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70 years IK RAILWAY RESEARCH INSTITUTE

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IN THIS ISSUE

Editor's

Jolanta Radziszewska-Wolińska

Head of Materials & Structure Laboratory

Dear Readers,

The Covid-19 virus pandemic almost suddenly introduced many changes in the lives and principles of functioning of individuals and entire societies. The introduced sanitary restrictions requiring an increase or even limitation of direct contacts forced the cancellation of many planned events also in the railway area, such as conferences, exhibitions, fairs or meetings of working groups. After a period of isolation and a break, there was an interest in online meeting tools. They had already entered professional practice, including at the Railway Research Institute, and in many cases allow reducing the time of meetings. However, online contacts will not fully replace the atmosphere of live events, nor do they provide the opportunity to conduct very important backstage conversations and make new contacts. Nevertheless, the CEN / TC256 WG01 Working Party on the revision of the EN 45545 series of standards Railway - Fire protection in rail vehicles, led by the French chairman, in which we are actively involved, continues to hold online meetings. The first hybrid meeting is scheduled for November.

The annual Fire Protection of Rolling Stock conference in 2021 was organized on-line. This year, the organizers had already decided to organize it live on February 23-24, traditionally in Berlin. However, the attendance was much lower than in the years before the pandemic.

Therefore, the conference organized on March 15 on the occasion of the 70th anniversary of the Railway Research Institute and the 25th anniversary of the IK Experimental Track Operation Centre in Żmigród, about which more information will be found in previous issue of the Newsletter, was received with great satisfaction. In this issue, we can also read the report on the 5th international conference on Modern Trends for Fire Protection of Rolling Stock, organized by our Institute, which took place on May 10-11, after a four-year break due to the pandemic, but with an attendance equal to the previous edition.

Also after a longer break, the World Congress on Railway Research 2022 was held on June 6-10 in Birmingham on the topic: Reshaping our railways post-pandemic: Research with an impact.

The congress was attended by scientists and experts from all over the world, and the attendance here also did not match that of years ago. The Railway Research Institute was represented by Przemysław Rakoczy, PhD Eng. from the Materials and Structure Laboratory with a paper entitled Puncture Resistance of Railroad Tank Wagons Used in the Transportation of Hazardous Materials - Comparison of requirements and performance between the EU and the USA.

At the Institute, we also returned to direct contacts with our partners and clients, both domestic and foreign, including: study visit of Bulgarian representatives (10 June 2022) oraz study trip of Georgian representatives (13 and 14 July 2022).

In September, the Institute will participate in the Innotrans 2022 International Transport Technology Fair, organized in Berlin after the Covid break. We hope for a fruitful participation, appreciating the possibility of direct contacts more than before.

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Status of Notified Body no. 1467 and Designated Body

On 27 June 2022, by decision of the President of the Office of Rail Transport no. DTW-SJOZ.810.4.2022.KP, the Railway Research Institute was designated to perform the tasks of a designated body for assessing the conformity of the INFRASTRUCTURE, ENERGY, CONTROL-COMMAND AND SIGNALLING Track-side and On-board, and ROLLING STOCK subsystems with the relevant national technical specifications and standardisation documents, the application of which enables meeting the essential requirements of the railway system. Due to this decision, which is required by Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union and the Act of 28 March 2003 on railway transport (consolidated text Journal of Laws 2021 item 1984, as amended), which implements it into Polish legislation, the Railway Research Institute will be able to continue its certification activities in this respect. Currently, the Railway Research Institute has the status of Notified Body no. 1467 and Designated Body. All matters related to the implementation of conformity assessment processes, certification and verification are conducted on behalf of the Railway Research Institute by the Quality and Certification Centre (tel.: +48 22 47 31 392, fax: +48 22 61 23 132, e-mail: ik@ikolej.pl)

Study visit of Bulgarian representatives to the Railway Research Institute

On 10 June 2022, the Railway Research Institute hosted representatives of the Bulgarian Railways. The study visit was also attended by Bojidar Kostadinov, Deputy Minister of Transport and Communications of the Republic of Bulgaria. The meeting included discussions on, inter alia, the possibility of cooperation between the Bulgarian Ministry of Transport and the Railway Research Institute. Other topics concerned experience in combining testing and conformity assessment body functions (NoBo, DeBo), safety and interoperability assessment, digitisation of rail transport.

Study trip of Georgian representatives to the Railway Research Institute

On 13 and 14 July 2022, the Railway Research Institute hosted representatives of Georgia. The study trip was attended by representatives of the Ministry of Economy and Sustainable Development of Georgia, JSC "Georgian Railway" and employees associated with the implementation of the twinning project GE18 ENI TR 04 19.

The programme of the visit included getting acquainted with the scope of the Institute's activities carried out by its departments, laboratories and the Quality and Certification Centre, learning about the type of work carried out and viewing the equipment and instruments used in research work, as well as visiting the Test Track Operation Centre in Żmigród.

Cooperation agreements

On 11 May 2022, the signing ceremony of a cooperation agreement between the Military University of Technology and the Railway Research Institute took place at the Institute of Electronic Systems of the Electronics Faculty of the Jarosław Dąbrowski Military University of Technology in Warsaw.
The signed agreement is aimed at scientific and didactic cooperation, mutual acquisition and implementation of R&D and educational projects. The cooperation will be pursued in the area of student or research internships in the Railway Research Institute's specialized laboratories, joint organisation of scientific seminars for scientific, research and technical employees, doctoral students and students, mutual participation in scientific and technical conferences, and exchange of experience in the field of scientific research.

On 30 June 2022, at the headquarters of the Railway Research Institute's premises in Warsaw, cooperation agreements were signed between the Main School of Fire Service and the Railway Research Institute. The agreement is aimed at cooperation in areas of activity related to fire safety.
The cooperation will be pursued in the scope of, inter alia, joint implementation of scientific undertakings, preparation and implementation of didactic, research and development and educational activities, as well as research and scientific projects.

Standardization of Selected Interfaces of Railway Rraffic Control Equipment and Systems

Andrzej Toruń
Head of Railway Traffic Control and Telecom Department, Railway Research Institute

In May 2022 the 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 Center for Research and Development and PKP Polskie Linie Kolejowe S.A. (Polish Infrastructure Manager) was completed.
The last phase (stage 9) of the project was to verify the results of conceptual and design works in real conditions and to confirm the results of laboratory tests.
The first step in the field tests of the IXL-LB interface was to prepare, in laboratory conditions, the implementation of an interface based on the UDPS data exchange platform in real station devices system type MOR-3 (interlocking system) and line block system type CBL 2010. The IXL-LB interface tests were performed on a test stand in the Producer's laboratory. The test stand includes:
a) line block system simulator in accordance with the specification developed in the project,
b) computer system of station devices type MOR-3 with implemented application data Brzeźnica - Generation. 59 2021-12-30 15:54, compliant with the conditions defined for the test site, based on the technical documentation of the traffic control devices at the test site,
c) computer simulator of external devices cooperating (semaphores - light chambers, isolated sections) - remote cassette simulator in the MOR-3 system.

Photo 1. Laboratory stand for tests - general view

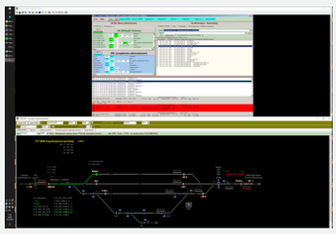

Photo 2. Test stand screen: line block simulator (top window), MOR -3 test stand (bottom window)

Simulation software IXL-LB simulator compliant with the specification was installed on the computers of the test stand:
a) BRIK_Symulator_urzadzen_LB_.exe - line block simulator,
b) MOR-3_application data Brzeźnica - Generation 59 2021-12-30 15:54.
In the next step, the application data for the CBL 2010 system (line block system) was checked in the IXL simulation conditions. Simulation software IXL-LB simulator compliant with the specification was installed on the computers of the test stand:
a) BRIK_Symulator_urzadzen_IXL_.exe - interlocking station device simulator,
b) CBL 2010_application data Brzeźnica - Generation 59 2021-12-30 15:54.
The last step of the tests to verify the correct operation of the UDPS platform were the tests of the IXL-LB interface (MOR-3 - CBL 2010) for the correctness of data exchange in real devices.
Tests with the use of real rail traffic control systems and simulators allowed verifying the correctness of the application data implemented in real rail traffic control systems MOR-3 and CBL 2010 before their installation on the test site.
Conducting field tests on a selected test site required the implementation of application data in the MOR-3 and CBL 2010 systems corresponding to the real conditions of the test site according to the provided executive documentation.

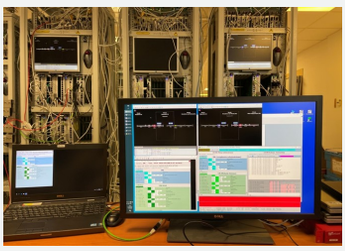

Photo. 3. Test stand: IXL simulator - CBL 2010 line block devices

The ninth stage of the project included field tests of the interface between the interlocking system IXL and the line block system LB (IXL-LB interface). The effects of the project stages so far, such as e.g. aspects of transmission safety and cybersecurity, analysis of interface models, results of simulation tests carried out with the use of IXL-LB interface models have been presented in the series of publications to date.
For this purpose, tests were conducted on real signaling systems in use on an exploited railway network. The field tests were carried out in real operating conditions on the PKP PLK S.A. infrastructure. The test site was located on the railway line no. 146 on the Brzeźnica - Cykarzew route. The IXL-LB interface based on the UDPS platform was implemented in the operated by PKP PLK S.A. systems: MOR-3 (interlocking system) and CBL 2010 (line block system).

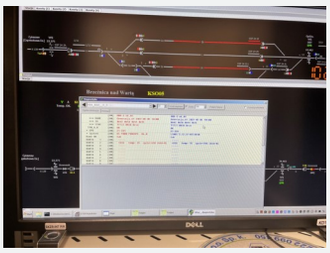

Photo. 4. Test stand: IXL simulator - CBL 2010 line block devices

The purpose of the tests was:
– obtaining reliable information on functionality, safety and reliability in relation to the interface based on the UDPS data exchange platform in the conditions of the actual operation of the devices.
– obtaining reliable information on the types and causes of possible errors in the operation of the UDPS protocol and their impact on cooperating with each other railway traffic control devices (rtc).
The equipment of the training ground during the tests consisted of the following configuration:
1) MOR-3 system at the Brzeźnica station (with application data in the version after laboratory tests),
2) CBL 2010 system at the Brzeźnica station (with application data verified in laboratory tests),
3) CBL 2010 system at Cykarzew station (no changes in software),
4) The existing stand of the dispatcher (desktop) at the Brzeźnica and Cykarzew stations (no changes in the software).
As part of the field tests, the MOR-3 and CBL 2010 systems for the Brzeźnica - Cykarzew route were operated as in normal operating conditions by an employee of PKP PLK S.A. and formed the basis of railway traffic management.
The obtained positive results of the performed operational tests confirmed that the LB-IXL interface built on the UDPS platform was implemented in actual operated on the PKP PLK S.A. network railway traffic control devices (digital line blockade CBL 2010 and in the computer system of station devices type MOR-3), ensures full functionality of the cooperating systems (in the full range of data transmitted in real time: status telegrams, commands and messages) ensuring the correct functionality of traffic management on the trail and at exits to the trail and entrances from the trail to the station).

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Railway Research Institute's Participation in Rail Accessibility Improvement Projects

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The Program for Supplementing the Local and Regional Railway Infrastructure, referred to in short as Kolej Plus, is dedicated to proper planning and support of investments improving passenger rail transport at the regional and interregional level, as well as rational and coherent actions supporting the directions of the Polish railway network development.
The Program enables:
– efficient process of preparation and implementation of railway investments in selected localities,
– use of the PKP PLK S.A. experience and potential by local government units in the preparation and implementation of railway projects,
– preparation of documentation enabling the implementation of railway investments and the implementation of investment tasks,
– promoting rail transport in towns without access to railways.

The program is addressed to local government units and metropolitan associations that are interested in launching railway connections in their area. These entities bear only 15% of the investment costs on their own. The Program implementation period covers the years 2019–2028.
The initial budget of the Program: PLN 6.5 billion, increased by PLN 5.6 billion, which ultimately gives a total of over PLN 11 billion for the implementation of projects intended for financial support.
Ninety-six applications were submitted to the Program, which were analysed and formally assessed. The railway infrastructure manager - the company PKP PLK S.A. - prepared a ranking list of eligible projects, which included 79 applications meeting the criteria and objectives of the Program. The next stage was the preparation by local governments of preliminary planning and forecasting studies, as well as obtaining the necessary documents, opinions and conclusions from public consultations, including documentation confirming the security of financing at least 15% of the investment value and a declaration of the competent transport organizer, concerning the launch and financing for 5 years at least 4 pairs of trains a day.
This stage was completed by the multi-criteria evaluation of the submitted projects. Ultimately, 34 railway infrastructure investments in 11 voivodships were qualified for support and implementation under the Kolej Plus Program:
– 10 line revitalization projects with a total length of approx. 315 km,
– 14 projects for the reconstruction or extension of the line with a total length of approx. 516 km,
– 7 new line construction projects with a total length of approx. 189 km,
– 3 documentation projects concerning approx. 183 km of railway lines.

The Railway Research Institute participated in the preparation of documentation for the following projects:
– Supplementing the railway network with a railway connection between Jastrzębie-Zdrój and Katowice,
– Revitalization of the railway transport route on the railway lines No. 390/236 Czarnków – Rogoźno – Wągrowiec,
– Revitalization of the railway line No. 369 on the Śrem – Czempiń section,
– Construction of the Kraków – Olkusz railway connection,
– Construction of the Kraków – Niepołomice railway connection.

The scope of the tasks performed included, in particular, the acquisition of data and definition of infrastructure variants, operational analyses with the evaluation of proposed solutions as well as traffic and transport forecasts for investment variants.
All 5 projects in preparation of which the Railway Research Institute participated were included in the Kolej Plus Program. The implementation of these investments will improve transport accessibility in the Małopolskie, Wielkopolskie and Śląskie voivodships, and thus will effectively reduce the problem of transport exclusion.

The Program includes 3 components:

Component	Assumption
Investment	It includes the completion of the railway network in order to enable train connections to towns with a population of over 10,000. people with no access to rail transport, with voivodship cities and improvement of internal communication and socio-economic cohesion of Polish regions.
Organization of passenger transport	Improving passenger rail transport at voivodeship borders (junctions) and launching new connections between neighbouring voivodeships on lines that currently are not operated or operate to a limited extent, as well as on new sections of railway lines. It will be possible due to the extension of the network of voivodeship connections deep into the area of the neighbouring voivodeship (no more than 30 km from the voivodeship border), to a larger urban centre generating larger flows of passengers.
Protecting railway infrastructure against decommissioning	Stop the degradation of the railway infrastructure, including transport corridors. This also applies to railway lines covered by the decision to close them. This will enable the protection of infrastructure routes that already show transport potential or this potential will appear in the future, by leaving the ownership sphere to the railway infrastructure manager (PKP PLK S.A.), other companies of the PKP Group or the State Treasury.

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New Research Potential for Photometric Measurements of IK Signalling and Telecommunication Laboratory

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Lighting technology is an area which covers methods, based on scientific theory, of producing, forming, distributing, measuring and using light in order to make objects and their surroundings visible. It is a relatively broad field, with a complex knowledge base and extensive applications.

The theory of this field is based on knowledge derived from physics, chemistry and electrical engineering, primarily in the areas of radiation, high vacuum, materials science, electrical metrology including photoelectric receivers. Moreover, it is also built on knowledge stemming from the physiology of the eyes. It is created to a significant extent on the basis of the results of specially conceived and performed experiments having used the human being as a measurement instrument to record experiences resulting from contact with the environment, in particular visible radiation.

The primary divisions of lighting technology are quite differentiated and are actually further subdivided. These can include: light sources, luminaires, photometry, colorimetry and lighting technology.

As far as light sources are concerned, specifically electrical light sources, constructional and technological issues dominate. They concern the manufacture of light bulbs and various varieties of discharge lamps, e.g. fluorescent, mercury vapour, sodium vapour, as well as auxiliary equipment enabling the ignition and lighting of discharge sources. Another issue is luminaires made with modern led technology (LED). There are also operational issues relating to light sources and their correct operating conditions.

Different constructional and technological aspects dominate the luminaire issue. These concern the formation of the light distribution emitted by the sources and the practical connection of the sources to the mains supply. They also refer to temperature, mechanical and aesthetic issues. There are also operational matters concerning the characteristics of the luminaires and their desired use.

The scope of photometry includes the measurement of light, from which the values of basic quantities and many indicators characterising light sources, luminaires and the effects associated with the use of light to make objects and their surroundings visible are determined.

The area of colorimetry includes the measurements and calculations of the colour of light. They are carried out to determine certain characteristics of light sources and the effects associated with their use.

Lighting technology includes ways of using light to make objects and surroundings visible, i.e. to illuminate.

In connection with the intensive development of the Signalling and Telecommunications Laboratory of the Railway Research Institute in Warsaw, owing to purchases of new measurement equipment as well as the construction of new test stands primarily in the field of electromagnetic compatibility (EMC), an open tender was launched in 2021 under the 'Public Procurement Law' procedure for the delivery of a new test stand for photometric measurements. The modern test stand was completed in 2022 by the company GL OPTIC Sp. z o.o. Sp. K. from Puszczykowo near Poznań as part of the RPOWM project: "RPMA.01.01.00-14-9845/17-00 Purchase of modern research and laboratory equipment for the Railway Research Institute".

Photo 1. Goniophotometric test stand with mounted dwarf signalling device for testing

The aim of this investment was to purchase laboratory and research equipment for the three departments of the Railway Research Institute: the Materials and Construction Laboratory, the Electrical Power Engineering Department and the Signalling and Telecommunications Laboratory. The state-of-the-art equipment will allow research tasks to be carried out in the area of strength testing, fire safety of rolling stock components and rail transport infrastructure and fire testing. It will also allow research and development work to be conducted in the field of electric traction and power supply. The development of research facilities will also enable specialised EMC and photometric research to be performed.

A state-of-the-art 15-metre long test stand for photometric measurements of the Signalling and Telecommunications Laboratory located in the modernised building 26 in the photometric laboratory (photometric darkroom) carries out photometric measurements for railway purposes. The supplied measurement equipment includes 3 new test stands:

a gonio-photometric test stand to measure the directionality of light, consisting of a GLGA 50-1800 goniometer with a control panel and hand-held transmitter, an OLS + Flicker photometer and auxiliary equipment in the form of two dedicated AC and DC power supplies to supply the test object mounted on the goniometer and a computer workstation with control software to perform tests and automatically generate reports of measurement results,

Photo 2. Measurement stand for measuring the luminance of a luminous surface

measurement stand for measuring mean luminance and luminance uniformity of the illuminating surface, consisting of a GL_OPTICAM 1.0 matrix luminance meter with two dedicated lenses, 3 types of grey filters and dedicated software for conducting the tests.

The above photometry and colorimetry test stands will be used for incandescent and LED railway equipment:

Light intensity by the goniophotometric method with a moving object according to PN-EN 13032-1+A1:2012, PN-EN 13032-4:2015+A1 and CIE.

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HuFRAS – Human Factor Railway specific Analytic System

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The risk management process as part of the ongoing day-to-day operations not related to the necessity to implement the changes referred to in *Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009* requires current monitoring and management of the level of risk.
The fourth railway package implemented on 31 October 2020 in accordance with the provisions of the Railway Safety Directive , inter alia, highlights the role of the human factor in the rail transport safety system. Taking into consideration that the primary task carried out by infrastructure managers is the safe provision of infrastructure to railway undertakings, one of the aspects influencing this process is the aforementioned human factor. Certified safety management systems (SMS) developed by infrastructure managers and railway undertakings must take into account the capabilities and limitations of staff and their performance within the limits of current procedures and rules. In view of the above, a risk evaluation and assessment method dedicated to the human factor must be considered necessary. Unfortunately, not every known risk evaluation and assessment method is suitable for every workplace. This article presents a risk evaluation and assessment method dedicated to railway safety jobs.
The exclusive Human Factor Railway specific Analytic System - HuFRAS method developed by the author was based on the analysis of combinations of probability and effect factors.

$$R(K_{D_m}, T_{P_m}) = P(K_{D_m}, T_{P_m}) \cdot S(K_{D_m}, T_{P_m})$$

The probability depends on the size of the organisation, whereby the effect depends on the Competence of the Train Dispatcher (KD) and the difficulty of the post (TP), including the current traffic situation – the scale of operational disturbance in deteriorated operating conditions.
The competence of a train dispatcher (KD) depends on Knowledge (WI), Experience (DO), Perceptual Abilities (ZP) and Soft Skills (UM). Due to the detailed definition of physical and mental health conditions in Appendix 2, the developed method did not take into account the health conditions that the employee must fulfil.
In terms of KD, factors impacting the amount of effect were identified and the following parameters were defined:
– level of education - H_{PW},
– seniority in office - H_{SP},
– seniority in post - H_{SPS},
– number of training courses per year - H_{SZK},
– age of employee - H_W,
– length of rest before on-call duty - H_O,
– soft skills – H_{UM}.
The above parameters are presented in the following formula:

$$K_D\,(WI, DO, ZP, UM) = \langle H_{PW}, H_{SP}, H_{SPS}, H_{SZK}, H_W, H_O, H_{UM} \rangle$$

The TP parameter of difficulty on the point depends on the technical (WT) and operational (WR) conditions occurring at that point. In this respect, the factors impacting the level of difficulty of the train dispatcher's work at a given operating control point (group of operating control points with the same parameters) were identified and the following parameters were defined:
– state of the railway superstructure - T_{SN},
– visibility at the operating control point - T_{WP},
– type of command control and signalling equipment - T_{USRK}
– amount of train work - T_{WPP},
– amount of shunting work - T_{WPM},
– shunting work quotient - Q_{TWPM}
– supervision of operating control points work - T_{Np}
The above parameters are presented in the following formula:

$$T_P\,(WT, WR) = \langle T_{SN}, T_{WP}, T_{USRK}, T_{WPP}, T_{WPM}, T_{NP} \rangle$$

The proposed method can be used to verify:
– the division of operating control points and train dispatchers into groups,
– the relation of the specific train dispatchers competence to the pool of operating control points,
– the relation of the difficulty of specific operating control points to the pool of train dispatchers,
– risks and trends over a longer period of time,
– the shift model,
– soft skills,
– and compare risks and trends in different parts of large organisations.

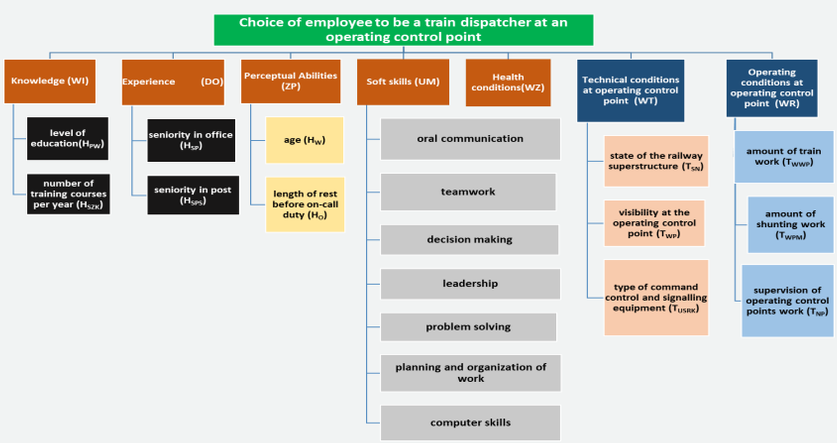

Fig. 1. Key risk factors
Source: the author's own elaboration

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Development of an Anti-Theft System for the Overhead Contact Line in Railway Transport

Valeriy Kuznetsov
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Theft of overhead contact line components is a serious problem for infrastructure managers, railway operators and passengers. Criminal activities result in significant material losses related to:

- the need to repair the overhead contact line (OCL);
- the need to repair damaged rolling stock,
- train delays,
- the need of substitute communication.

The analysis of existing technical solutions monitoring the state of the OCL network in many European railway administrations shows that the main emphasis in these solutions is on ensuring the correct operation of the network and safety in case of breakage, not anti-theft diagnostics. Therefore, there are few solutions on the market that detect attempted theft and so-called intelligent theft (e.g. when a thief steals only a contact wire or only a carrier cable). These types of thefts are not detected by existing systems, because they react to the fact of a blackout. And "intelligent" theft, in addition to material losses related to the mere fact of theft, has another important aspect i.e. the lowered traction line as a result of criminal activity may damage the current collector on the locomotive, which additionally poses a threat to safety and causes financial losses associated not only with the need to perform repairs (replacement costs), but also delays of traffic. Therefore, the development of a system for detecting attempted theft and theft carried out in an "intelligent" manner (e.g. theft of the carrier cable itself or the contact wire itself) is a priority.

In order to detect such "intelligent" thefts, the Railway Research Institute together with company NEEL Ltd. developed an innovative anti-theft system under the project No.: POIR 04.01.01.00-0018/17 co-financed by the National Centre for Research and Development entitled: "Development and implementation of elements of the anti-theft system of the overhead contact line in rail transport".

Fig. 1. Installation of the anti-theft system on the IK test track

In order to check the anti-theft system functionality, the system was installed on the 2C120-2C-1 overhead contact line on the IK test track and on the access track on the C95-2C overhead contact line. During the tests, the OCL was normally operated. The anti-theft system was checked under controlled real-life conditions. In addition, during the tests, the system was checked for its response to a change of the tension of contact wires and carrier cables; attempts to cut the contact wire, attempt to cut the carrier cable, switching off the voltage in the OCL, tool manipulation at the contact wires and carrier cables.

All sensor indications and recorded data during the tests were read via the website on the server of the consortium member – NEEL Ltd. (Fig.2 and Fig.3)

Fig. 2. The view of the information panel in the state of alarms

The audible signals recorded during the tests from the vibration sensors are the basis for teaching the neural network to generate warning signals for staff via SMS. On the basis of the research, a database of sound signals was obtained during attempts to cut the OCL with a saw, grinder, strikes of some bodies on the OCL (hammer, beam).

The tests were carried out near the vibration sensor and in the middle of the tension section, where the distance from the vibration sensor is maximum. The tests showed that the nature of sound vibrations caused by foreign bodies is different from the nature of vibrations caused by the interaction of the contact line with the pantograph during normal operation.

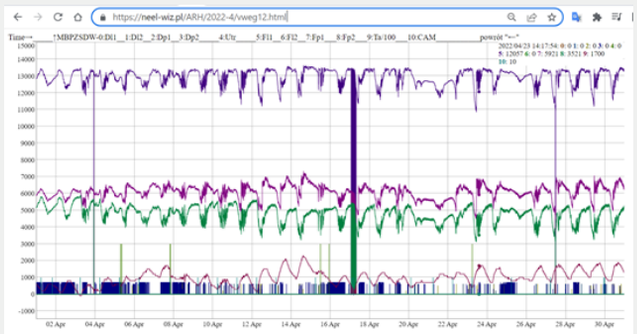

Fig. 3. Example of tension changes of carrier cables and contact wires and diagnostic signals

The operational tests of the anti-theft system have shown that the system correctly records the changes in the tension force of contact wires and carrier cables and records the vibrations of these elements. In the case of changes in the tension of contact wires or carrier cable exceeding 10%, the system generates warnings sent via SMS. In the case of major changes in the tension force (greater than 25%), the system generates an alarm about this event.

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5th International Conference "Modern Trends of Fire Protection of Rolling Stock"

Jolanta Radziszewska-Wolińska
Head of Materials & Structure Laboratory, Railway Research Institute

The subject concerning fire safety of rolling stock has a relatively short history compared to other studies in the railway area. Its beginning dates back to the 1970s, when the number of fires in passenger rolling stock, which was increasing year by year, influenced the search for tools for fire safety assessment, and then directions for fire prevention. Currently, the issues related to fire protection of passenger rolling stock constitute a very wide and rapidly developing field. It has an international character, in which the Materials and Structure Laboratory of the Railway Research Institute plays a vital role. On May 10-11 this year, we were the organizer of the 5th international conference "Modern Trends of Fire Protection of Rolling Stock" connected with the "Modern and safe rolling stock equipment" Exhibition.

The conference enjoyed the honorary patronage of the Minister of Infrastructure, the President of the Office of Rail Transport and the President of the Rail Industry Fire Association (RIFA). The media patronage was assumed by the following magazines: Raport Kolejowy, Wolna Droga, Kurier Kolejowy, as well as German magazines: Cargo-Manager Journal and Rail & Mobility.

One hundred and twenty-five delegates from Austria, the Czech Republic, France, Finland, Spain, Germany, Switzerland, Italy, Great Britain, the United States and Poland participated in the conference. The guests included representatives of state administration, research units, universities, operators, rolling stock manufacturers, producers of non-metallic materials and vehicle components, and producers of fire detection and extinguishing systems.

During four plenary sessions, 18 papers were presented by the following European and American experts and specialists in the field of fire protection: Andrews Robert (The Catalpa Falls Group, LIC, USA), Barbagli Michele (TUV, Germany), Bartoletti Luca (FIR. EX. S.R.L., Italy), Bünker Jörg (Saertex Gmbh & Co. KG, Germany), Cash Tony (RIFA, UK), Cremoncini Andrea (Ingegneria Dei Sistemi Elettonici S.R.L., Italy), Diana Paolo (Trenitalia S.P.A., Italy), Dinmore Neil (RSSB, UK), Dirksmeier Roger A. (FOGTEC, Germany), Guillaume Eric (EFECTIS, France), Kiehl Julien (Walter Mäder Agcomposites, Switzerland), Kober Jeffrey F. (Milwaukee Composites Inc., USA), Malinverno Davide (ELANTAS Europe, Italy), Mrozik Wojciech (Newcastle University, UK), Pawlik Marek (Instytut Kolejnictwa, Poland), Pauli Wojciech (Firma Handlowa Barwa, Poland), Radziszewska-Wolińska Jolanta Maria (Instytut Kolejnictwa, Poland), Tarka Izabela (Instytut Kolejnictwa, Poland).

The presented issues covered the current requirements and the state of European legislation in the field of fire protection of rolling stock, directions and results of research in the field of material modification, including tests that were carried out at the Railway Research Institute. International projects concerning the organization of rescue operation exercises according to scenarios of potential dangerous events in passenger rolling stock were also discussed. A novelty at our conference was a block of papers on the dangers of using lithium-ion batteries in railway infrastructure.

The summary of the discussed topics was the Discussion Panel, in which the participants of the conference had the opportunity to receive answers to the questions bothering them in the field of fire safety of rail transport. After the Discussion Panel was completed, a very popular visit to the Materials and Structure Laboratory of the Railway Research Institute followed. Discussions were also held at the accompanying "Modern and safe rolling stock equipment" Exhibition, in which the following companies presented their latest offers: ASTE Sp. z o.o., Areo-X AG., Fir. Ex S.R.L (Fire Kloud), Milar Sp. z o.o., FOGTEC Brandschutz GmbH & Co. KG, El-Cab Sp. z o.o., GFWW GROWAG Sp z o.o., Walter Mäder AG Composites, Milwaukee Composites, RIFA (Rail Industry Fire Association), ISE S.R.L and Railway Research Institute.

The reviewed papers will be published in a monograph.

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