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IN THIS ISSUE

Editor's

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Safety first – railway transport key principle
Moving big masses over long distances with reasonable speeds, from the very beginning of the railway transport in the 19th century, has required ensuring safety as a prerogative for railway public acceptance. The scope of railway related potential risks had and has to be minimized up to really low, so called acceptable, levels. Practically, all railway technical and operational experts always take safety as the most important factor influencing decisions they are taking in their professional life => safety first.
Safety in railway interoperability regulations is one of the six essential requirements. All new and modernized railway lines and stations as well as all new and modernized railway vehicles can only be put in service if they fulfil essential requirements. Safety was and is required.
Railway Research Institute is acting as a **designated body** (**DeBo**) since it was founded in 1951 – for over sixty-six years in accordance with regulations applicable in Poland. Since the beginning of the 1990s the Institute is acting as an **independent safety assessor** (**ISA**) in accordance with so called RAMS European Standards. Since Poland entered the European Community in 2004 Institute is acting as a **notified body** (**NoBo**) under European Directive on the interoperability of the railway system within the Community. Now we are also acting as a **risk assessment body** (**AsBo**) under European Railway Safety Directive. Disregarding the formal base safety was, is and will be required.

The challenge is not to apply safety requirements for known technical and operational solutions. The challenge is to see the overall comprehensive and detailed safety picture with its technical, operational and organizational aspects, influence of environment, internal and external interferences, cyber risks and other detailed safety requirements to ensure defining, applying and maintaining appropriate and comprehensive safety measures. On a separate page in this newsletter you can find a description of the upper layer of the overall safety picture that we are using to ensure that all technical, operational and organizational risks are always taken into account including interactions between different risks and different safety measures.

UIC 90th General Assembly held in Istanbul

The UIC Executive Board and 90th General Assembly was held in Istanbul on 10 July, 2017. Prior that day, the meeting of International Railway Research Board (IRRB) took place there. Currently the members of this research platform, IK including, are preparing the upgrade of a strategic document Global Vision for Railway Development (GVRD). It was decided during the meeting that the development of upgraded document would be preceded by a world conference for railway transport in a global dimension. This event will be organized by the Railway Research Institute and it is initially planned for November 2018.

Photo: IK

Assessment Centre granted accreditation as Inspection Body in ICMS area

On 7 June, the Railway Research Institute, Safety Assessment Centre was granted accreditation as Inspection Body type A no AK 029 in ICSM area – adequacy inspections to use a common safety method on risk evaluation and assessment for all subsystems, SMS and QMS.
More information can be found at: www.ikolej.pl

PCA Polskie Centrum Akredytacji INSPEKCJA
AK 029


Polskie Centrum Akredytacji
CERTYFIKAT AKREDYTACJI
JEDNOSTKI INSPEKCYJNEJ
Nr AK 029

Railway Research Institute signed letters of intent with Hyper Poland and Euroloop

On 3 June, the Director of the Railway Research Institute and representatives of Hyper Poland (Limited liability company) Krzysztof Tabiszewski and Przemysław Pączek signed a letter of intent regarding cooperation for the development of Hyperloop technology and building a Hyperloop experimental track on the Institute's premises.
"The Institute's laboratories as well as specialists from several universities will be engaged in the project. Hyperloop is an ambitious challenge and requires taking advantage of resources just as the Institute has. "We would like to participate in the global transport revolution, thus increasing the Polish contribution in its implementation," commented Andrzej Żurkowski, Ph.D. Eng., the Director of the Railway Research Institute.

On 26 June, the Railway Research Institute (IK), represented by its Director Andrzej Żurkowski, Ph.D. Eng. and EUROLOOP (Limited liability company) represented by company founder and President of the Management Board Marek Gutt-Mostowy and Director for Operations and PR Piotr Krzemiński signed a letter of intent at the IK headquarters, regarding cooperation in developing modern transport solutions based on Hyperloop technology.
Considering the need to develop cutting edge transport solutions and to be involved in implementing provisions of the Polish Government's economic projects, particularly the Plan towards Responsible Development, the parties of the letter of intent expressed their wish to cooperate mainly, but not only, in the area of legislation, standardization and traffic management systems.


Photo: Hyper Poland


Photo: Piotr Krzemiński

Electric energy storage in 3 kV DC system

Artur Rojek
Chief Researcher
Head of Electric Power Department

Electric energy storage systems have been known for a long time. On order to store energy there can be used mechanical storage (rotating wheels, compressed air), chemical ones (hydrogen) or electrical ones (supercapacitors and batteries), etc. In the electric traction systems, supercapacitors and also batteries are most often used and installed in vehicles and substations. They are most widely applied in urban traction supply systems and intended to store braking energy, which provides energy saving. Within 3 kV DC system, the work has also started to store braking energy in storage and to analyze energy effectiveness.

In one of its own projects, the Railway Research Institute developed an energy storage concept designed to work in 3 kV DC electric traction power supply systems, in which batteries are used as energy storage. It is intended to be mounted in traction substations and sectioning cabins. In contrast to the previously used energy storage, apart from accumulating recuperation braking energy, its basic function is to stabilize voltage parameters in the overhead contact line and protect against short-time traction substation's overloading. In addition, this storage can be used as emergency power supply in case of its lack.

In order to carry out research, electric energy storage of 1.2 MW power capacity and capable of storing almost 0.5 MWh electric energy was designed and built. The device was installed in the IK short-circuit laboratory which directly adjoins Mińsk Mazowiecki traction substation. Apart from basic components like accumulator batteries and DC/DC converter, the device is equipped with overvoltage and overload protection systems and filters. Initial analyses show that the application of such a type of storage can prevent short-term overloads of contracted capacity and excessive voltage drops, especially in case of significantly high values of traction substation total resistance and long power supply sections.

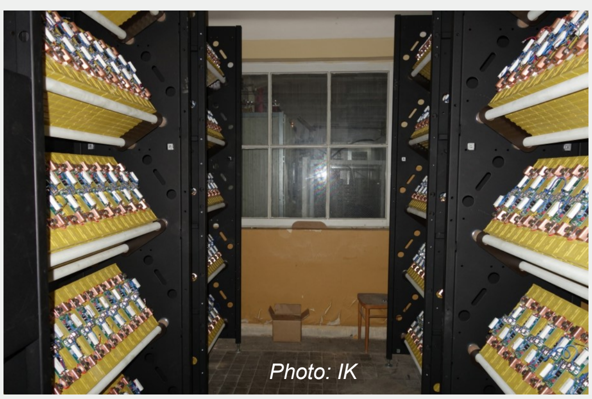

Fig. 1. Energy storage accumulator battery

The storage works automatically basing on developed accumulator batteries' charging and discharging algorithms. Charging takes place in cases of a defined voltage exceedance on the storage input/output, i.e. on the main bars of 3 kV DC traction substation's switchgear. It means that the energy storage can be charged in three cases:

- increase of voltage due to recuperation braking of a vehicle located on the power supply section operated by the energy storage;
- occurrence of no load voltage in rectifier sets;
- rectifier sets' low loading.

The voltage level after which the storage charging takes place is defined taking into account characteristics of external traction substation. The charging current value is determined automatically depending on the level the accumulator battery is charged and on voltage value on 3 kV DC switchboard rails.

Energy storage discharging is initiated by two values – voltage on 3 kV DC switchgear bars rails and/or rectifier sets' load current. After setting the discharge trigger voltage value, the converter controls the current value from the storage so as the voltage will not drop below the set value. While controlling the energy storage with rectifier sets' load current value, the current released from energy storage has such a value so that the rectifier sets' current would be on the constant level.

Supporting the electric traction power supply system with energy storage takes place from the moment of its discharging. Having been discharged, the storage switches off and waits until it has the possibility to charge accumulator batteries again.

Fig. 2. Energy storage DC/DC converter

The electric energy storage is undergoing laboratory tests during which it interacts with rectifier sets from the IK short-circuit laboratory equipment. After the tests stage, the storage will be included into the Mińsk Mazowiecki traction substation and further tests and trial operation will follow.

Apart from traction substation, the energy storage could be installed in a sectioning cabin. In case when the supply system is not loaded, it is charged with a small current from the overhead contact line and discharged in the time of increased energy demand. Such a work setting is also included in scope of tests during the Mińsk Mazowiecki traction substation's operation as a sectioning cabin.

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Tests Track Centre in Żmigród

Waldemar Szulc
Head of Test Track Centre, Test Track Centre Żmigród

Railway transport plays a fundamental role not only in national economy but in the everyday life of society as well. Therefore it should be comfortable, reliable and effective. These requirements necessitate better and more innovative solutions which after being tested by the Railway Research Institute's specialists and obtaining appropriate certificates will be put into service. In order to carry out tests in conditions close to normal railway operation, it is necessary to have a proper test field. Such a test and research base of the Railway Research Institute is the Test Track facility near Żmigród, where various kinds of tests connected with rail transport are performed in a closed test track.

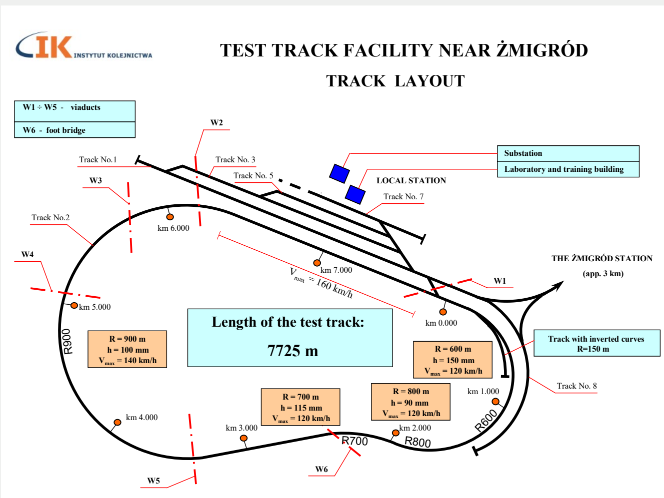

Fig. 1. Test Track facility near Żmigród

The Test Track near Żmigród is a specific tool and place to perform rail tests. The facility enables carrying out tests of track superstructure, traction power supply, command control and signalling systems and rail vehicles. Curvilinear and closed track layout of a length of 7725 m and curves with a radius of 600, 700, 800, 900 m and straight ones (including more than 1 km long one) has been the IK testing ground for 21 years and is predominantly used for rolling stock testing. Due to its specific construction, there can be tested vehicles in relation to their dynamic performance in conditions specified in TSI and UIC Leaflet 518 as well as in EN 14363 standard. These tests allow defining safety of the vehicle under dynamic driving conditions. Braking systems' operation tests are conducted in compliance with TSI and UIC Leaflet 544 -1 in order to specify the effectiveness of braking performance. With the use of a special coupling, freight wagons and passenger coaches are uncoupled from the measuring set and the following parameters are measured: pressure, delay and stopping distance in emergency braking. The braking system's heat capacity is measured during a simulation of the test object's drive down from St. Gotthard Pass in order to specify energy-dispersing capacity without the loss of its performance effectiveness. A special test stand (a track of special geometry – reverse curves S) allows testing the vehicle's vulnerability to derailment while high longitudinal forces appear. According to TSI, UIC Leaflet 530-2 and EN 15839 standard, longitudinal dynamics conditions are forced. A special section of the track with higher parameters and due to acoustic neutrality is used to measure noise of passing trains with set speed and during starting runs.

A special test stand was built for conducting tests measuring passing train interference on track circuits. The Test Track is equipped with ETCS System Level 1. The overhead contact line is supplied with 3.3 kV voltage and there are efforts to introduce other traction power supply systems.

Due to its unique advantages, the Test Track Operation Centre is also an excellent testing ground to perform various kinds of national and foreign rail or other similar projects. Gathering all railway features that appear on a railway line, a possibility of non-standard operations that may be repeated many times and controlled without disturbing a rail traffic operation, as well as highly qualified staff of the Railway Research Institute caused that the following projects were carried out on this Test Track:

– Safetram,
– Safetrain,
– ProtectRail – threat scenarios and proposed IT solutions intended to improve rail safety,
– Monit – testing the rolling stock dynamic performance while various disturbances were introduced.

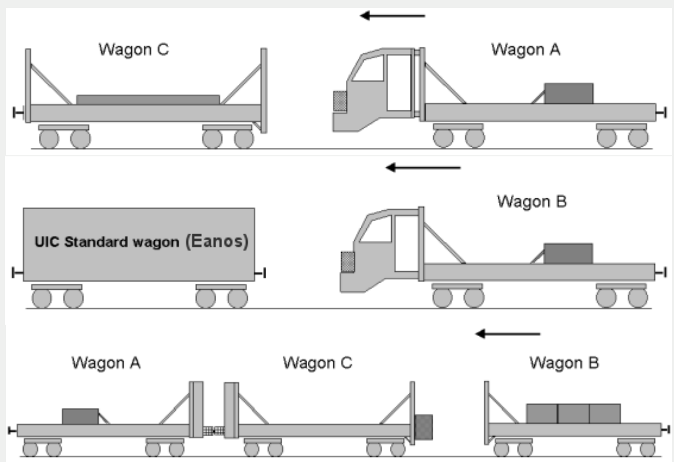

Fig. 2. Exemplary scenarios of vehicle crash tests

Vehicle crash tests in real conditions prove to be the most spectacular tests because of selected track with a possibility to mount a mobile test stand and specialist impacting wagons used many times for that purpose and qualified professional IK staff. Thanks to these advantages many projects for vehicle producers were performed.

The IK Test Track so far is the only closed test track facility in Poland which can meet research and test needs for the railway development.

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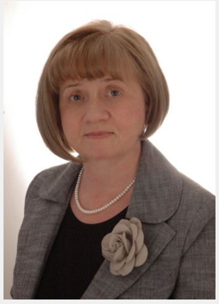
Materials and Structure Laboratory in the European Space

Jolanta Maria Radziszewska-Wolińska
Assistant Professor, Head of Materials & Structure Laboratory



Materials and Structure Laboratory, within its three sections, carries out scientific, research and service work in a wide spectre including fire safety in rail transport, mechanical tests of materials and structure elements used in vehicles and infrastructure as well as physical-chemical properties of consumables. Our competence was confirmed by PCA accreditation (AB 369), obtained in 2001, and systematically expanded. The recognition of our experience and research potential is reflected in growing international cooperation shown in conducting tasks and projects for foreign customers, participation in European working groups or inviting our specialists to present research results on international conferences.

The greatest international activity takes place in the area of fire safety in rail transport which was started in the 70s of the 20th century with the participation in UIC, ERRI and OSShD. We also participated in TRANSFEU project within the EU 7th Framework Programme. Due to RPMA.01.01.00-14-013/10 project entitled “Purchase of modern research equipment for Materials and Structure Laboratory, Railway Research Institute (IK) in Warsaw” co-financed by the European Regional Development Fund within Priority 1 RPOWM Activity 1.1 of the Regional Operational Programme of Mazovia Voivodship 2007-2013, the Laboratory was equipped with most of the research equipment required by the new EN 45545:2013 standard. Our experts actively participated in developing this series of standards and now take part in its verification within CEN KT 256 WG01, also carrying out research within European inter-laboratory comparisons in order to check research methods’ modifications and develop requirements.

Since 2007, the Laboratory has been successfully taking part in the systematically expanding laboratory comparisons ERO-COMPARISON organized by CERTIFER (Railway Certification Agency in France). We are also the organizer of an international conference MODERN DIRECTIONS IN FIRE PROTECTION. This conference is a cyclic event aiming at presenting current requirements and European legislation concerning fire protection of rolling stock and the directions of European research projects.

Since 2006 we have presented our research results on international conference Fire Protection on Rolling Stock, held initially in London and for a few years in Berlin. In 2014 Dr. Jolanta Maria Radziszewska-Wolińska presented a speech entitled “The Contribution of the Railway Institute in Warsaw for Fire Safety of Rolling Stock in Poland and Europe” at the Conference on EMERGING FIRE PROTECTION TECHNOLOGIES FOR ROLLING STOCK in New Delhi, for which prominent experts from Europe were invited on behalf of the government of India.

Laboratory’s competence presented also at INNOTRANS fair in Berlin results in orders from countries that do not have a specialised laboratory accredited according to EN 45545 standard.

It must be underlined that the Laboratory systematically develops its experience and improves competence within performed grants and own projects financed by the Institute. The projects being carried out at the moment include:

- The influence of the ignition source on the combustion process,
- Possibilities of adapting rolling stock equipment materials to current requirements in the area of fire properties,
- Testing the impact of thermal radiation intensity on toxic gases’ emission during combustion using infrared spectroscopy technique FTIR.

The other crucial international activity area includes strength tests. Recognising the Laboratory’s experience and credibility in this area, especially in rail vehicle bogie frames, has resulted in international orders since 2006. Being aware of the responsibility, as well as the will to keep the existing position and expanding competence in the area in question motivates us to undertake development projects. Our own projects financed by the Institute include:

Fig. 1. Tests according to ISO 9705-2 (MARHE, RHR, TSP)

- Impact of loads on load distribution during strength tests of rail vehicles bogie frames,
- Construction of test stand for bogie frames with the application of multifunction, multi-signal system of control command and actuators’ measurements using home-grown methods,
- Development and implementation of a new research procedure to test bogie frame construction with the use of multifunction, multi-signal system of control command and measurements.
- Assessment of the impact of the paint system composition on its fire and utility properties.

Finally, it should be added that the Laboratory also carries out other projects for foreign customers in the area of testing objects intended for European or Asian market, including, inter alia, expert works relating to lacquer surface coating, or testing rails, sleepers or fastening systems for sleepers. The above-mentioned confirm the competence and competitiveness of the Materials and Structure Laboratory on the international forum.

Fig. 1. Tests of vehicle bogie frame, according to PN-EN 13749:2011 standard

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How we ensure comprehensiveness of safety analyses

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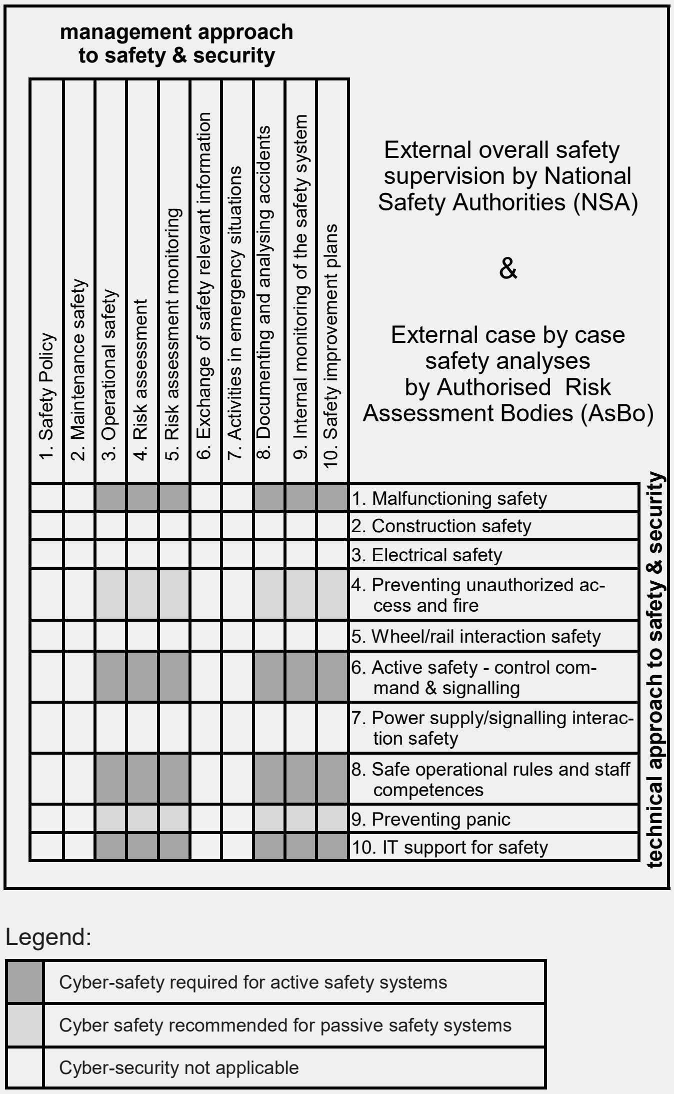
Safety is a complex issue, as shortly described on the first page, and therefore straight safety model is helpful to ensure verification of appropriateness and comprehensiveness of safety analyses, safety assessments, safety requirements and safety measures in view of safety acceptance. For such a purpose we use our own 10-by-10 safety matrix model. The upper layer of the model is shown on a figure and shortly described below.



The ten technical safety aspects of the essential requirement "safety" are defined as follows:

1. **Malfunctioning safety** - design, construction or assembly, maintenance and monitoring of safety-critical components, and more particularly of the components involved in train movements have to guarantee safety in normal operation and in degraded situations.
2. **Construction safety** - infrastructure to which the public has access have to be designed and constructed in such a way as to limit any human safety hazards + used components has to withstand any normal and exceptional stresses that can appear during their technical life + vehicles' structures as well as links between vehicles have to be designed in such a way as to protect the passengers and driving compartments in the event of collision or derailment.
3. **Electrical safety** - operation of the energy-supply systems cannot impair the safety either of trains or persons (users, operating staff, trackside dwellers and third parties).
4. **Preventing unauthorized access and fire** - appropriate steps have to be taken to prevent access to and undesirable intrusions into installations + design of fixed installations and rolling stock and the choice of the materials used have to limit the generation, propagation and effects of fire and smoke in the event of a fire + appropriate means, procedures and personnel protecting passengers and railway objects against criminal activities, vandalism and terrorism have to be defined, provided and used when necessary.
5. **Wheel/rail interaction safety** - parameters involved in the wheel/rail contact have to meet the stability requirements needed in order to guarantee safe movement at the maximum authorised speed + parameters of the brake equipment have to guarantee that it is possible to stop within a given braking distance from maximum authorised speed.
6. **Active safety - control command and signalling** - control-command and signalling installations and procedures have to enable trains to travel with an appropriate level of safety corresponding to network objectives in normal operation and in degraded conditions – not only appropriate functionality but also appropriate Safety Integrity Level have to be ensured.
7. **Power supply/signalling interaction safety** - electrical equipment cannot impair the safety and functioning of the control-command and signalling installations.
8. **Safety of the operational rules and staff competence** - alignment of the network operating rules and the qualifications of drivers and on-board staff and of the staff in the control centres have to ensure safe operation + all devices intended to be handled by users cannot impair the safe operation of the devices or the health and safety of users if used in a foreseeable manner, albeit not in accordance with the posted instructions.
9. **Preventing panic** - appropriate devices enable passengers and accompanying staff to contact the driver in the event of danger have to be available + emergency exits have to be provided and indicated + emergency lighting system of sufficient intensity and duration have to be provided on board + trains have to be equipped with public address systems, which provide means of communication to the public from on-board staff + appropriate means and procedures, which are associated with preventing panic in case of construction disasters and natural disasters have to be defined, provided and used when necessary.

How we ensure comprehensiveness of safety analyses

10. **IT support for safety** - suitable levels of integrity and dependability have to be provided for the storage and transmission of safety-related information.

The ten operational safety management aspects are defined as follows:

1. **Safety Policy** - infrastructure managers IMs and railway undertakings RUs (operators) have to have safety policies + safety policy has to be formally accepted by management and binding all persons having safety relevant duties + safety policy has to form a basis for common safety understanding in relation to all safety relevant activities being undertaken + IMs and RUs have to have safety management systems SMSs covering all safety related management aspects.
2. **Maintenance safety** – maintenance cannot impair the safety and functioning of the existing infrastructure and rolling stock which are aging + maintenance procedures have to be well defined and associated with exact types of systems, devices, equipment, traction vehicles, coaches, wagons, etc. + rules have to be defined for taking decisions when maintenance is required and what scope of maintenance works have to be considered + safety requirements + competences of maintenance staff, the maintenance stands, equipment and tools, maintenance procedures as well as commissioning rules have to be described, accepted and applied hereafter during whole lifecycle of the infrastructure and vehicles.
3. **Operational safety** - detailed operational rules for operational staff (signalmen, train drivers, foremen gangers, crossing keepers, examiners, operational instructors, and others) including interactions between works performed by different persons including exchange of information and interactions between different rules have to be written, accepted, binding, applied and periodically verified + requirements for personnel must be set and respected in relation to health and competences including periodical verification + means used by operational staff have to be precisely defined, including signalmen desktops and drivers interfaces, and applied + respecting precise signalling rules defining all signal aspects, all used indicators, signs, and signals have to be imposed and supervised + visibility and audibility of all types of signals have to be defined, respected and verified + special rules have to be defined and respected for out of gauge loads, special loads, dangerous goods, operational communication procedures, protecting track workers, and operational disturbances.
4. **Risk assessment** - risk assessment has to be applied for all cases when technical or operational or organizational changes potentially affecting safety are foreseen + expert judgment on the significance of the change being implemented has to be based on: credible worst-case scenario in the event of failure, scale of novelty, complexity, inability to monitor change influence on safety, change reversibility, and accumulation with previous safety-related changes + significant changes can only be implemented if associated risks are put in hazard log together with defined and imposed safety measures ensuring meeting safety requirements.
5. **Risk assessment monitoring** - expert judgments which lead to undertaking risk assessment or abandoning risk assessment for individual changes have to be defined by each IM and each RU individually + dedicated procedure(s) ensuring appropriate scale of use of risk assessment have to be binding and understood as valuable support tool providing valuable information + hazard log have to be verified also on the basis of accidents and incidents.
6. **Exchange of safety relevant information** - precise and productive information exchange procedures and means have to be defined and used + safety related information has to be provided to all involved partners + use of communication means have to be foreseen and verified in advance + communication with rescue services, local authorities, investigation bodies, have to be provided and used especially in case of accidents and incidents + information about dangerous and e.g. out of gauge loads have to be associated with trains and have to follow the trains.
7. **Activities in emergency situations** - decision makers have to be known in advance and associated with emergency situations + stopping trains in an affected area, closing tracks, revoking given movement authorities, requesting rescue services, requesting rescue trains, ordering cranes, heavy caterpillars and rail-road machines, requesting presence of a prosecutor, etc. have to be possible, regulated and mandated when necessary.
8. **Documenting and analysing accidents and incidents** - all accidents, incidents and near-misses have to be documented, analysed, reported and utilized for hazard log verifications.
9. **Internal monitoring of the safety system** – safety management system SMS functioning and improving have to be ensured by each IM and each RU + SMS has to form the basis for IM safety authorisation and RU safety certification.
10. **Safety improvement plans** - IMs and RUs annually have to hand over detailed information about safety situation to the National Safety Authority NSA + such information has to be used for verifying fulfilment of the common safety targets and setting safety targets for the future + IMs and RUs annually have to hand over to NSA safety improvement plans defining especially safety goals and means, ways to minimize risk, to maximize protection, and to improve staff competences.

Legally, all activities of all IMs and all RUs regarding all technical safety aspects and all management safety aspects are supervised by the National Safety Authority, however detailed and comprehensive safety analyses are performed especially by applying risk analyses for critical areas and verified for completeness of risks and appropriateness of safety measures by the Railway Research Institute as a formally accepted inspection body entitled to perform Risk Assessment regarding all railway safety aspects.

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Railway Research Institute's participation in DEMONSTRAROR+ pilot project

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In 2013 - 2016, a project of constructing a simulator demonstrator for rail vehicle operators „DEMONSTRATOR +", co-funded by the National Centre for Research and Development (NCBiR) was carried out. The Railway Research Institute was the executive consortium participant. IT company QUMAK S.A. (the consortium leader), Military University of Technology as well as Centre for Training and Counselling „IKKU Sp. z o.o." were also involved in the project design work.

The main task (product) of the project was to design and construct a functioning traction vehicle simulator demonstrator. However, the subject matter scope of works covered by the agreement contained a much larger set of issues referring also to formal and legal matters. In this respect, it was vital to define principles how to use simulators in the process of train drivers' or their candidates' recruitment, training and testing. In other words, the performed work was supposed not only to answer the question how a modern and competitive traction vehicle simulator should look like from a technical point of view but also how it should be used in order to effectively train new train drivers.

Taking into account the above mentioned assumptions, the tasks conducted by the consortium in the Demonstrator Project (31 tasks in total) were clearly divided substantively into two groups. Most of them (25 tasks) made up design-construction tasks which constituted the demonstrator's design and building. The Railway Research Institute carried out two tasks from that group:

– Task 3 – defining formal and functional requirements of the demonstrator,
– Task 7 – developing requirements concerning the spatial data import and processing (GIS).

The second group of tasks included training tasks to define formal bases and proposed methodology of simulation techniques' implementation into the process of train drivers' or their candidates' recruitment, training and testing. The project consisted of 6 tasks in that area. The Institute performed three of them:

– Task 8 – developing assumptions for simulation scenarios,
– Task 26 – preparing the training programme and a glossary of terms, so called "syllabus",
– Task 27 – describing a formal scope of exercises' methodology.

The project called „Modern simulator demonstrator for rail vehicle operators increasing safety and effectiveness of their operation" was successfully completed in November 2016. Common effort of consortium participants led by QUMAK S.A. resulted in building an operational simulator demonstrator, presented at InnoTrans fair in Berlin in 2016 but also in developing systemic assumptions concerning the way of simulators' practical application in the process of train drivers' or their

candidates' recruitment, training and testing.

The Railway Research Institute's team contributed greatly to the project. From the very beginning of the project till its end, they constantly shared their expertise from the railway field, both technical and engineering areas, e.g. defining the requirements for the demonstrator, assessment of possibilities to apply PKP PLK S.A. data, as well as their knowledge concerning training process organization and its course (using the simulator in the training process – developing scenarios' assumptions).

Moreover, the Railway Research Institute's team supported consortium members with knowledge referring to rolling stock and procedures (among others, information on procedures to gain access to enter railway premises, what is necessary while on-spot checking), as well as played a leading role in creating a team of experts consisting of train drivers' instructors, what consequently provided a practical aspect (ready to implement) of the consortium's work.

Fig. 1. Winter time imaging in the simulator's visualisation system

It is also worth underlying that the Railway Research Institute established cooperation with PKP PLK S.A. in the area of effective infrastructure manager's IT system connection with software that accounts for creating virtual scenery in simulators as well as connecting traction vehicle simulators with simulators for train dispatchers.

A detailed description of the Railway Research Institute's effort in the demonstrator project was presented in "Prace Instytutu Kolejnictwa", issues no. 152/2016 and 153/2017.

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Testing ETCS trackside equipment on test stand in Żmigród

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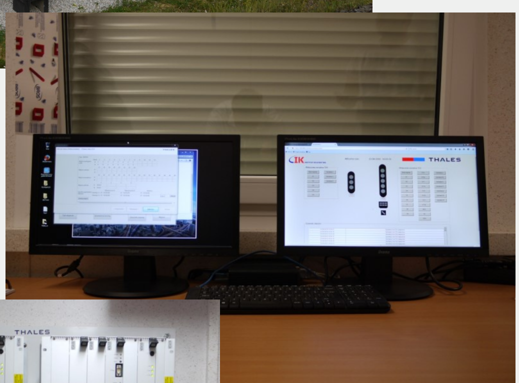
The installation to carry out on-board testing of Level 1 ERTMS/ETCS system was launched on the Test Track in Żmigród on 1 August 2016. The test stand located on the Railway Research Institute's infrastructure includes:

– a container with research equipment (ALTRAC 6431) and a simulation stand (Photo 1).

– track-side signals which are a source of information for LEU and balises,

– unswitchable balises CBF 2010 – 22 pcs.,

– switchable balises CBF 2010 – 6 pcs.,



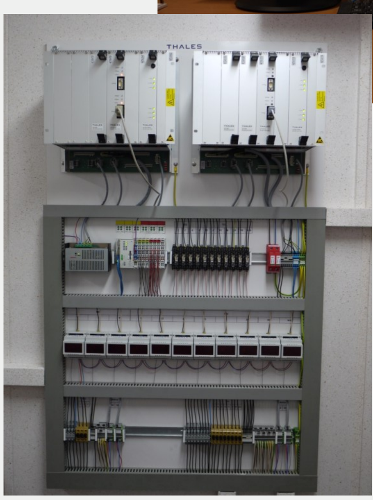


Photo 1. A container with ETCS_L1_IK simulation stand and ALTRAC 6431 equipment
Source: IK_A own study

The application of signal simulator (signal images) displayed on real track-side signals allows transferring to the ETCS system permissions of any drive and any speed criterion compliant with Ie-1 instruction (signals binding in PKP PLK S.A.), which is later transmitted through balises to the tested on-board equipment and in this way enabling the implementation of all operational scenarios that can verify CCO subsystem installed on new or retrofitted traction vehicles. In addition, mounting balises on the track circuit and the possibility to change telegrams on particular unswitchable balises (with the use of PTE2000 programming unit) allows a complete verification if the on-board ETCS system interacts correctly with the Polish infrastructure.

In 2017, the IK Railway Traffic Control and Telecom Department's employees carried out on-board ETCS system tests (BT production) on vehicles produced by PESA Bydgoszcz:

21 WEa – three-unit vehicle,

34 WEa – two-unit vehicle,

and the mentioned above vehicles were tested in multiple-traction (operation).

Photo 2. 21 WEa vehicle during CCO system tests on the test stand in Żmigród
Source: IK_A own study

Among others, an odometer, braking distance, train automatic braking detection and transit were tested. Moreover, traffic operation scenarios were checked, i.e. CCO system reaction to incoming information from balises like entry/exist from the area, voltage disconnected drive, transition to STM mode. The performed tests confirmed correct operation of on-board ETCS equipment and full functionality of the tested installation.

The ERTMS/ETCS system installed has expanded the Institute's service portfolio concerning Test Track accessibility with carrying out manufacture's (producer's) tests necessary to launch ERTMS/ETCS system in traction vehicles before the EU assessment process begins.

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Innovative technology of production and installation of high quality railway turnouts

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Senior tech. and eng. specjalist.
Rolling Stock Testing Laboratory

Pursuant to the agreement on establishing a research consortium, the Railway Research Institute (IK) and Kolejowe Zakłady Nawierzchniowe (KZN) „Bieżanów" Sp. z o.o. in Krakow participated in a project within „INNOTECH" programme, IN-TECH path, called "Innovative technology of production and installation of high quality railway turnouts". This research project was co-financed by the National Centre for Research and Developemnt (NCBiR) – agreement no. INNOTECH-K3/IN3/51/227706/NCBR/14.

The aim of the project was to develop an innovative and complex process of production, transport and unloading of railway turnouts in blocks with the help of special railway vehicles integrated with HDS cranes and safety protection system. The project, which promotes ecologically friendly transport, was marked by high level of innovation. Its results allow shortening the time of turnout exchange from several dozens to a few hours safeguarding the turnout so as it will be transported to the place of installation with unaffected geometry.

The project was designed in two options:

– adopted to HDS crane installation, during the drive the cranes are mechanically blocked, cranes have their own combustion engine power supply mounted on the frame (Fig.1)
– with long loading platform, without crane installation possibility (Fig.2).

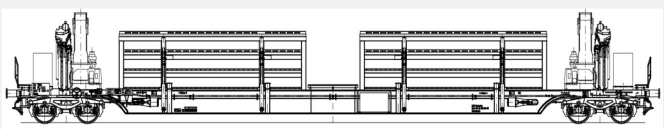

Fig. 1 – A schematic vehicle KZN01A type – „SWITCHER" with installed HDS cranes

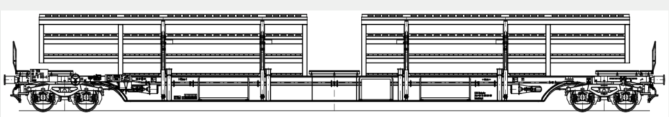

Fig. 2 – A schematic vehicle KZN01B type – „SWITCHER" with long loading platform

The proposed technology of turnout transport assumes that after the technical approval the turnout (turnout block) is additionally stiffened by a specially designed system. It aims at protecting the turnout against deformation and possible damage during loading, transport and unloading. Then with the use of HDS crane, the turnout element is loaded on the vehicle whose platform is situated horizontally. Afterwards the turnout is fastened to the vehicle platform. The last activity before the turnout is transported is to lift the platform to its transport position, i.e. tilting and its mechanical fixing. The unloading on site takes place in a reverse order.

Depending on the turnout type, it can be transported in various configurations of the vehicle arrangements:

– 3 vehicles equipped with cranes,
– 2 vehicles with cranes and a long loading platform,
– 3 vehicles with cranes arranged alternately with vehicles with a long loading platform (in special cases the composition may be limited to two vehicles with cranes and two vehicles with a long loading platform).

The Railway Research Institute took part in the research phase A of the project. The tasks with IK participation included:

– tests of vehicle prototypes,
– tests of the railway turnout fastening to the vehicle in order to ensure safety of the load on the tilted platform as well as turnout stiffening system integrated with the load protecting against damage or deformation,
– tests of turnouts – part 1 (IK),
– operation tests and project results assessment – part 1 (IK),
– verification tests as well as technology assessment and opinion.

KZN01A vehicles underwent necessary tests to prove the product compliance with TSI requirements for rolling stock (TSI WAG). The basic tests included tests of dynamics and safety of the drive, strength of the structure, brake, noise, gauge and wheel sets' impedance.

Tests of turnouts' fastening aimed at showing safety of railway turnout fastening to the vehicle basing on ERRI B 12/RP 17 issue 8 Report, RIV regulations and PKP Cargo S.A Regulation on loading and securing the goods, Centrala PKP Cargo S.A.

Fig. 3. Loading and unloading of the railway turnout from the vehicle with HDS cranes

Innovative technology of production and installation of high quality railway turnouts

A special stand for hydraulic tests of turnout lockings and hydraulic tests of turnout locking couplings was designed and produced for the turnout tests. The task was also to mount on the test stand converters (transducers) of displacement, strength, pressure for the equipment functionality assessment. The tests of hydraulic coupling on the test stand were carried out at ambient temperature from 0°C to +25°C.

The operation tests were intended to check the loading and unloading of a four-axle KZN01A type vehicle, a turnout component – rails connecting the turnout with the frog (common crossing) in operational conditions. Technical documentation connected with loading and unloading logistics, OHS description while conducting work were analysed before the tests commenced. The operation work had already started during the vehicle loading to dynamic tests. Then within operation tests, the vehicle loading with the turnout and frogs was observed at theses elements' producer's location, whereas unloading at the customer's on-site.

Due to the applied transport technology of the infrastructure elements, their disassembling was not needed. While unloading the turnouts from the vehicle, the contractor could immediately start laying them on the track.

This allowed shortening the time and eliminate possible probability of errors and inaccuracies while installing the turnout in the track.

Verification tests and assessment aimed at issuing certificates that are the basis to KZN01A type vehicles' placing into service. The following activities were performed within this task:

1. Approving the construction, technical and operational documentation as well as Technical Conditions for Execution and Acceptance;
2. Review of the request and appointing the Chairman for the subsystem assessment;
3. Analysis of certificates for interoperability constituents necessary for the vehicles' certification;
4. Audit of Quality Management System of KZN01A type vehicles' production at the producer's place;

Fig. 4. KZN01A type vehicle loaded with a railway turnout.
The turnout is additionally stiffened by a dedicated protection system

5. Certification decision on issuing a certificate for structural subsystem;
6. EC Certificates for SB, SF and SD modules.

Fig. 5. Dynamic tests of KZN01A type vehicle for transporting railway turnouts on Grybów – Ptaszkowa section

Fig. 6. Dynamic tests of KZN01A type vehicle for transporting railway turnouts on Grybów – Ptaszkowa section

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IK Railway Research Institute

ALMOST 70-YEAR ACTIVITY IN THE AREA OF RAILWAYS AND URBAN RAIL TRANSPORT

WELL EQUIPPED RESEARCH LABORATORIES
COMPETENT STAFF WITH EXPERIENCE, TREMENDOUS ACHIEVEMENTS AND TECHNICAL, ORGANIZATIONAL AND OPERATIONAL KNOWLEDGE
THE FIRST POLISH NOTIFIED BODY NO. 1467 UNDER EUROPEAN DIRECTIVE ON THE INTEROPERABILITY OF THE RAILWAY SYSTEM WITHIN THE COMMUNITY
AUTHORIZATION OF OFFICE OF RAIL TRANSPORT DECISION OF THE OFFICE OF RAIL TRANSPORT'S PRESIDENT NO. DZTI – WI810.8.2016.IM
CERTIFICATION OF ALL RAILWAY INTEROPERABILITY SUBSYSTEMS AND ALL INTEROPERABILITY CONSTITUENTS
ACCORDING TO ALL AVAILABLE MODULES OF PROCEDURE VERIFICATION AND EU AND EC CONFORMITY ASSESSMENT
AUTHORISED BODY TO CARRY OUT TESTS AND CERTIFICATION IN THE NATIONAL LEGISLATION AREA FOR STRUCTURES, EQUIPMENT AND RAILWAY VEHICLES
RISK ASSESSMENT INSPECTION BODY PURSUANT TO EU REGULATION NO 402/2013
ON A COMMON SAFETY METHOD ON RISK EVALUATION AND ASSESSMENT
SAFETY ASSESSMENT FOR TECHNICAL, OPERATIONAL AND ORGANIZATIONAL CHANGES FOR ALL RAILWAY SUBSYSTEMS
AND SAFETY MANAGEMENT AND MAINTENANCE MANAGEMENT SYSTEMS – INSPECTION OF ADEQUACY OF APPLIED RISK EVALUATION AND ASSESSMENT
COMPLETE TESTS FOR CERTIFICATION, SCIENTIFIC RESEARCH AND STUDIES IN THE RAIL TRANSPORT FIELD IN THE FOLLOWING AREAS:

– ROLLING STOCK AND INFRASTRUCTURE ELEMENTS,
– ELECTRIC TRACTION AND ELECTRIC ENERGY,
– RAILWAY TRACKS,
– TRAFFIC CONTROL COMMAND AND SIGNALLING SYSTEMS AND EQUIPMENT,
– TELECOM AND COMMUNICATIONS SYSTEMS AND EQUIPMENT,
– MATERIALS AND STRUCTURE OF ROLLING STOCK AND INFRASTRUCTURE,
– ENVIRONMENTAL PROTECTION,
– FEASIBILITY STUDIES.

CALIBRATION OF STANDARDS AND MEASURING INSTRUMENTS
OF LENGTH AND ELECTRICAL QUANTITIES AND MEASUREMENT OF THESE QUANTITIES
WE COOPERATE WITH, AMONG OTHERS: UIC, OSJD (OR OSShD), ECTRI, ERRAC, EURNEX, ELCF AND OTHER NATIONAL
AND INTERNATIONAL RESEARCH UNITS
WE ARE A MEMBER OF SUCH ORGANIZATIONS AS: EURNEX, C4R CAPACITY FOR RAIL, NEAR, EUREMCO, SMARTRAIL, ECTRI

WE LOOK FORWARD TO COOPERATION WITH YOU

Notified Body no. 1467 under European Directive on the interoperability of the railway system within the Community

Invitation for TRAKO 2017

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