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IN THIS ISSUE

Editor's

Andrzej Żurkowski
Director

This year the Railway Research Institute celebrates two jubilees. The first of them is connected with the 20th anniversary of the Test Track Centre in Żmigród, which is one of eight such objects in the world. A few months later there will be celebrated the 65th anniversary of the Institute, which was founded in 1951. Both anniversaries will be accompanied by international conferences.

The activities of the IK are focused on rail transport development. The collected record and experience together with professional scientific and engineering staff provide a background for innovativeness, technical and technological progress of railway.

By the year 2000 the Institute was a part of the PKP company, and since its restructuring and commercialization it has been directly subordinate to the minister in charge of transport. As a result of so called 'evaluation' conducted three years ago the Institute obtained high A category. The budgetary measures obtained thanks to this event are spent on Institute's own research projects, staff development and other research activities. The Institute is also a notified body with the broadest in Poland spectrum of competencies to certify products and systems.

It cooperates closely with the Office of Rail Transport in the field of implementation the European Union law in Poland in term of interoperability.

The research projects are financed from national resources, mainly from the National Centre for Research and Development (NCBR), but also from the EU programmes. In the recent period a cooperation with railway companies has been intensified in the field of innovative projects that respond to the most important challenges. They are connected mainly with the huge scope of modernization of Polish railway infrastructure as well as modernization and purchase of a rolling stock. These activities are aimed at reaching the highest possible technical level of railway thanks to the correct use of available EU and budget measurements.

The Railway Research Institute cooperates with a huge number of national and foreign manufacturers and service providers from the railway industry. Amongst our partners are also other research institutes and universities. Especially important is an international cooperation based on direct contacts and cooperation agreements with many research units and universities both from the EU and other countries.

The activity of the Railway Research Institute is a good background for realization of programme for development of Polish economy, especially its innovativeness, taken recently by the Polish government.

3rd Railway Safety Forum

On 24 and 25 February took place the 3rd Railway Safety Forum under the honorary patronage of the Ministry of Infrastructure and Construction, the Office of Rail Transport and the Railway Research Institute.
The meeting had an international dimension due to participation of representatives of the European Railway Agency, among others Christopher Carr, Head of Security Department. He explained in particular issues of new EU regulations that are going to be introduced within the framework of the Fourth Railway Package.
Within the Forum a wide range of subjects on rail transport security was discussed.
In meetings participated Undersecretary of State for rail transport Piotr Stomma, Director of the Railway Research Institute – Andrzej Żurkowski PhD. Eng. A debate including law, insurance, production and risk management on railway experts chaired Marek Pawlik PhD. Eng., Deputy Director of the Railway Research Institute for Railway Interoperability.

Photo IK

Cooperation Agreement

Photo Kielce University of Technology

On 23 February 2016 a Cooperation Agreement was signed between Kielce University of Technology and the Railway Research Institute seated in Warsaw.
The objective of the agreement is to set up a cooperation by exchanging information on innovations in rail industry, identifying opportunities for realization of joint R&D projects aimed at development of new products and technology of their manufacturing, as well as their implementation at pilot and industrial scale.
The cooperation includes also close alignment of conducted research works to expectations of entrepreneurs R&D sector in area of material engineering and rolling stock exploitation, and also identifying research purposes for acquiring industry partners in order to apply for joint projects.

Elections to the Transport Committee of PAN

In March a new composition of the Transport Committee of the Polish Academy of Sciences was chosen.
In the term of office 2016/2020 Prof. Wojciech Wawrzyński became the new Chairman, and the Secretary Prof. Mirosław Siergiejczyk, the Scientific Secretary in the Railway Research Institute. Both professors are employed in the Faculty of Transport of Warsaw University of Technology.
Also directors of institutes related with transport acceded to the Committee, amongst which Ph.D. Andrzej Żurkowski, director of the Railway Research Institute.
The Transport Committee exists since 1972 and its range of actions embraces the most important issues of technology and organization of railway, road, air and water transport service as well as issues regarding logistics.
The Committee publishes a quarterly whose Chief Editor is Prof. Marianna Jacyna.

Photo IK

Innovative technology of production and embedding of high quality rail turnouts

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Rolling Stock Testing Laboratory

On the basis of the consortium agreement with Kolejowe Zakłady Nawierzchniowe 'Bieżanów' Sp. z o.o. in Cracow the Railway Research Institute (IK) participated in a project executed within the framework of the 'INNOTECH' programme, in the 'IN-TECH' programme path called 'Innovative technology of production and embedding of high quality rail turnouts'.

Photo 1. Wagon KZN01A type to turnouts transport

The mentioned above project was co-financed from the National Centre for Research and Development (NCBiR) funds – agreement No INNOTECH-K3/IN3/51/227706/NCBR/14.

The aim of the project was to develop an innovative and complex process of production, delivery and unloading of turnouts in blocks, with using of special rail wagons integrated with HDS cranes and security system. The project characterized with a high level of innovativeness. Proposed solutions are groundbreaking in current domestic and international market situation. The results of the project allow to shorten a turnout replacement time from several dozen hours to several hours only, they secure a turnout so it comes to a construction site with unchanged geometry, and also promote an ecological way of transport.

Within the project the Railway Research Institute participated in phase A (research phase) by execution of the following tasks:

– No 3 – prototype wagons research,
– No 5 – research of turnout mounting to a wagon securing the load on hinged platform and turnout stiffener system integrated with the load and securing against its damage or deformation,
– No 8 – turnout research – part 1 (IK)
– No 10 – operational tests and project results evaluation – part 1 (IK),
– No 12 – verification tests with technology evaluation and opinion.

In the task No 3 wagons KZN01A type were subject of the following tests:

– brakes (stationary tests, running tests, and resistance tests of braking systems on heat load (simulation of a ride from the St. Gotthard Pass)),
– rolling noise,
– wheel static contact force and tare weight,
– journey safety on a warping track,
– twist rigidity Ct* of wagon superstructure,
– position of buffers and couplings, secure access and exits, axle superheating detection – hot axle detectors (HABD zone), tail lamp mountings, towing bracket covers and label holders,
– tilt coefficient S_R and wagon asymmetry η,
– wagon's ride trough a linkspan, a track with minimum curving radius and a test hump,
– bogies resisting torque about wagon superstructure,
– shunting on reverse curve S type,

Photo 2. Preparation of a turnout to be loaded onto the wagon

– journey security, dynamic characteristics of a running gear, and impact on track,
– wagon strength empty and loaded during crash tests on a testing hump,
– static tension measurements during loading and tension measurements during lifting a wagon,

Photo 3. Loading of the wagon with a secured turnout using HDS cranes

– axle impedance,
– turnouts carrying wagon resistance.

The mentioned above tests were carried out for compliance with requirements set out in the Technical Specifications of Interoperability for rolling stock subsystem.

The task No 5 was aimed to demonstrate safety of mounting a rail turnout to a wagon in accordance to the IK procedure No PB-LW-S07, which is compliant with ERRI B 12/RP 17 issue 8 report, RIV regulations and PKP Cargo S.A. regulations on loading and securing of the goods, PKP Cargo S.A. Headquarters.

The aim of the task No 8 was to design and manufacture a special stand for hydraulic tests of locking of points and hydraulic coupling in locking of points. The task provided also for assembling on the test stand the displacement, force and pressure transducers for the device functionality evaluation. Hydraulic coupling tests on the test stand were carried out in different ambient temperature from 0 °C to +25°C.

In task No 10 there were carried out the operational tests of loading and unloading of four-axle flat wagon KZN01A type with a turnout element – rails connecting points with crossing.

Before the tests were started, the technical documentation of wagons loading and unloading logistics, and safety regulations description of the mentioned above works were analyzed.

The task No 10 was started at the stage of realization of the task No 3 – wagon loading for dynamics tests. Subsequently, within the operational tests, an observation of wagon loading with points and crossings at the manufacturer's and unloading the mentioned above elements on a construction site.

Thanks to the used technology of infrastructure elements transport there was unnecessary to disassembly them into parts.

The executioner of works after unloading turnouts from the wagon could immediately proceed to place them on the track. It allowed to shorten time and eliminate possibility of mistakes and inaccuracy during embedding the turnouts on the track.

The aim of the task No 12 was to issue certificates that are a basis of placing the wagons KZN01A type in service. Within the task the following activities were carried out:

1. The approval of constructive documentation, technical and operational documentation and technical conditions for execution and acceptance;
2. The review of the proposal and appointment of the president to subsystem evaluation;
3. The analysis of interoperability elements certificates necessary to wagons certification was made;
4. The audit of the Quality Management System of KZN01A type wagons production at its manufacturer's was carried out;
5. The Certification decision was made to certify a structural subsystem;
6. There were developed and issued WE Certificates for SB, SF and SD modules.

Photo 4. Wagon KZN01A type loaded with a turnout

Photos: Kolejowe Zakłady Nawierzchni „KZN BIEŻANÓW"

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Test Track Centre

Waldemar Szulc
Head of Test Track Centre

New construction solutions in basic areas of rail industry such as: rolling stock, superstructure, signaling equipment, electric traction etc. should be reliable and operational, what guarantees safety of railway traffic. Such requirements cause necessity of carrying out comprehensive and thorough research works in conditions close to conditions of normal operation, and this can be met only when having an appropriate research base, the essential element of which is a proper test track. The Railway Research Institute is in a possession of such test bed. It is called Test Track Centre.

The Test Track Centre is situated in Dolnośląskie Voivodship, c.a. 4 km west from the town of Żmigród. The object is connected to Żmigród railway station, located on E59 line (Wrocław – Poznań). Existing road system provides also convenient communication with other localities (Fig 1).

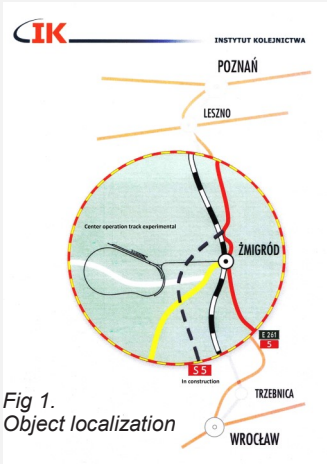

Fig 1. Object localization

Curvilinear, closed, 7725 m long Test Track Centre is built from 25 track sections 300 m long each and a turnout section 225 m long. The superstructure is built of UIC 60 rails partly on different types of concrete sleepers and timber sleepers – made from hard and soft wood. By proper location of particular types of sleepers and different fastenings it was possible to obtain track sections with different construction and track layout.

It has got significant meaning for carrying out various types of superstructure research works. The Test Track Centre is a continuous welded rail track, excluding S-7 section built as a classic section. It is built from straight sections 1313.9 m and 543.9 m long and curves with the following radii: R = 600 m and h = 150 mm, R = 700 m and h = 115 mm, R = 800 m and h = 90 mm, and R = 900 m and h = 100 mm. In a longitude section the track loop consists of level sections and with gradient ratio 1‰ and 2‰. For rolling stock tests with forced longitudinal dynamics conditions of measuring train set in order to test its vulnerability for derailment with high longitudinal forces there was built track No. 4 – reverse curves "S". This track branches off the track No. 2 with a S 60 turnout – 300-1:9 near 0,00 km and runs along it in area of the curve with radius = 600 m, on its inner side. The usable length of the track is 415 m. Between the reverse curves there is situated a 6 m long straight insert. Special configuration of the experimental loop, especially four curves with radii 600 m, 700 m, 800 m and 900 m together with over 1 km long straight section allow to test vehicles' dynamic behaviour. Maximum speed of 160 km/h on this section enables to perform running tests of brake sets with this speed (Fig 2). On the track No. 2 on 6.500 km there is a separated section, where neutral acoustic conditions are preserved and which characterizes with increased dynamic parameters and increased track geometry quality.

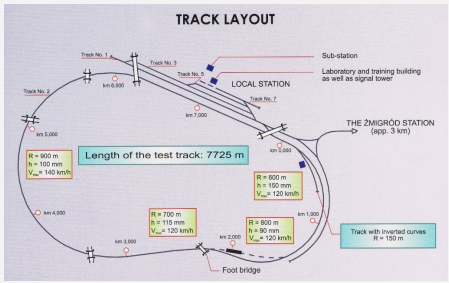

Fig 2. The IK experimental track, track layout scheme (Tomasz Kędzierski IK)

The section is used for noise tests in accordance with requirements of Technical Specifications of Interoperability. On this section there is measured noise emitted by running vehicles as well as during their starting up.

The Test Track Centre is in a possession of three special battering ram cars which are used for vehicles crash test on a special station track (track No. 1), equipped with an infrastructure enabling to assembly measuring devices, high-speed camera registering test progress, and all equipment necessary for carrying out and registration of the test.

The electric traction is supplied with 3.3 kV voltage – traction substation connection power equals 7.5 MW.

The Test Track Centre thanks to its values it's also an excellent test bed for various national and foreign projects from the broadly-understood railway and similar sectors. Focusing of all rail values occurring on railway line, possibility of customized activities that may be repeated and controlled without interferences in railway traffic together with highly qualified IK staff results that the following projects were completed in the Test Track Centre:

- Safetram,
- Safetrain,
- ProtectRail – threats scenarios and IT solutions for railway safety improvement,
- Monit – rolling stock dynamic test with various interferences.

Test Track Centre it's an exceptional tool for experimental research works, which offer various advantages:

- Tests are carried out in conditions similar to normal traffic without mutual interferences,
- Depending on purpose of the performed test, the test conditions may be modified and steered in controlled way,
- Thanks to establishing identical and easy to determine conditions it is possible to carry out comparative research works, which enable objective evaluation of state and technical level of objects and research processes,
- Performing continuous tests and their quick start shortens results awaiting time,
- Thanks to the tests it is possible to verify analysis's results and laboratory tests and perform model operational conditions,
- Tests enable to develop new experimental methods,
- Research process makes possible to evaluate usability and desirability of new technical solutions, construction elements and new material in railway industry.

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Accidents on level crossings

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Accidents on level crossings make up approx. 25% of all railway accidents, the second largest cause of them after trespassers' accidents (approx. 60%). It is a direct result of European statistics rules, counting each accident with railway vehicle on move as a railway accident. The problem of ensuring safety on level crossings is twofold. First of all, due to the Union's railway system, it is crucial necessity of fulfilling Common Safety Target (CST) for the European to reduce the number of accidents on level crossings. In spite of the fact that approx. 98% of all accidents on level crossings are caused by road users, all of these accidents are counted as railway accidents. But nowadays more and more often it becomes crucial to protect railway passengers and transported goods against wrong and dangerous behaviour of road users.

The improvement of the safety on level crossings may be obtained more efficiently by synergy of four parallel groups of activities, so called "4 E", in alphabetic order composed of:

- Education – a range of activities focused on the appropriate information, teaching and training of road users; this activity includes all awareness campaigns;
- Enforcement – monitoring, revealing and penalization of all wrong behaviour incidents done by road users on level crossing area;
- Engagement – the continuous discussion between all entities important for the improvement of safety on level crossings and achievement of necessary agreements and compromises;
- Equipment – the best possible protection equipment relevant to local conditions and required safety level.

Instytut Kolejnictwa since 2006 has actively been participating in the European Level Crossing Forum, the informal, joint initiative of research entities and railways, the initiator of the European Level Crossings Awareness Day (ELCF), spread and established as the ILCAD - International Level Crossing Awareness Day, led by the UIC as one of two most important, global level crossings awareness campaigns apart from the Operation Life-Saver, originally US awareness initiative running since 1970. These campaigns play the most important role in the education of road users' behaviour on level crossings.

The enforcement, depending on particular societies' customs, has also a very important impact for increasing the safety. It is very important to ensure that each offence committed by level crossing users is registered and adequately punished, particularly fined. The penalty should be unavoidable, quick and painful. As many as possible level crossings, particularly automatic ones, should be equipped with monitoring and video registration systems. Level crossings equipped that way should be the basic type and ensure the highest safety level.

It is also very important to keep permanent and deep engagement of all parties involved in the safety on level crossings. Basically, together with the railway infrastructure managers, road managers and local authorities as well as law and order forces should be involved in this activity including the relevant financial participation in design, building and exploitation of level crossings.

The basic rule that the party responsible for increasing the risk is paying for the appropriate modernization of a level crossing should be applied. It is obviously necessary to equip each level crossings with all warning signs and signalling systems selected adequately to the local conditions including rail and road traffic, visibility and all other factors affecting the accident risk level. The operation of the installed equipment should be as much as possible unified from the point of view of road users to avoid possible misunderstanding of the accident risk. In parallel to the basic equipment necessary to ensure a required safety level in recognized danger causes, the list of auxiliary systems and devices should be available for designers for the further improvement of safety on particular level crossings.

All possible activities performed to increase the safety level on level crossings will not reduce the number of accidents to zero. Among road users there is a certain percentage of people consciously breaking traffic laws, including drunk and addicted to drugs drivers, but also possibly a wide group of people with not diagnosed diseases influencing their behaviour on road and recognition of a danger.

Thus, it should be worked out a list of all level crossings ordered due to a recognized accident risk. The modernization of level crossings including equipping them with improved equipment, but also their elimination and replacement by tunnels or viaducts, as the only way of total reduction of level crossings accidents, should follow that list of risk level. For the expected effectiveness, such a process should be performed under a relevant national program of level crossing safety improvement.

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Traffic analysis with application of microsimulation models

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One of research areas in scope of interest of The Railway Track and Operation Division is railway infrastructure analysis regarding volume of passenger and freight railway traffic nowadays and in the future. The basis of this analysis are simulations performed in RailSys, software produced by RMCon. Simulations are carried out for the specific area of railway infrastructure described in the microsimulation model, which consists of three basic parts:

- Infrastructure part,
- Rolling stock part,
- Timetable part.

In the Infrastructure part of the microsimulation model, information listed below are input:

- Maximum speed for trains of different categories,
- Geometric parameters of railway tracks,
- Layout of station tracks,
- Platforms location,
- Signalling systems.

In the Rolling stock part railway vehicles data for tractive stock is added:

- Maximum speed of railway vehicle,
- Traction characteristics,
- Resistance to motion,
- Vehicle weight and length.

Moreover this part contains information about trains, for example weight and length of each train as well as train category.

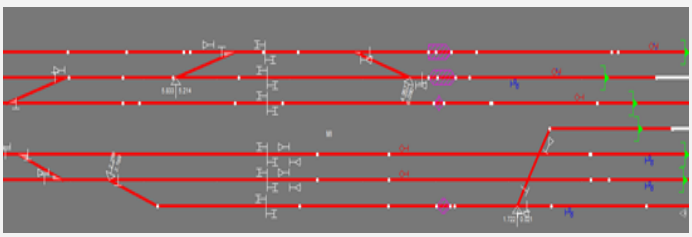

Fig. 1 Fragment of microsimulation model in RailSys Software

In the Timetable part the timetable is created on the basis of quantitative and qualitative assumptions for passenger trains and on the basis of traffic volume for freight trains.

Completed microsimulation model is the basis to carry out railway traffic simulation using deterministic and stochastic methods. In the deterministic simulation there is supposed, that all trains run according to pre-prepared timetable.

This kind of simulation allows to specify run times in the context of changes of current infrastructure parameters and railway infrastructure capacity in accordance with UIC 406 Code.

The process of stochastic simulation includes large amount of single simulations. On the base of historical data, in each single simulation the software assigns initial delay for the specified train. The initial delay time is the result of probability distribution, where for the same train in different single simulation the delay time may change. Completed stochastic simulation enables to define railway infrastructure ability to suppress traffic disturbances caused by initial delay. On the basis of microsimulation model railway traffic analysis may have a variety of uses. Used by Infrastructure Managers, they can be applied for verification of investment plans. They help to revise effectiveness of projected solution compared with the target put before start of construction works.

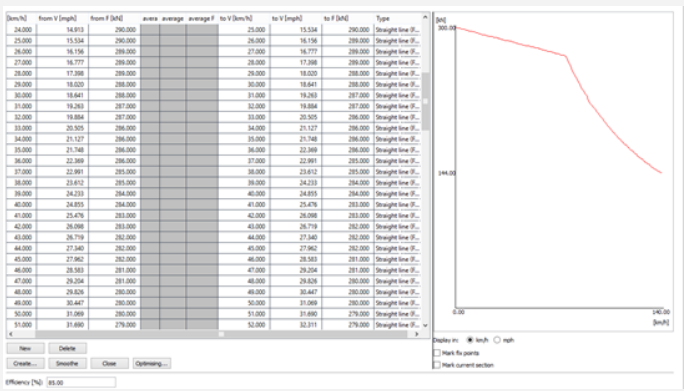

Fig. 2 Traction characteristic in RailSys Software

Moreover, these railway traffic analysis can provide completely new solutions, which can be used for example to improve functionality of railway infrastructure or increase the capacity of railway system. Microsimulation model can also be treated as a support tool in the process of railway traffic management, especially during planned or unpredicted traffic disturbances. For railway operators and organizers microsimulation models and traffic analysis can be assistance to optimize transport offer and rolling stock management.

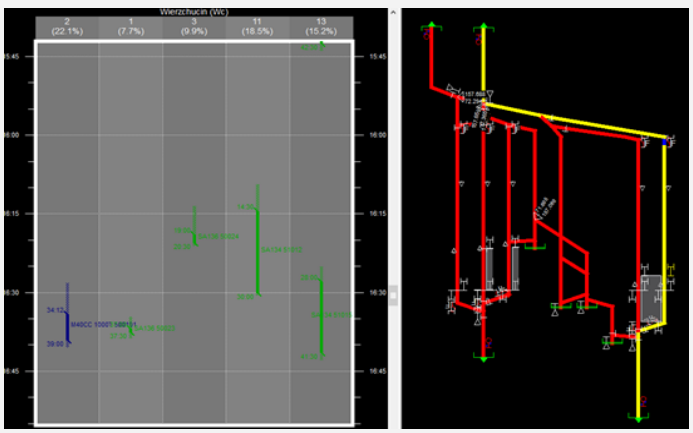

Fig. 3 Chart of station track's occupation in RailSys Software

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Safety Assessment Centre in IK

On 1st November 2015 in the Railway Research Institute Safety Assessment Centre was created as a unit responsible for assessment of the adequacy of using by applicants risk management process and its results.

Securing of proper safety level in rail transport is a matter of concern of all its users – law-making institutions, carriers, infrastructure administrators, bodies responsible for a maintenance, manufacturers, suppliers and subcontractors. These bodies bare full responsibility for the safety, therefore the role of common method of safety assessment in area of risk assessment and evaluation has become particularly significant. Reliable identification of threats and risk management is required.

The problem of safety management in rail transport in recent years has become a priority within the whole European Union. The first legal act implementing risk management in area of risk assessment and evaluation was the EC Regulation No. 352/2009 of 24 April 2009 on introducing a common method of the risk management in area of risk assessment and evaluation. Subsequently this Regulation was replaced with the Council Implementing Regulation No. 402/2013 on a common method of the risk management in area of risk assessment and evaluation.

The aim of both acts is to apply a single threats identification process and risk management due to new changes introduced to the railway system. The new regulation, however, introduced one crucial change for the IK. So far, operating on the basis on the regulation No. 352/2009 the IK performed risk assessment and evaluation. According to the new regulation it also became necessary to formalise the process of confirmation of assessment body competences. New rules were set according to which an assessment body can be solely the body with competences confirmed by the empowered authority.

In Poland it is possible to perform so by an accreditation process carried out by the Polish Centre of Accreditation (PCA).

The inspection body recognized as credible and competent must meet:

- general accreditation requirements given in PN-EN ISO/IEC 17020:2012 Conformity Assessments standard,
- specific requirements given in the European Council Implementing Regulation No. 402/2013,
- requirements presented in DAK-08 document, containing detailed accreditation requirements to be met by assessment bodies applying for the accreditation in accordance with Regulation No. 402/2013.

It means that the Safety Assessment Centre to perform its assessment activities must firstly be accredited by the PCA. For this purpose the Centre completed documentation including the Quality Book – the Technical Competence Paper and general procedures according to which all further activities of the Centre will be performed. The documentation has been already submitted to the PCA, so the accreditation process has begun.

After the successful accreditation the Centre will assess the correctness of:

- risk analysis of structural subsystems construction (infrastructure, signalling, power supply, rolling stock) for project of construction and modernization of railway lines and rail vehicles,
- risk analysis for significant changes implemented by the applicant in operated systems, subsystems and elements of railway lines and rail vehicles.

The role of the Centre will be to support bodies implementing changes in risk management process by verification and confirmation that the process was carried out appropriately and comprehensively, and met formal and substantive criteria. If any irregularities are found, it will be the task of the Centre to perform additional analyzes or implement additional solutions in control measures in order to provide adequate security level after the implemented change.

Magdalena Garlikowska
Head of Safety Assessment Centre

Advanced Rail Technologies Conference, November 2016

The Railway Research Institute together with the Faculty of Transport of the Warsaw University of Technology organize the Vth International Scientific Conference: **"ADVANCED RAIL TECHNOLOGIES".**

The conference will be a platform of exchange of ideas related to a broadly understood problematics of construction and exploitation of the railway transport. The aim of this conference is to present scientific and research achievements both on national and international level, which deal with issues of implementation and exploitation of modern technologies related to the rail transport.

Within the conference there will be prepared separate panels regarding technical issues, as the spectrum of problems and specializations is very vast. Similarly to the previous years, preparation and conducting of panels have been attributed to the acknowledged specialists, which guarantee the proper choice of papers and interesting discussions. This year the conference will be connected with the celebration of 65-years anniversary of the Railway Research Institute, therefore we invite already to take part in this event which will take place in Warsaw in the mid of November.

A precise date of the conference and details related to preparation of papers are under arrangements.

We kindly ask to visit our web site www.ikolej.pl, on which soon there will appear information about this topic.

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