and extension of tunnels.

The implementation of the above changes is one of the elements of the complementary process of implementing the fourth railway package necessary to confirm compliance with the requirements of the Technical Specifications for Interoperability for subsequent railway investments.

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Diploma and Badge of DIIT Honorary Professor for Dr. Andrzej Białoń

On 28 February 2019, His Magnificence Prof. Alexander Pshinko, Rector of Dnepropetrovsk National University of Railway Transport named after Academician V. Lazaryan (DIIT) in Ukraine awarded a diploma and a badge of DIIT Honorary Professor for Dr. Andrzej Białoń, an employee of the Railway Research Institute in the presence of the Director, Dr. Andrzej Żurkowski and Prof. Valeriy Kuznetsov.

Photo: IK

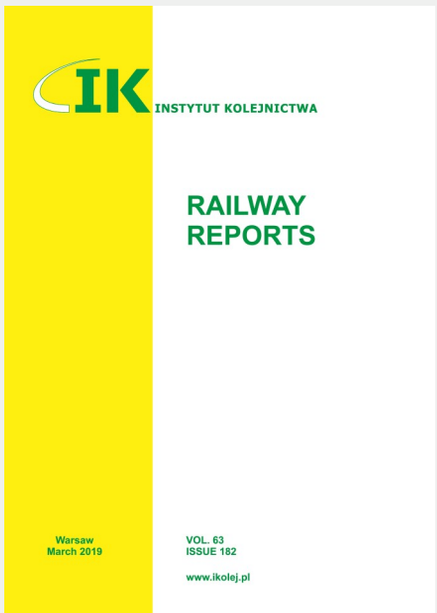
Disciplinary Commission of the Second Instance Level for Scientists and Scientific and Research Workers in Research Institutes at the Minister of Science and Higher Education

Director of the Railway Research Institute Dr. Andrzej Żurkowski was appointed to the Disciplinary Commission of the second instance level for scientists and scientific and research workers in research institutes at the Minister of Science and Higher Education for the term of 26 February 2019 – 25 February 2023. At the request of the Chairman of the RGIB, Prof. Leszek Rafalski, the following persons also joined this eminent group:

Prof. Marcin Kruszewski from the Institute of Nuclear Chemistry and Technology, Assoc. Prof. Andrzej Świderski, from the Motor Transport Institute, Karol Swadźba, MA in Law from the Research Institute of Roads and Bridges, Assoc. Prof. (in Medicine) Wiesław W. Jędrzejczak, from the Institute of Physiology and Pathology of Hearing, and Prof. Magdalena Chechlińska - as a Disciplinary Spokesperson at this Commission.

Co-financing in 2019-2020 for dissemination of science

By the decision of the Minister of Science and Higher Education, the Railway Research Institute received for 2019–2020 co-financing amounting over PLN 90,000 for tasks in the field of disseminating science. The above-mentioned tasks have been planned for the development of the scientific quarterly "*Problemy Kolejnictwa*" (Railway Reports) primarily through its internationalization, i.e. the creation of English-language versions of published articles and the increase of the share of foreign reviewers in the evaluation of the publication. Moreover, the acquired funds will be used for the anti-plagiarism verification of published articles and the digitization of publications to provide open online access to them. All these tasks are aimed at enabling the "*Problemy Kolejnictwa*" quarterly to reach the largest group of international recipients, and in perspective also to join magazines indexed in internationally recognized scientific journals databases, i.e. WoS or Scopus.



Research Institutes' Networking in Selected European Countries

Renata Barcikowska
Chief of Section of Project Coordination and International Cooperation at the Railway Research Institute

Research institutes networks have recently become a modern international trend. This solution is promoted by the Government Administration in Poland.[1] Research institutes are public organizations in many European Union's states, their functioning, however, is embedded into the binding structure of particular national systems of financing science. In western European countries, they are associated in thematic groups that form a network of specialized institutions.

In Germany, there is a vast and diverse variety of scientific specializations and innovations. Research is carried out by many different public and private institutions. The equivalent of Polish research institutes are institutes associated in the Fraunhofer Society.

Source: Source:https://www.instituts-carnot.eu/en/mot-cl%C3%A9s/carnot-network

The Fraunhofer Society is the largest non-profit organization in Europe that deals with applied research and its implementation in industry. Currently, the Society associates 72 German research institutes (Fraunhofer-Institute) representing more than eighty research sectors. Over 70 percent of Fraunhofer-Gesellschaft's research income comes from contracts with industry and publicly funded projects. Fraunhofer-Gesellschaft's research projects focus on specific applications and results. The network offers a variety of research services, pre-competitive testing, custom-based research, trainings, seminars and workshops, specially tailored consulting services for companies and public sector institutions. The Society's offer also includes publications.[2]

In France, the issues of science belong to the Directorate-General for Research and Innovation (DGRI), which proposes directions for the development of science policy and manages the necessary assets. CARNOT is a national multidisciplinary network of 29 French institutes and research and development laboratories and 9 associated research units, established in 2006. The units in the network constitute about 15% of the state research and laboratory base and employ 26,000 scientists. The French Ministry of Science and Research manages and supervises the Carnot network system. The National Agency for Research (L'Agence Nationale de la Recherche ANR) is responsible for its funding, structure and administration management.

Source: https://www.instituts-carnot.eu/en/mot-cl%C3%A9s/carnot-network

Each of the research institute in the network has its own legal separation, specialization and competence in specific research areas. The Carnot brand is awarded by the minister of higher education and research to units who effectively cooperate with representatives of the business sector and local communities. The network's activity is financed from contributions paid by individual Carnot Institutes and grants from government administration of individual ministries, local authorities and partners involved in promoting research and innovation. The CARNOT network consists of certified and accredited laboratories, teams of specialized experts whose business objective is to develop a knowledge-based economy using modern technologies and innovations. The network has been designed to develop research based on partnership, carried out by state laboratories in cooperation with socio-economic entities, primarily from the sector of small and medium-sized businesses.[3] More information on the above topic can be found in the article published in the journal Marketing of Scientific and Research Institutions.[4]

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[1] https://lukasiewicz.gov.pl/ Accessed on 25.04.2019
[2] https://www.fraunhofer.de/content/dam/zv/fhgg
[3] https://www.instituts-carnot.eu/en/mot-cl%C3%A9s/carnot-network
[4] https://minib.pl/sieciowanie-instytutow-badawczych-wybranych-krajach-europejskich

Test Track of the Hyperloop Technology at the Railway Research Institute

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Increasing demands placed on rail transport force the search for new solutions and travel models, which will allow moving at high speed, while maintaining high standards (including quality, economic and environmental requirements).
The existing transport system may be complemented by the vacuum railway technology - Hyperloop, i.e. a combination of the advantages of rail transport (close proximity to the city centre) and air transport (high speed). It is a mode of transport that uses capsules for the transfer of passengers and/or goods, moving in a tunnel with decreased pressure. The conditions in such a special tunnel, where the pressure will be reduced to about 100 Pa (i.e. about 1% of the atmospheric pressure), will significantly reduce air resistance.
The tunnel structure will be made of steel pipes, from 3 m to 5 m in diameter, attached to pillars/foundations.
Entrances and exits to passenger stations, transshipment stations and service stations will be carried out through a system of locks to ensure the tightness of the entire vacuum system. The lowered pressure will be maintained by means of high-efficiency vacuum pumps placed along the entire route.
The vacuum rail capsule will be built of lightweight materials used in aviation, which will significantly reduce its own weight. The capsule will be able to accommodate approximately 50 passengers who will be able to travel in a semi-recumbent position without being able to move around.

Fig 1. Project of a capsule

The capsule will be propelled by a magnetic cushion, i.e. electromagnets distributed along the entire length of the capsule and a guide bar mounted in the artery pipe.
From the very beginning, the Railway Research Institute has been involved in initiatives related to the Hyperloop technology. With its knowledge, experience and access to modern laboratories it has supported Polish designers of vacuum railway technology. A close cooperation between the Railway Research Institute and the Hyper Poland company allowed obtaining funding from the National Centre for Research and Development in the amount of PLN 16.5 million. The acquired funds will be used, among others, for the construction of a full-size prototype vehicle and a 500-metre-long track on the premises of the Railway Research Institute at the Experimental Test Track Operation Centre in Żmigród, where Hyperloop vehicles will be able to accelerate up to 300 km/h.

Fig 2. Hyperloop Station

The developed concept for the implementation of vacuum railway technology is to enable vehicles using passive magnetic levitation at a speed of 300 km/h to travel on the existing railway infrastructure. The installation of a vacuum system on the existing infrastructure will allow speeds of up to 600 km/h, and the construction of a separate dedicated vacuum rail route will allow vehicles to travel at speeds of 1200 km/h.
Positive results of research and tests on the experimental section will enable the use of this technology in passenger and freight transport in the future.

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Railway Research Institute's New Portable Multifunctional Highly Precise Contactless Measurement Equipment in Rail Transport

Andrzej Aniszewicz
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Metrology Laboratory of the Railway Research Institute carry out measurements with a modern portable Calipri C40 measuring device.
It enables measurements in both air-conditioned laboratory rooms as well as in particular in repair and production halls.
Calipri C40 innovative instrument can be used to inspect the condition of wheels, wheelsets brakes, rails without making contact.
We can measure:
wheel profile; wheel diameter; wheel clearance; wheel defects; tyre thickness; brake disc; rail, rail head; radial runout; axial runout; wheel shop.
The optoelectrical measuring instrument is equipped with a built-in camera and a laser unit which continuously record the outlines of the object to be measured, in this case the wheel profile, rail head profile etc. During the measurement the specially devised software evaluates the recorded data and displays it to the user. The great advantage is the fact that imprecise handling is compensated by a patented tilt correction. Acoustic and visual signals guide the operator during the measuring process.

Fig 1. Measuring set for measuring the parameters of wheelsets

The device enables measurements of objects with complex spatial shapes to verify dimensions with technical requirements specified in the drawings, documentation, in tables, CAD models, etc.
Calipri C40 device metrological features include absolute accuracy equal to < ± 0.08 mm, repeat accuracy equal to < ± 0.04 mm, profile accuracy equal to < ± 0.02 mm.
Dedicated computer software allows for the collection and analysis of measurement results obtained with Calipri C40. The software installed on a portable laptop allows taking measurements, analyzing and archiving them. Therefore, it is possible not only to reliably and quickly measure, but also to assemble and compare several measurement results, to make graphs of shape errors or to analyze changes in the geometry of surfaces progressing with wear (Calipri Analyzer).
The set includes "Wheel clearance gauge AR 1360", "Wheel diameter gauges D1050" and "Wheel diameter gauges D1350".
The pictures show examples of this device's use and obtained results of geometric dimensions wheel sets' measurements made with the portable Calipri C40 device.

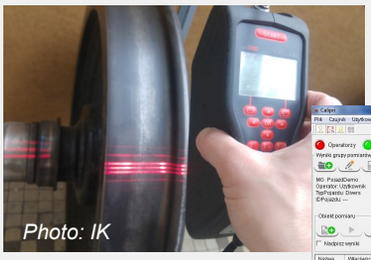

Fig 2. Wheel profile measurement

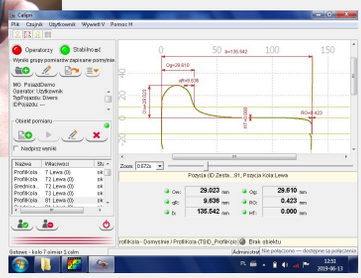

Fig 2. Dedicated computer software

The device is used to determine the dimensions of wheelsets', wheel discs', brake discs' and rails' parameters. Obtained results of measurements are used to carry out analyses in the preparation of reports and expert opinions, as well as research projects.

Fig 4. Wheel diameter measurement

The Calipri measuring device is useful at all stages of the using and operation of products. It can be used to check the wear of components and to document the quality of new or renovated parts.

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Tests of Electric Traction Units (EMU) with Prototype System Knorr-Bremse

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The effectiveness of the brake and the course of the vehicle's braking process largely depend on the characteristics of the friction coefficient of the friction brake elements. There are several problems associated with this obvious fact:

– the value of the coefficient of friction depends on the speed of the vehicle,
– the braking deceleration due to the variation of the friction coefficient is variable during braking,
– friction materials (both brake pad inserts and disc brake linings) supplied by individual manufacturers also differ in the coefficient of friction, which makes it difficult, and in some cases even impossible to substitute such materials.

The abovementioned problems have been a challenge for constructors of rail vehicles braking systems for many years. In the German company Knorr-Bremse, which is one of the world leaders among manufacturers of brake systems for rolling stock, an innovative system of active braking control was developed.

Obviously, at this point one cannot reveal details about this system (they are covered by the obligation of the manufacturer's professional confidentiality), but in general it can be stated that this electronically controlled system, due to the analysis of the braking process performed with dedicated transducers, aims to control the course of braking (of course, without the necessity of the driver's intervention), in order to obtain:

– practically constant value of braking deceleration irrespective of vehicle speed,
– improvement of the braking distances stability and repeatability,
– brake's effectiveness independence (in the extent of physical possibilities) on the type of friction materials used.

Specialists from the Railway Research Institute's Brakes Section carried out tests of an electric multiple unit (EMU) equipped with this Knorr-Bremse prototype system. The tests were conducted on the test track of the Railway Research Institute in Bychów near Żmigród.

The system was installed on the type 36WEa "Impuls" EMU manufactured by Newag Nowy Sącz - this vehicle was a typical vehicle in operation, modified for the duration of the tests.

Photo: IK

The tests' scope was very broad and included tests:

– in several states of vehicle load,
– for initial speeds of 30 km/h to 160 km/h,
– under normal conditions and in conditions of reduced wheel-rail adhesion,
– in situations simulating failure of the tested system elements.

At this point, we cannot present the results of research - they belong to our client. We are convinced that these extraordinary tests carried out by the Railway Research Institute's specialists will once again contribute to the development of braking techniques for rail vehicles.

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Reduction of Traffic Noise in Europe

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Engineering and Technical Specialist Railway Track & Operation Department of Railway Research Institute

Rail noise is a factor that has an adverse effect on the existence of human populations living in the vicinity of railway areas. In Europe, the particularly perceptible impact of rail noise is observed in countries with the highest population density, i.e. the Netherlands, Belgium and Germany. The World Health Organization (WHO), on the basis of the conducted research, determined the disorders and illnesses that people exposed to railway noise most often complained of, these are, inter alia, cardiovascular diseases, sleep disorders, hearing impairment and tinnitus or constant irritability. Since the problem of noise emitted by means of transport in Europe affects dozens of millions of people, most EU countries have taken measures to reduce it. According to the binding regulations in Poland, noise is determined for four sources: road and rail noise, aircraft noise, power lines, other sources of noise (e.g. noise from wind turbines).

In order to reduce the noise emitted by air transport, in addition to the latest technical developments in the production of jet engines, commercial flights are banned during the night hours, e.g. at Chopin airport in Warsaw, the ban is valid from 23:30 to 5:30, except for delayed flights and emergency landings. The noise emitted by road transport is limited by transferring transit traffic outside city centers, motorway bypasses are built from a special asphalt mix (porous surface), the noise emission of which is lower by approx. 5 dB from the considered to be the quietest concrete surface. Moreover, the construction of noise barriers along transportation routes contributes to the noise reduction, although their costs and controversies with aesthetics arouse a lot of emotions. Limitations related to the distance from buildings have been introduced for newly built power lines and it is recommended to design them along existing transportation routes, e.g. motorways. Wind farms can be built at a distance of not less than 10 times the height of the wind turbine with the rotor and blades from residential buildings and protected areas. In rail transport in accordance with COMMISSION REGULATION (EU) No. 1304/2014 of 26 November 2014 on the technical specifications for interoperability of the subsystem "rolling stock - noise", noise is defined for four cases: stationary noise, starting noise, pass-by noise, cab-noise.

The most perceptible noise is the pass-by noise, because it concerns the largest group of people, along the railway routes, because it grows linearly with increasing speed. Limits for pass-by noise for various types of rail vehicles are presented in Table 1.

Table 1

Category of the rolling stock subsystem	$L_{pAeq,Tp,80\ km/h)}$ [dB]
Electric locomotives and OTMs with electric traction	84
Diesel locomotives and OTMs with diesel traction	85
Electrical Multiple Units (EMUs)	80
Diesel Multiple Units (DMUs)	81
Passenger coaches	79
Freight wagons	83

It should be remembered that the noise level is measured on a logarithmic scale and increasing the sound intensity by 10 dB gives the impression of a double noise increase. The contact between the wheel and the rail generates the most noise during train journeys and it depends mainly on the condition of the railway infrastructure (roughness of the rails) and the condition of the running surface of the wheels (wheel roughness). The reduction of noise emission in the wheel-rail contact, i.e. the reduction at the source, gives the most tangible effects. Fig. 1 shows the sources of noise emitted by the passenger train during pass-by - the biggest noise is generated in the lower parts of the vehicle.

Fig 1. Noise emission in various parts of rail vehicle

Fig 2. A low acoustic screen that protects the rolling noise emission

In order to reduce the roughness, the rail rails are subjected to cyclic grinding treatments that allow to reduce the noise to 5 dB. To reduce rolling noise, acoustic screens up to 1 m high are sufficient. In new passenger rail vehicles, disc brakes are used and the traditional brake system is replaced for the disc brake in the modernized ones. Such modernization is associated with an increase in the weight of passenger cars (air conditioning, use of current converters, or toilets with closed circulation), which makes traditional brake with iron blocks not meet the required brake performance, which in turn translates into excessive wear and overheating of friction brake pairs. New freight wagons are constructed on the basis of a block brake with brake blocks made of K type organic materials (with a high coefficient of friction). Freight wagons, which until now have been used with cast iron brake blocks, are being modernized in accordance with the UIC guidelines. The rim wheels are replaced by monoblock wheels and the cast iron inserts are replaced with LL composite inserts with low coefficient of friction. Roughness of the wheel surface during interaction with cast iron inserts is about 2 μm, and interaction with composite inserts about 0.5 μm. For rails maintained in accordance with ISO 3095 (medium smooth rails) the noise of a passing train equipped with cast iron inserts is 92 – 95 dB and the train equipped with composite materials inserts (K and LL) is 80 – 85 dB. The difference is significant, which confirms the validity of placing composite friction materials implementation on the market. However, it should be remembered that only proper operation, proper periodic inspections and trained staff allow for trouble-free use of freight cars equipped with a composite braking system, because the smoothed wheel surface increases the possibility of blocking the wheels in the wagons.

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13th International Railway Fair TRAKO 2019

The fair is held biennially, with it's first edition in 1996.

ALL TRACKS LEAD TO TRAKO

- Poland's largest and most prestigious meeting of the rail transport industry
- Europe's second-biggest railway show in terms of size and importance
- 20,000 m^2 exhibition space
- 800 metres of display track for metropolitan, regional, long-distance and freight rolling stock, as well as track machinery and equipment
- exhibits from leading Polish and European manufacturers of railway / tram rolling stock and on-track machines
- innovative solutions for infrastructure, transport management systems, new technologies in rolling stock equipment and furnishings

TRAKO CONNECTS

TRAKO is a meeting place for rail and tram businesses: organisers and operators,
technology providers, manufacturers, distributors, central and local authorities,
experts, engineers, investors, railway enthusiasts.

TRAKO INSPIRES

TRAKO is a place for debate, exchange of experience and finding the best solutions. More than 30 events-debates, seminars, conferences and presentations -with international attendees addressing the industry's most current priority subjects.

TRAKO SUPPORTS

For many years, the TRAKO FOR KIDS Charity Fundraiser has been brought to you by the TRAKO Exhibitors and Organisers. This year, the proceeds go to the patients in the care of the Dr Clown Foundation, which runs the Laughter Therapy programme in Polish children's hospitals, special facilities, welfare centres, social therapy centres, children's homes and everywhere else where there are sick, disabled children.
TRAKO FOR KIDS is a railway-themed art competition for children and young people. The competition's finale is an auction of the works by the talented young artists – the winners – at the TRAKO GALA evening.

TRAKO PROVIDES OPPORTUNITIES

Career Day is a special event addressed to both young people who begin their professional career and to the TRAKO exhibitors.
It promotes attractive job, internship and traineeship opportunities among college students and graduates. It also enables employers and candidates to get in touch directly, making it possible to compare job offers.

TRAKO BUILDS UP PRESTIGE

TRAKO is accompanied by prestigious competitions:

- The Józef Nowkunski Special Award-for completed line projects and enclosed buildings, as well as designs for new rail infrastructure projects implemented in Poland and rail rolling stock authorised for placing in service in at least one EU Member State and presented at TRAKO 2019.
- The Ernest Malinowski Award-for products and technical innovations applied in the rail industry and presented at TRAKO 2019.
- The Prof. Czesław Jaworski Award-for outstanding achievements in the application of new technologies and equipment in electric traction.
- The SEP Association of Polish Electrical Engineers President's Medal.
- The Prof. Jan Podoski Award-for the best products, innovative technical solutions and state-of-the-art technologies addressed to electric traction in urban transport.
- TRAKO 2019 Best Company Stand Design Award.

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