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Editor's

Andrzej Żurkowski
Director



The Railway Research Institute is a basic research unit in the area of rail transport in Poland subordinated directly to the minister with the responsibility for transport.

The main aim of the Institute's activity is to conduct research and development works in railway industry. The Institute employs many outstanding

specialists from various technical and technological areas of rail transport. The Institute has got also on its disposal a variety of specialized test stands.

The Railway Research Institute is an owner of the test track centre in Żmigród suitable for field tests.

The Institute as a Notified Body has got the widest powers to certificate products.

It holds accreditation granted by the Polish Centre for Accreditation (AB 310, AB 369, AB 742, AP 024, AC 128 and AC 185 certificates) in the area of testing, assessment and certification of products and quality management systems. It is a notified body NB 1467 under Directive 2008/57/EC on the interoperability of the rail system within the Community according to EC conformity assessments to all interoperability constituents, as well as EC conformity verification for all structural subsystems constituting rail system – permanent way, traction power supply, railway signalling systems (including track-side and on-board equipment) as well as all types of rolling stock in accordance with possible modules of conformity assessment procedures comprised in Commission Decision 2010/713/EU and all Technical Specifications for Interoperability (TSIs).

First International Scientific Conference „Railway Circular Test Tracks”

Mirosław Siergiejczyk
Scientific Coordinator IK



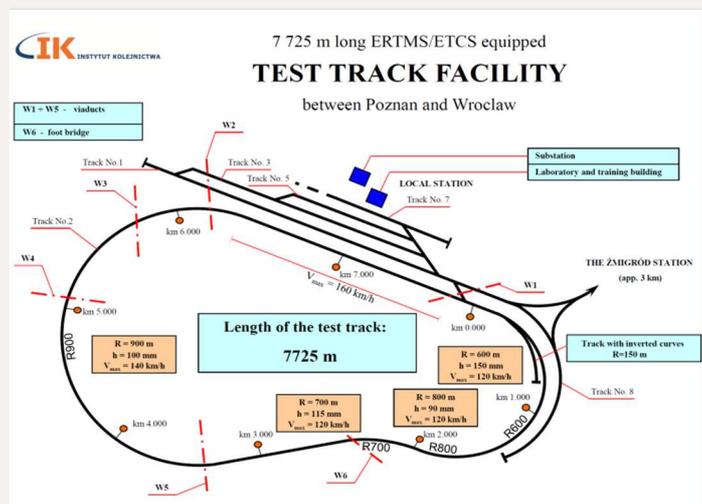
On 8th -9th June 2016, The first International Scientific Conference “RAILWAY CIRCULAR TEST TRACKS” took place in Trzebnica. The conference sessions were preceded on 7th June 2016 by a celebration of the 20th anniversary of the Test Track Centre in Żmigród. They were opened by Dr Andrzej Żurkowski, the Director of the Railway Research Institute. During this session Jean-Pierre Loubinoux, the General Director of UIC, presented a plenary paper covering the topic of „*The UIC response to new challenges for development and modernization of the railway sector*”. In the final speech of this session Dr Marian Fijałek presented the history of creation of the test track in Żmigród.

The participants of the jubilee session included the European Railway Agency (ERA), the International Union of Railways (UIC), the European Rail Industry Association (UNIFE), the Ministry of Infrastructure and Construction, the Office of Rail Transport, the Polish State Railways Joint Stock Company, the Governor of the Trzebnica District, representatives of companies and railway operators, the Road and Bridge Research Institute, the Rail Vehicles Institute “TABOR”, the Warsaw University of Technology, the Cracow University of Technology, the University of Zielona Góra, representatives of seven existing railway circular test tracks as well as present and future employees of the Railway Research Institute who contributed directly to the accomplishment of the construction project of the circular test track in Żmigród. After the session the participants took part in an extraordinarily interesting technical visit on the test track of the Railway Research Institute in Żmigród.

On 8th July, the sessions of the International Scientific Conference “RAILWAY CIRCULAR TEST TRACKS” commenced. In the opening plenary session participated the representatives of the European Railway Agency ERA (Richard Lockett), the International Union of Railways UIC (Jerzy Wiśniewski) and the European Rail Industry Association UNIFE (Nicolas Furio). A subsequent part of the sessions was devoted to the methods and research programs accomplished on the railway circular test tracks. There were presented technical capabilities and chosen test methods conducted on the currently exploited test tracks in Europe and the United States of America. In the two plenary sessions the following speakers took part: the representatives of the test track in Shcherbinka (Russia), the

test track in Velima (Czech Republic), the test track in Pueblo (United States of America), the test track in Făurei (Romania), the test track in Wildenrath (Germany) and the test track in Valenciennes (France). All the presentations were enriched by a material showing research methods and programs of those test tracks. In the session that was finishing the first day of the conference there were presented research possibilities on the test track in Żmigród within the development of railway vehicles construction (Prof. Andrzej Chudzikiewicz from the Warsaw University of Technology), the inert system of railway track versine measurement (Juliusz Grabczyk from the company P.U.T. GRAW Sp. z o.o.) as well as technical solutions to prevent animal - train collisions (Marek Stolarski from the company P.W.P. NEEL Sp. z o.o.).

The second day of the International Scientific Conference “RAILWAY CIRCULAR TEST TRACKS” was dedicated entirely to the research capabilities and research done on the railway circular test track in Żmigród, chosen aspects of rolling stock tests on this test track and procedures of electromagnetic compatibility followed there. The presentations contained many practical examples of ongoing tests.



The conference gathered a numerous circle of specialists dealing with research methods and programs conducted on railway circular test tracks. Amongst the participants of the conference there were representatives of railway test tracks, sector authorities, universities, research institutes and representatives of companies and producers who are using railway test tracks for testing their technical solutions employed in railway transport.

New test stands of the Railway Research Institute

Andrzej Toruń
Chief Researcher
Head of the Railway Traffic Control and Telecom Department



On 01.08.2016, a new research stand for tests of the onboard system ERTMS/ETCS L1 was launched on the Circular Test Track in Żmigród. The new stand had been constructed within the Department's own work 8901/10 „Implementation of level 1 ERTMS/ETCS on the Circular Test Track of the

Railway Research Institute “.

The test stand comprised the following main elements:

- The ERTMS/ETCS system level 1 - ALTRAC 6413 (together with switchable and non switchable balises, lineside electronic units (LEU))
- Five-aspect signal together with additional light (orange, green) and W24 – TD2 indicator;
- Three- aspect block signal together with W18 – TD1 indicator;
- Simulator for signals transmitted by semaphores;
- balises programmer PTE2000;



Fig. 1. "Container with built-in signals simulator to ETCS"

Taking into consideration the functional conditions of the system it is in line with z:

- 2012/88/EU: Commission Decision of 25 January 2012 on the technical specification for interoperability relating to the control-command and signalling subsystems of the trans-European rail system (with further amendments);
- Functional Requirements Specification ERA/ERTMS/003204 ERTMS/ETCS FRS version 5.0 an
- Functional Requirements Specification UNISING SUBSET-026 SRS version 2.3.0d.

The installation of the level 1 of the system ERTMS/ETCS on the circular test ring in Żmigród enabled the Railway Research Institute to join the very few research units in Europe which offer tests of the ERTMS/ETCS system level 1 while limiting to the minimum tests conducted on actively used railway infrastructure. The newly constructed test stand enables to test onboard devices of the ERTMS/ETCS L1 in the full range of operational scenarios of cooperation between vehicle and track-side infrastructure. The test stand generally uses typical elements of ETCS L1 (LEU, balises, ...), but an important element of the test stand is unique simulator for signals. The functionality of this test stand also allows testing scenarios of railway lines equipping, e.g. transitions between operational modes or values of national variables.



Fig. 2. "TD2 Signal with group of balises"

Due to limiting the number of tests necessary to be conducted on the railway tracks managed by PKP PLK S.A. which are equipped with ERTMS/ETCS level 1 (short time of accessibility of the lines per 24 hours, night tests), the testing time will improve (shortening of the tests` time).

The newly– built test stand there enables performing on – board equipment tests in a full range of operation scenarios. The functionality of this test stand also allows testing scenarios of railway lines equipping, e.g. transitions between operational modes or values of national variables.

Thanks to the accomplished investment of construction of the ERTMS/ETCS level 1, the Railway Research Institute may conduct a comprehensive certification of the traction vehicles within compliance with requirements of the TSI “Signaling” without using the PKP PLK S.A. infrastructure.

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Tests of brakes' compliance with the TSI Loc and Pas 2014

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An organizational unit of IK where tests of brakes are performed is the Brakes Section of the Rolling Stock Testing Laboratory with premises in Cracow.

Before the TSI (Technical Specification of Interoperability), implementation of the provisions tests both of brakes systems elements and complete sets already installed on railway vehicles were carried out

accordingly to the requirements of the International Union of Railways (UIC) and for the vehicles intended for service in Poland additionally in accordance with appropriate Polish Standards PN.

From the beginning of the TSI provisions functioning, the Railway Institute has been adapting both the research methods and also testing equipment in order to enable execution of brakes systems tests in line with the modified, and updated TSI provisions in force.

Undoubtedly, one of the best examples which bring closer the range of attempts are tests of traction brake sets.

A traditional approach to the tests of brakes systems of this type of vehicles, which were used before the implementation of the TSI provisions, enabled to divide brake tests into standstill and in-motion ones. The first tests were performed during standstill and their main goal was to check correctness of work of separate elements of a brake system, the whole brake system and to check if a brake system had been produced accordingly to the binding requirements and to the vehicle construction documentation. After the positive completion of standstill tests, a vehicle was allowed to proceed to in-motion tests. The aim of these tests was to determine the effectiveness of a brake, most commonly expressed by quantities called braked mass and percentage of braked mass. The tests were conducted for all the modes and switches of a brake in which a brake system may have worked, obviously in different load conditions.

The implementation of TSI provisions – for our exemplary traction unit Decision 2011/291/EU (abbreviated as TSI Loc&Pas 2011) – enforced changes of attitude towards brake tests.

The range of obligatory test was widened, the way of conducting them as well as analyzing and evaluating their results were primarily based on the European Union's standards. The division into stand still and in-motion tests became much more blurred because of the fact that tests in-motion are conducted obviously not anymore only in order to establish the effectiveness of a brake, correctness of work of an anti-lock braking

system, but also in order to check the correctness of functioning of a brake system in operation in-motion as well as correctness of cooperation between separate subsystems and elements, also in emergency situations. This fact together with an obligation of conducting tests also for speeds lower than 120 km/h resulted in a significant widening of works' range, which obviously resulted in extending the time necessary for



performing complete testing.

In 2014, modified provisions (Regulation 1302/2014 – abbreviated as TSI Loc&Pas 2014) were implemented. Apart from some editorial changes there were also more important amendments introduced, which have influence on the range and time necessary for tests execution. From the point of view of brake tests the most significant differences are visible in a change of value of initial speed during tests as well as the introduction (with some exceptions) of a distinct obligation of conducting brake tests for three states of vehicle loading, which in practice means, above all, a significant extension of time necessary for both the execution of tests and for further analysis of their results. It is worth underlying that the time extension may be equal even to 25 – 30 %. For instance, it may be assumed that the total time of execution of mere tests solely of a brake of a traction set with maximum speed of 160 km/h (including i.a. preparation of a vehicle for tests, execution of standstill and in-motion tests, work of anti-lock braking devices) may be equal to approximately 30 days.

In conclusion, it is worth enumerating the most important parameters which are measured and established during brake tests:

- *braking distance,*
- *speed,*
- *braking delays,*
- *pressures in the most important points of pneumatic set of a brake,*
- *contact force of elements of friction pairs (e.g. brake blocks, brake friction linings),*
- *temperature of elements of friction pairs (e.g. wheels, brake discs),*
- *times (e.g. filling, emptying).*

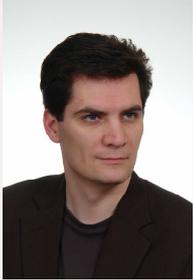
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Support in switch to 3 Kv DC power supply system

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Head of Electric Power Department



The Electric Commuter Rail (EKD) line, transformed in 1951 into the Warsaw Commuter Rail (WKD), was the first electrified railway line on the territory of Poland in the interwar period. Since its start in December 1927 for almost 90 years the trains on the WKD line had been powered by 600 V DC.

This state was maintained until the night of 27/28 May 2016, when an electric traction power supply was switched from 600 to 3000 V DC.

The change of power supply system was preceded by a large number of research and modernization works. The scope of modernization of the power supply of the WKD line included a reconstruction of traction substations in Pruszków and Grodzisk Mazowiecki, in each of which two new 12-pulse rectifiers sets type PD-17S were installed replacing the old 6-pulse ones. A sectioning in Podkowa Leśna was also rebuilt, and four old unnecessary WKD substations were turned off.

In the area of Warszawa Zachodnia railway station, power supply was connected from Warszawa Zachodnia traction substation, owned by PKP Energetyka S.A.

In order to provide safe power supply switching on the WKD line the Railway Research Institute performed a number of works, measurement and tests. The first work conducted in this scope was to specify formal, legal and technical activities. Within the formal and legal activities the Warsaw Commuter Rail should obtain a possibility of issuing declaration of conformity to type for devices of modernized electric traction power supply system. For this purpose the Railway Research Institute performed tests of devices being a part of this system and issued certificates of conformity of four types of catenary, overhead contact line, return circuit and its elements

In a scope of technical activities there was indicated a necessity of checking the technical condition of catenary insulators and their distance from other infrastructure elements. Taking into consideration that currently operated catenary was built between 1960 and 1975, specification of the technical state of its insulation was a crucial action before the switch of tension from 600 to 3000 V. Checking and diagnostic works were carried out by the WKD employees.

Other tests performed by the Railway Research Institute in order to provide safe functioning of 3 kV DC power supply system were short-circuit current minimum values measurements. Within these works there were measured values of the short-circuit current in case of contact line short-circuits with infrastructure elements in the least convenient situations. For

this purpose there were performed short-circuits on Warszawa Śródmieście WKD station powered overhead contact line from Grodzisk Mazowiecki and Warszawa Zachodnia substations and also on Grodzisk Mazowiecki Radońska and Milanówek Grudów using Warszawa Zachodnia substation. Measured values of minimum short-circuit currents allowed to specify high-speed circuit breakers setting on the level providing break short-circuit current even in the least convenient situations. All the performed attempts resulted in breaking the short-circuit current.

Another group of tests and measurements was performed to specify values of contact voltage in case of short-circuit currents in electric traction power supply system or rolling stock. The measurements were aimed to specify whether in case of short-circuit elements available for passengers and staff, dangerous, life- and health-threatening tension would not appear. The tests were performed in accordance with PN-EN 50122-1:2011. The tests were performed on the following stations: Warszawa Śródmieście WKD, Grodzisk Mazowiecki Radońska and Milanówek Grudów and also on WKD technical background area in Grodzisk Mazowiecki. During the tests there were measured values and times of occurrence of voltage on metal elements, for example accessible for passengers and staff catenary supports and signal, metal barriers and other elements of infrastructure. Achieved results met the PN-EN 50122-1 requirements, which allowed recognising that in case of short-circuit in electric traction power supply system on elements accessible for people, a tension with life-threatening, or causing permanent health damage value and duration will not appear. All works, tests and measurements performed by the Railway Research Institute contributed to safe placing into service and operation of 3 kV DC electric traction power supply system WKD Sp. z o.o. line.

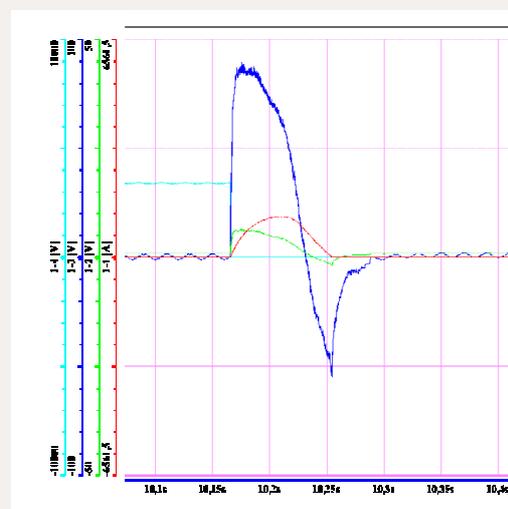


Fig. 1 Exemplary profiles of short-circuit current and contact voltage registered during WKD line measurements.

Support in development of Łódź Agglomeration Railways (ŁKA)

Szymon Klemba

Senior Engineering Specialist

Railway Track and Operation Department



One of the areas of the Railway Research Institute's activity is the technological and organizational support of the organizers of transport and railway operators.

The scope of this help includes the preparation of strategic documents for the development of transport, application documents for European

funds, the concepts of transport services for areas or business plans. The basis for studies and research is transport system and processes modelling, as well as modelling of rail traffic, based on specialized computer software.

The Railway Track and Operation Department cooperates with the authorities and the Łódzkie Voivodship and Łódź Agglomeration Railways (ŁKA) in terms of determining the development of regional rail and analysis on the projected volume of traffic and the effects related to it.

Our work began on the verification of existing documents related to the development of railways in the Łódź region. Both the methodology of preparing passenger flows forecasts and organizational assumptions were evaluated. The next step was to prepare a development concept for the ŁKA system -with updates- related to the changes of conditions of transport infrastructure. Afterwards our Department worked on the feasibility study for the purchase of new rolling stock.

The aim was to develop a solution, thanks to which it will be possible to increase the modal share of rail transport in the Łódź region. It was found that the main barriers to the development of the system, and to achieve this target, are:

- no connection between two main stations in Łódź: Łódź Kaliska and Łódź Fabryczna ("diametrical railway line"),
- insufficient line and stops infrastructure,
- no integration of the rail transport system with other systems (timetables, tickets),
- insufficient number of train connections.

As a result of the analysis the extension of the transport offer ŁKA was proposed. It was suggested that ŁKA system should cover all major railway lines in the Łódzkie Voivodship (Figure 1).

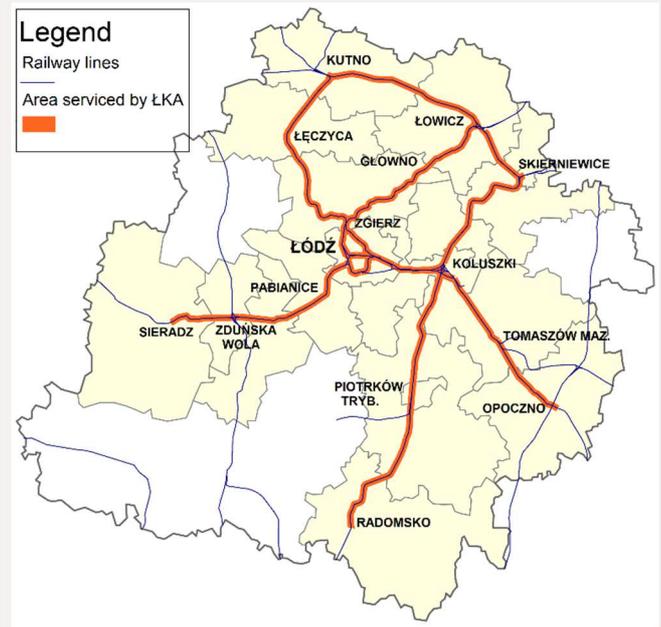


Figure 1. The target ŁKA system coverage

On the basis of the forecasting model it was predicted that the regional railways on these lines can transport around 31 thousand passengers a day. However, if the development barriers are not removed, it will be only about 20 thousand passengers. It emphasizes the importance of investment in rail infrastructure. ŁKA can handle up to 70% of the passengers volume in the region.



Figure 2. Daily volume of passenger traffic (forecast for ŁKA)

As shown in Figure 2, a large part of the stream of passengers will be serviced by the upgraded and new infrastructure, especially the "diametrical railway line" in Łódź.

[Feasibility Study for the 2nd stage of development of ŁKA (IK Work No. 4750/11)]

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IIIrd International Conference MODERN TRENDS OF FIRE PROTECTION IN ROLLING

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The Railway Research Institute was established as one of the first in Europe, and has initiated actions in fire safety of rail vehicles in Poland. The Institute also takes part in the development of European standardization and European scientific projects. Our Materials & Structure Labor-

atory carries out fire tests, prepares opinions in the field of fire safety for the needs of the Ministry, the Railway Transport Office (UTK) and certification of railway vehicles, and present our research achievements at national and international conferences. For several years, we have been also the organizers of international conferences addressed to people associated with fire protection in rail rolling stock and on June 18th 2016 took place the Third International Conference MODERN TRENDS OF FIRE PROTECTION IN ROLLING STOCK associated with Exhibition Hall THE MODERN AND SAFE EQUIPMENT OF ROLLING STOCK. The Chairman of the Scientific Committee of the Conference was **Prof. Mirosław Siergiejczyk**. The honorary patronage over the conference was taken by the Minister of Infrastructure and Construction, the Chairman of the Railway Transport Office and the Chief Commander of the State Fire Service, while media patronage: *Problemy Kolejnic-twa* which will publish in English the conference articles, and *Rynek Kolejowy* as well as *Przegląd Pożarniczy*. 130 participants from 11 countries had the opportunity to listen to outstanding European experts of fire protection in rolling stock. In three sessions held in turn by **Dr. Tony Cash** International President of the Rail Industry Fire Association (UK), **Roger A. Dirksmeier** (Germany) and **Richard Nowell** (UK), papers described below were presented.

David Tooley (Mott MacDonald, UK) prepared the paper *Estimating Rail Vehicle Peak Heat Release Rate* which was presented by chairman of session Dr Tony Cash (UK). The author underlined that rail vehicle peak heat release in the event of a fire is an important parameter, especially for trains operating in tunnels because a vehicle fire is a credible tunnel fire ignition source. This report presented the approach of different research projects and calculates methods, and reviewed the alternative ways in which vehicle fire peak heat release is currently estimated, and proposed a development

programme for a validated calculation method. **Roger A. Dirksmeier** (FOGTEC Brandschutz GmbH & Co. KG, Germany) showed the *Trends and Developments in Fire Protection for Rolling stock – a global view*. That paper presented the general worldwide trends in fire protection in rolling stock. It included cultural differences causing different philosophies of understanding of fire protection. The paper featured also information about some of the fire accidents during the last few years. The mentioned above information and great commitment to the work in the EN, NFPA 130 and TSI mirror group, made it possible to present a really global view, a “status-quo-report”. **Serge Métral** (SNCF, France) the convener of the Working Group CEN/TC 256 WG01 presented *Fire Containment and Control Systems*. The paper concerned the review process of EN 45545 and included the current assessment on Fire Containment and Control Systems for railway vehicles to close open point in the current TSI LOC&PAS. The author described also changes in fire testing on seats and outlined new specifications for toxicity tests on railway materials. The next paper *EN 45545 in transition... a GB perspective* was presented by **Richard Nowell** (RSSB, UK). The author described from a RSSB perspective of the transition from national standards in Great Britain (GB) to a full application of European regulations and the GB strategy for a full implementation of European Standards, the issues that arise and how the process is being managed. **Guillaume Craveur** (SNCF, France) presented the paper *Use of technical specification STM S 001 to complete EN 45545-2 at SNCF*. That paper described SNCF-RATP technical document which permits to reach a satisfactory level of safety for passengers according to the EN 45545-1 in order to complete the requirements of EN 45545-2. **Beth Dean** (Exova Warringtonfire, UK) showed the paper *EN 45545-2: Proposed New Seat and Toxicity Test Methods*. The paper explained specific details of the two test methods which will see significant modification in the review process of EN 45545: Seat test and Chamber toxicity test for materials having a surface area greater than 0.2m². The author described changes referring to test equipment and test procedures. She underlined the importance of repeatability and reproducibility of test results. **Prof. Dieter Hohenwarter** (Federal Institute Of Technology, TGM - Die Schule der Technik, Austria) presented the paper *Experience gained from fire tests according to ISO 5658-2, ISO 5660-1 and DIN 5510-2 for testing of seats*. Prof. Hohenwarter described results of numerous tests of the fire behavior of seats according to DIN

5510-2 and according to EN 45545-2. He discussed also the test results of the seat components materials and the influence of flame retardants on fire parameters. **Dr. Jolanta M. Radziszewska-Wolińska** showed the paper *The influence of the ignition source on passenger seat burning*. The paper presented the tests carried out using the furniture calorimeter according to ISO / TR 9705-2. It discussed the results of previous studies on the effects of different sources of ignition (pillow newspaper, traveller's luggage, Belfagor burner with several power levels) for the development of the combustion process of passenger seats. The author presented also results of different seats tested according to requirement of project prEN 16989. **Dr. Marta Walk** (Ship Design and Research Centre, Poland) presented the paper *Fire resistance barriers - overview of requirements and presentation of selected results of tests*. That paper related to a set of requirements described in the EN 45545-3:2013 and the standards cited there. Dr Walk explained the details of the introduced testing method, followed by the discussion on the classification requirements. Some examples of fire resistance tests of railway fire barriers performed in the Fire Test Laboratory in CTO were also presented. **Jerome Visse** (Efectis, France) prepared the paper *Fire resistance of rolling stock elements and EN 45545-3 standard*. The author described historically the approach to fire hazard in the train going through the tunnel and the influence of accidents on regulation and definition of new standards whose aim was to increase the safety for people and infrastructures. He presented requirements of EN 45545-3 and 2 concerning the fire compartmentation in the rolling stock in order to limit the propagation of fire. **Tomasz Stachowicz** (London Underground, UK) presented by video the paper *Project GETAWAY*. The author described the range of the research GETAWAY project sponsored by the European Commission project which London Underground Fire Engineers actively supported. Encoded project name GETAWAY stands for **G**enerating simulations to **E**nable **T**esting of **A**lternative routes to improve **W**AY finding in evacuation of overground and underground terminals. The Project involved testing the proposed evacuation systems on operating railway/metro systems. **Michele Barbagli** (FOGTEC Brandschutz GmbH & Co. KG, Germany) presented the paper *High-pressure water mist active firefighting systems; first testing experiences according to Italian Standard UNI 11565*. The author discussed high pressure water mist - a relatively new technology in the railway industry, its advantages and also German documents ARGE constituting a guide for design and assessment of that technology. Then he introduced a new

Italian Standard UNI 11565 and results of tests carried out by accredited laboratories. **Dr. Dana Grefen** from BATEGU Gummittechnologie GmbH & Co KG (Austria) presented the topic of *Fire protection of flexible metal/rubber units including elements in bogies*. Dr Grefen discussed the scope of BATEGU company works, which allowed for the development of rubber compound designed for rubber-metal railway elements which satisfy both requirements – the fire protection according to EN 45545 and the dynamic-mechanical properties.

Another highlight of the conference was a Panel Discussion led by **Dr. Radziszewska-Wolińska** (IK), who gave as the introduction a presentation *Polish regulations concerning fire tests of materials for rolling stock*. Discussions on the papers and in the Panel, as well as talks on the sidelines were an opportunity to exchange experience between experts from European research centers and an approximation of all the participants of the trends fire safety of rolling stock. At the same time the spectrum of papers presented and discussed topics showed how wide and important issue is.

The participants also had the opportunity to get acquainted with the offer presented in the Exhibition Hall by: Rogum Kable Sp. z o.o., LANKWITZER POLSKA sp. z o.o., FOGTEC Brandschutz GmbH & Co. KG, Rail Industry Fire Association and the Railway Research Institute.



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