TRANSPORTATION SAFETY
BUREAU

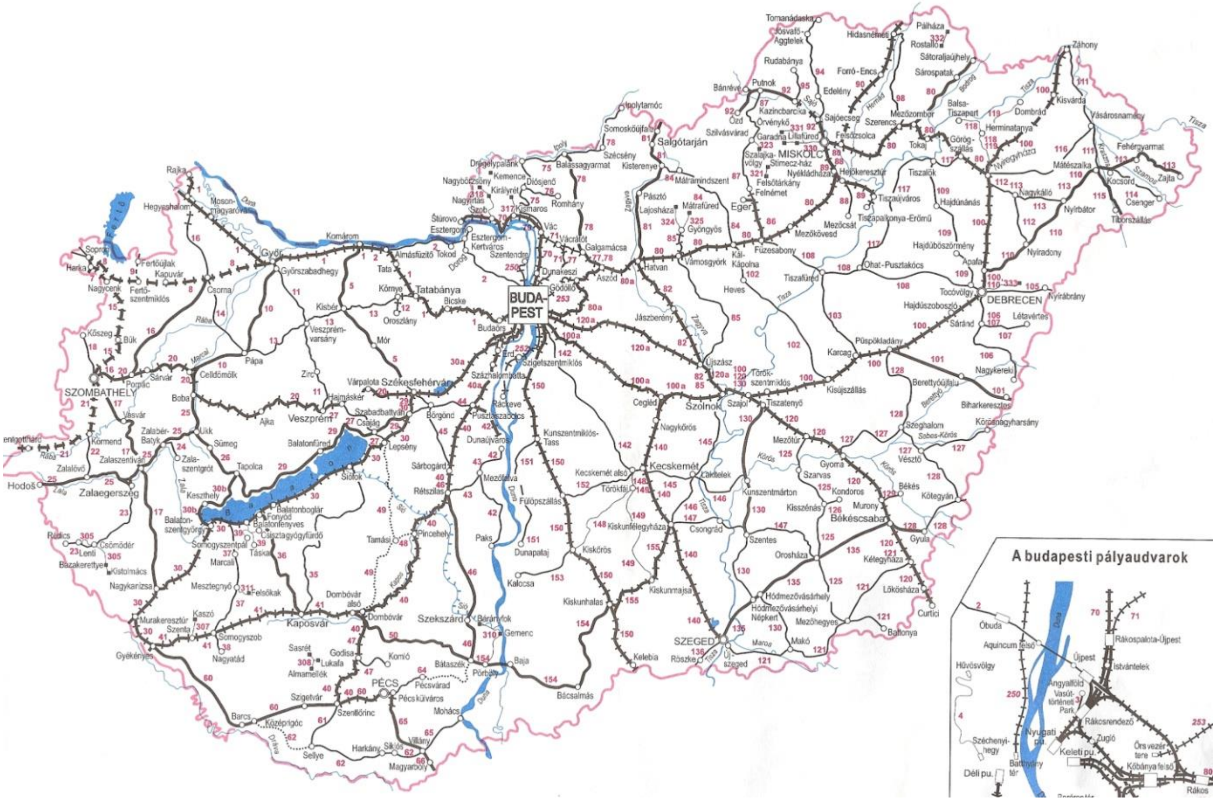
ANNUAL REPORT 2015

Transportation Safety Bureau

Hungary

CONTENTS

RAILWAY NETWORK IN HUNGARY



Basic data of the infrastructure:

National lines:	7690 km IM: MÁV (94%), GySEV (6%) Trans-European network: 2830 km (37%)
Regional lines:	480 km (100% narrow gauge)
Suburban lines:	210 km
Local network:	in Budapest, Debrecen, Miskolc, Szeged
Level crossings:	6041 (48% active, 52% passive)

SUMMARY

Hungary fully implemented all essential requirements concerning accident investigation of the Railway Safety Directive 2004/49/EC in its national law. Based on previous experiences and preliminary consultation with the Commission, in 2012 provisions of the relevant act had been reviewed, as a result of which an amendment has been made to the act in order to enhance implementation of Railway Safety Directive and transpose to the railway sector good practice applied in aviation.

The Transportation Safety Bureau was established on 1st January 2006 as the legal successor of the Civil Aviation Safety Bureau (founded in 2002). TSB operates in a multimodal form. Its main duty is the independent technical (safety) investigation of aviation, railway and marine accidents and incidents. Within the organisational framework of TSB, the Railway Department began to operate on 1st March 2006.

In 2015 there was one occurrence (serious accident) on the railways which the Railway Department of TSB was, pursuant to the regulations, obliged to investigate.

TSB decided at its own discretion to conduct independent safety investigation into 37 further occurrences. This is 18% more than in the previous year.

During year 2015, TSB published 37 final reports, including 17 safety recommendations. 3 of these recommendations have been implemented, implementation of 11 recommendations is in progress, 5 of them was rejected by the addressee. Furthermore, TSB issued 2 safety recommendations prior to the completion of the investigations started in 2015, in which recommended immediate preventive actions. One of these recommendations has been implemented, and the implementation of one is in progress.

At its own discretion, TSB included in the scope of the technical (safety) investigation some occurrences of signals passed at danger (SPADs), taking into consideration hazards and high frequency of these cases with an otherwise fortunate outcome.

Based on previous positive experiences, TSB monitored with particular consideration the occurrences related to level crossings (LC accidents) and to persons injured by railway vehicles, initiating technical (safety) investigations in cases that appeared to be instructive.

Abbreviations	
IC	Investigating Committee
LC	Level crossing
MÁV Co.	Hungarian State Railways Plc.
NIB	National Investigation Body
NTA	National Transport Authority (the National Safety Authority of Hungary)
RSD	Railway Safety Directive (2004/49/EC directive)
TSB	Transportation Safety Bureau

1. INTRODUCTION

The Transportation Safety Bureau of Hungary (TSB) as a multimodal organisation for the investigation of accidents was established on 1st January 2006.

The Annual Report 2015 of TSB - in accordance with Article 23 (3) of the Railway Safety Directive 2004/49/EC - gives an account on the following:

- the implementation of 2004/49/EC Railway Safety Directive into the Hungarian law,
- the relations of TSB with other concerned organisations,
- the philosophy and process of the independent safety investigation at TSB,
- the overview of the past 12 months from transport safety point of view,
- the experiences of the independent safety investigations carried out by TSB,
- the safety recommendations issued by TSB and the provisions made in relation to the recommendations, and
- the participation of TSB in the work of the European Railway Agency.

1.1 Legal basis - The implementation of the Safety Directive in the Hungarian law

Hungary implemented all essential requirements concerning accident investigation of Railway Safety Directive 2004/49/EC in Act CLXXXIV of 2005 on the safety investigation of aviation, rail and marine accidents and incidents. Based on the Directive, Transportation Safety Bureau was established on 1st January 2006 and – as a multimodal organisation - is responsible for the independent safety investigation of aviation, railway and marine accidents and incidents.

The detailed regulations of the safety investigation are included in the decrees of Act CLXXXIV of 2005 which were separately issued for the three modes of transport by the Minister of transport. The decree on the regulation of the safety investigation of serious railway accidents, railway accidents and incidents (7/2006 GKM) was issued on 27th February 2006.

Based on previous experiences and preliminary consultation with the Commission, in 2012 provisions of the act had been reviewed and, as a result of this, an amendment has been made to the act in order to enhance implementation of Railway Safety Directive (e.g. the term of railway accident more specifically defined) and also to transpose into the railway sector good practice applied in aviation (e.g. the issuance of intermediate reports for investigations longer than one year).

Powers of TSB have been extended: previously, the scope of TSB activity had not included investigations of accidents and incidents occurred on local railways. Serious accidents are not frequent on these railways (underground railway, cogwheel railway, funicular, tram – Budapest, Miskolc, Debrecen, Szeged), nevertheless, related hazards are high, considering the high number of passengers transported daily. Extension of the investigation scope by including these railway systems was justified by this hazard, completion of the safety investigations additionally generated being possible by an allocation of minor extra resources.

The extension helped the mutual exchange of good practices and their dissemination between the local and conventional railway systems, in both direction.

Act CLXXXIV of 2005 on the safety investigation of aviation, rail and marine accidents and incidents was also amended parallel to this, the amendment

concerning TSB activity by introducing the institution of accident investigation of the operator in the railway sector as well. Positive experiences of the accident investigation system of the operator, well established in the aviation sector, can be effectively applied to enhance safety in the railway sector also. Therefore, according to the new regulation for occurrences not included in the serious accidents category required to be investigated by the National Investigation Body (NIB), in case NIB takes decision on not conducting a safety investigation of the occurrence, the safety unit of the railway undertaking will be requested to conduct the investigation by the operator and inform NIB on the results in a report.

This regulation does not aim the duplication the safety system, it does not concern investigations required by the safety management system (SMS). Its objective is to ensure that reports, being issued anyway by the accident services of railway undertakings, would be forwarded to NIB, furthermore, authorizes NIB to request additions, when necessary, to these reports – by this, the regulation helps NIB in collecting data on safety issues. Involving organisations already actors of the SMS in the activity of NIB does not require extra resources (HR, etc.) on either side, nevertheless, it broadens significantly the information base of NIB activity and, by this, the enhancement possibilities of railway safety.

These rules were implemented into the decree on the regulation of the safety investigation of serious railway accidents, railway accidents and incidents (7/2006 GKM) issued on 27th February 2006, the new number of this decree: 24/2012 NFM issued on 8th May 2012.

Within the organisational framework of TSB, the Railway Department began to operate on 1st March 2006 pursuant to the regulations.

The national Act guarantees the complete independence of TSB from all other actors of the concerned transport sector. The Act defines the objective of the independent safety investigation as follows:

‘The objective of the independent safety investigation is to reveal the causes and circumstances of serious railway accidents, accidents and incidents and to initiate the necessary technical measures and make recommendations in order to prevent similar cases in the future.’ It also states that ‘it is not the purpose of the investigation carried out by TSB to apportion blame or legal liability’.

The Act contains the rights and responsibilities of the investigators defined in the Safety Directive.

According to the national regulations:

– All aviation, railway and marine occurrences shall be reported to TSB.

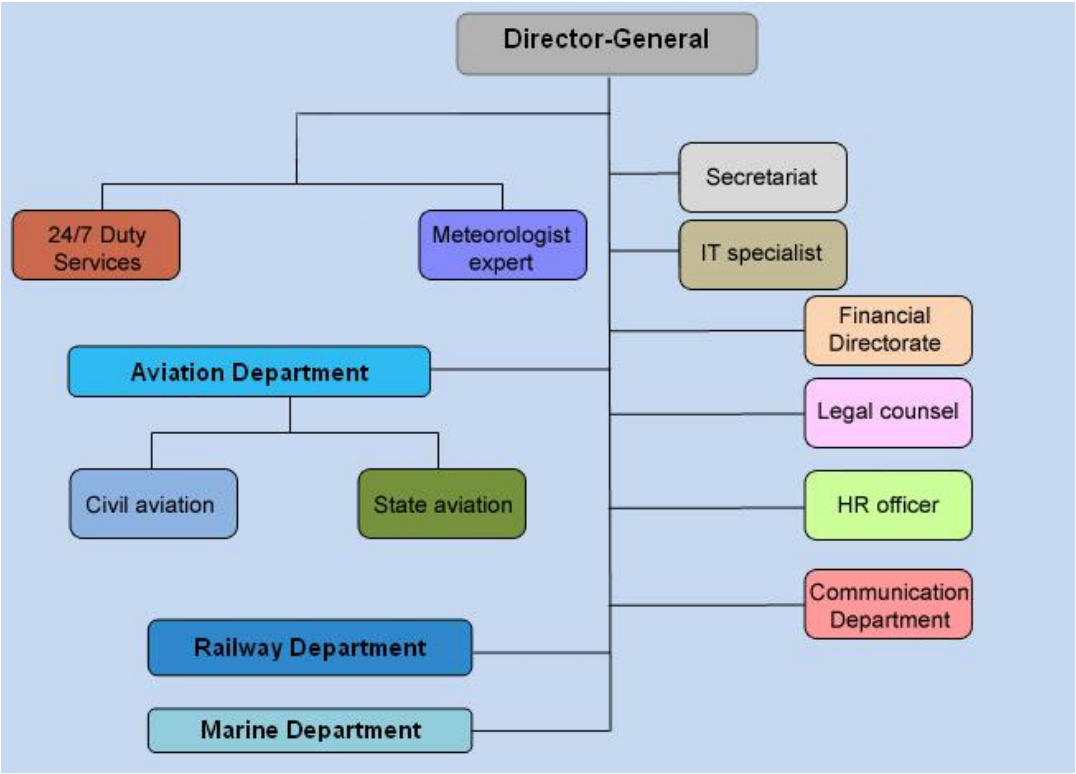
– The members of the Investigating Committee of TSB are authorized to be present at the site of any occurrence and to conduct the safety investigation parallel with the police investigation (if there is one).

– Based on the results of the investigation, TSB is entitled to issue safety recommendations and recommend immediate preventive actions before the completion of the investigation, if necessary. The implementation of safety recommendations is not obligatory, however, the addresses must report to TSB once a year whether they have accepted or rejected them. (The addresses must forthwith respond to the recommended immediate preventive actions.)

– The anonymity of the relevant parties is guaranteed. TSB shall make public the final reports on the results of the safety investigation. However, the final report shall not contain data based on which the relevant parties can be identified. The final report shall not be used in criminal procedures.

– At the time drafting the report an organizational change is ongoing. The impact of this change on the independence is not known yet.

1.2 Organisation of TSB Hungary



– TSB regards prevention as the main objective of its activity. TSB endeavours to share the findings, the results and the experiences of the safety investigations with a wide circle of organisations in the profession as well as with the civil sector.

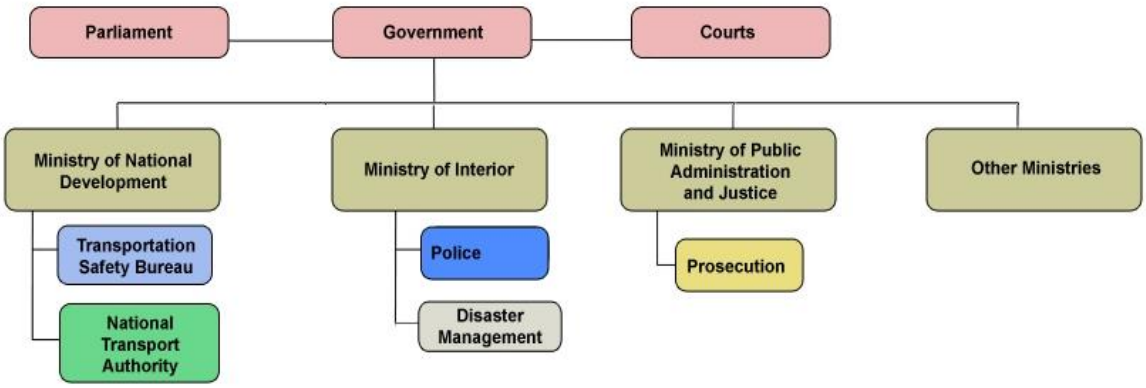
– The predecessor of TSB was the Civil Aviation Safety Bureau which conducted investigations in the field of aviation between 2002 and 2005 in line with Directive 94/56/EC establishing the fundamental principles governing the investigation of civil aviation accidents and incidents.

– TSB was established on 1st January 2006. The Aviation Department and the 24/7 Duty Services operated from the beginning of 2006 and the other departments and units grew gradually during the year. The Railway and the Marine Department began to work officially on 1st March 2006. The total number of permanent staff at the end of 2006 was of 50 which increased to 57 by the end of 2007. The reason behind this increase is that since 1st July 2007, the Aviation Department of TSB has been conducting investigations into occurrences involving state (military and police) aircraft as well, which required further human resources. The total number of permanent staff was reduced by 3 persons in 2011 in the frame of a general staff reduction of the governmental sector.

– The Railway Department – in accordance with the regulations – began its work on 1st March 2006.

– The Railway Department consists of 8 investigators (one less than earlier) and the Head of Department, one of the investigators was retired by the end of 2014, who has not been replaced. In 2015 one investigator left the organization, and one new investigator was hired, who have had more than 20 years experience in the railway sector.

1.3 Organisational flow of TSB Hungary



- TSB is supervised by the Ministry of National Development. The Director General of TSB works under direct supervision of the Minister. According to the national law, the Minister shall not instruct TSB in matters concerning the independent investigations.
- TSB reports to the government annually on the activities of TSB, the lessons learned from the independent investigations, the processes and trends concerning transportation safety.
- The Ministry of National Development is the national regulator.
- The general rules regarding the operation of the railways are currently defined by the state-owned MÁV Co., the largest infrastructure manager in Hungary. The National Transport Authority only assents to the amendments to the rules.
- Based on the outcome of the investigations, TSB may issue safety recommendations to the National Safety Authority (NSA). The implementation of safety recommendations is not mandatory; the addressees however are obliged to compile an annual report on their response (acceptation, implementation, or refusal).
- TSB is authorized to get access to all data relevant to the occurrence in question (including data stored on data recorders).
- The Investigating Committee of TSB may conduct its site investigation simultaneously with the police investigation.
- TSB and the police may help each other's work with exchange of factual data and results of expert analyses. The IC may withhold information obtained in the course of the investigation from other authorities in occurrences when the owner of the information would have had the right to do so.
- TSB, the police and the disaster management mutually inform each other about the received occurrence reports.
- TSB has the right to manage confidential and personal data, including sensitive data.

1.4 Overview of the last 12 months

1.4.1 Trainings

In order to maintain and improve the professional knowledge of the investigators, the trainings organised based on our training plan continued in 2015.

One colleague participated in the “Investigating Human Performance” course and successfully passed the exam in Cranfield University (UK).

Two of our investigators attended the Inspectors’ Training in field of Human Factors organised by the Office of Road and Rail (ORR), United Kingdom.

Three colleagues participated and successfully finished the 2 semester long investigator course in University Győr.

These studies can be utilised effectively in the investigations.

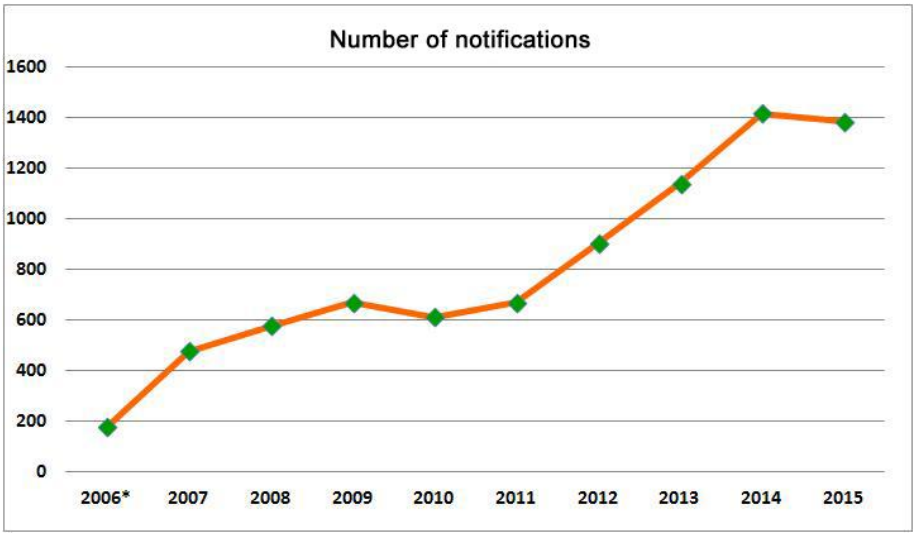
Our colleagues also succeeded in passing the public administration examinations – basic and higher level – obligatory for all civil servants in Hungary.

1.4.2 Notifications

In accordance with the extension of its powers TSB began during the fall of 2011 to receive notifications on occurrences concerning local railways also (underground railway, cogwheel railway, funicular, tram – Budapest, Miskolc, Debrecen, Szeged). Data of 2015 reflect, that the number of notifications of this kind increased continuously until 2014, considering that the notification practice concerning these railway systems was stabilized during the years. In year 2015 the numbers of notification stabilized on the same level like in 2014.

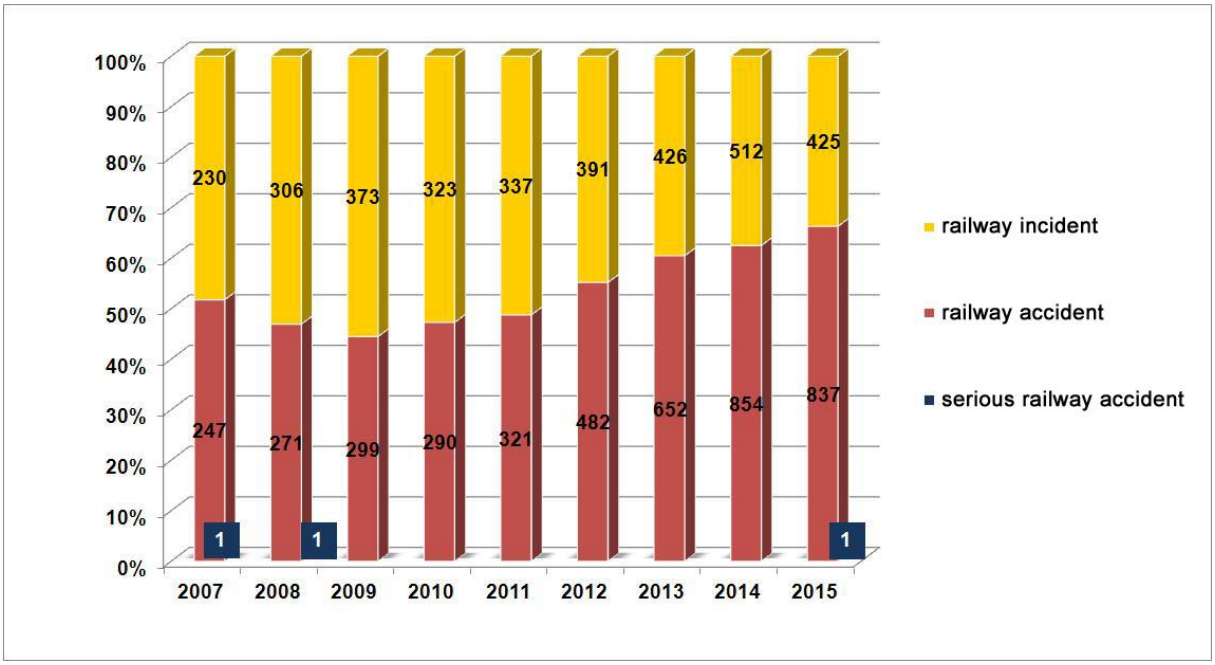
The stable number of notifications shows the emergence of a common reporting practices among all industry actors.

Reported railway occurrences in 2006-2015



* Data collection since 01. 03. 2006 pursuant to Kbvt.

Reported railway occurrences in 2007-2015 by category



Parallel with the growing number of notifications until 2014 there was a change in the former rate of railway accidents and incidents: comparing the total number of reported occurrences, the accident rate increased significant. In addition to the same number of notifications it continued the trend that it has increased the accident rate among all the events.

The reason of the higher increase rate of railway accidents is the number of collisions and bumps between trams and road vehicles. These accidents in most cases with minor injuries typically occur in road-tramway crossings and caused by human factor, mainly by the attention disorder of the drivers of road vehicles, and lack of knowledge of local conditions

Another characteristic type of railway accidents is where a tram passenger falls over; the cause is usually the standing passenger's failure to use the handhold. Such occurrences are also classified as railway accidents.

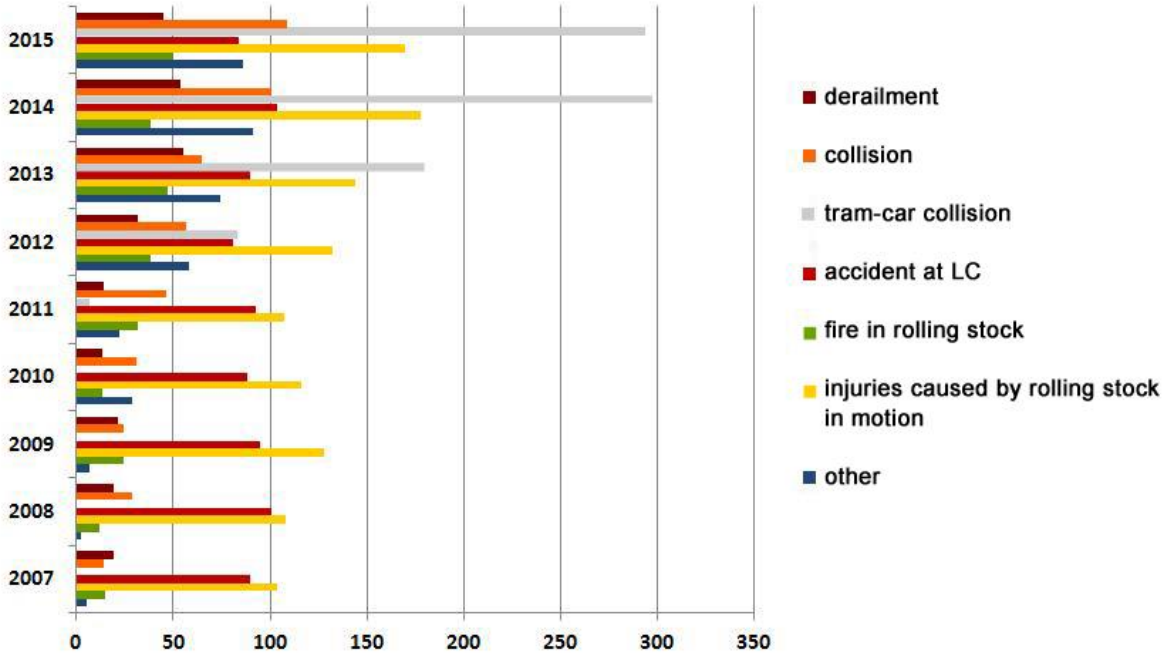
Reported significant accidents in 2008-2015 by content

SIGNIFICANT RAILWAY ACCIDENTS	TSB							
	2008	2009	2010	2011	2012	2013	2014	2015
	132	165	131	134	122	107	109	102
- collision	1	-	-	-	1	-	3*	1
- derailment	1	2	-	-	-	1	2	2
- injuries caused by rolling stock in motion	88	113	89	91	88	71	69	69
- accident at LC	42	50	42	43	31	33	33	26
- fire in rolling stock	-	-	-	-	-	-	-	
- tram-car collision	no data available				2	2	2	4

* One of these 3 occurrences is a tram collision with a stop-buffer with significant damage.

There is a remarkable improvement in the number of significant railway accidents. In the last four years it decreased from 134 (2011) to 102 (2015). This is a 24% decrease, even though the influence of some significant railway accidents occurred to local and special railway undertakings have already been included in the data since 2012. The most attractive improvement is in the significant LC accidents, 40% less accidents in four years. The low number in the injuries caused by rolling stock in motion shows stability after the 3-years long improvement period.

Reported railway accidents in 2007-2015 by content

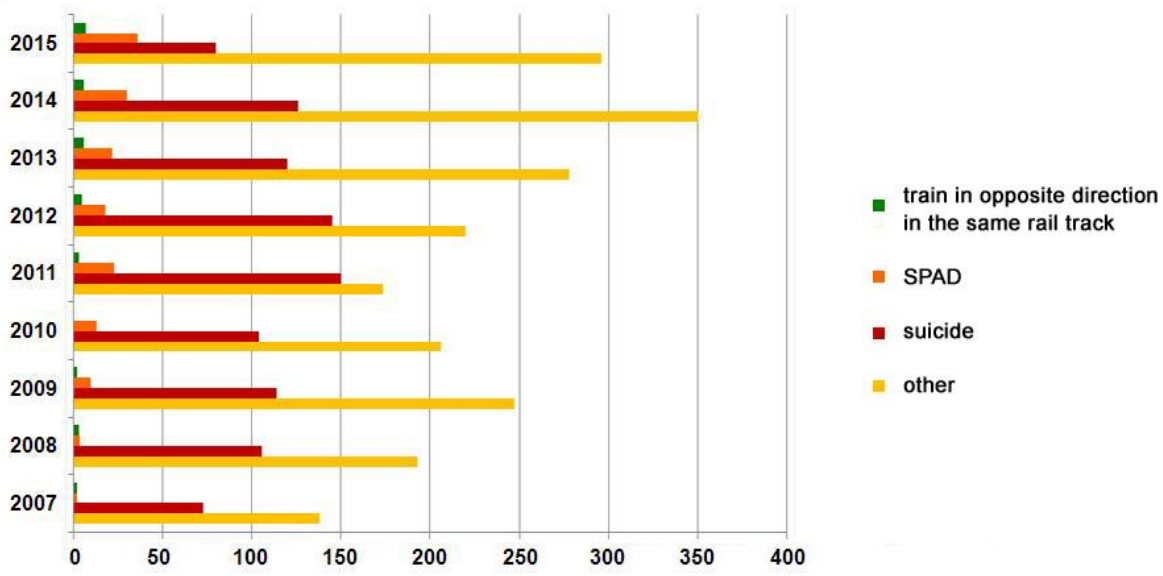


The total number of occurrences is virtually stagnant, just a slight internal restructuring can be observed, because of the stochastic characteristics of these events.

Derailments, minor bumps and collisions typically occur in the area of tramways. Due to the low speeds used, such occurrences usually cause little damage only, and injury to people occurs only exceptionally. In addition, the number of collisions with an object (e.g.: fallen trees, elements of the infrastructure reaching into the structure clearance, etc.) and derailments occurring typically during shunting in heavily worn-out track sections in the major railway system should not be neglected either.

In 2015 the number of accidents occured at level crossings shows decrease even in the number of significant accidents in this category though in total. The number of injuries caused by rolling stock in motion have also decreased significantly. The reason of this tendency is analysed in Chapter 3: Investigations. The number in accident category 'other' is caused by the emergence of accidents occurring to local and special railway systems that cannot be classified with the traditional method.

Reported railway incidents in 2010-2015 by content



The category other in this diagram shows all the occurrences, which cannot be categorised into the existing categories, and it has no worth to define further ones, because these occurrences have very low impact on safety (e.g. problems with overhead lines, minor incidents in tram system, etc.).

The number of SPAD incidents reported to TSB shows further increase and its number is relatively high. These occurrences were of fortunate outcome, practically having no consequences to persons or property, nevertheless, each of these represented serious safety risks and in some cases the occurrence of a serious accident was indeed close. For this reason, TSB took decision on conducting technical (safety) investigations in some of these cases, issued final reports on the results and issued safety recommendations as well. As part of the investigation we investigate the human and organizational factors as well, for example failed or missing safety critical communication.

The cause of the increasing number of accidents of trains in opposing direction on same track is that in the period under review there were several of this cases occurred in the single-track part of the tram system: 6 occurrences in 2015. Though due to the low speed used the danger is slight in these accidents but regarding the fact of recurrence, TSB launched technical safety investigations to find out the reasons to prevent similar future occurrences.

Reported occurrences with great significance in 2015

Head on collision close to station Acsa-Erdőkürt got a lot of media attention in 2015. At this accident two passenger trains collided and occurred serious injuries for 5 persons.

On station Békéscsaba a freight-train collided to the rear end of another freight train. At the time of the accident on the station started the pilot period of a new signalling system.

2. INVESTIGATION PROCESS

2.1 Independent basis of the investigation

Pursuant to national law, TSB is independent of all persons and organisations whose interests are contrary to the duties of the investigating organisation, in particular:

- authorities granting permission to put vehicles into service,
- authorities granting permission and controlling the operation and the maintenance of the vehicles,
- authorities issuing driving licences,
- the organisation operating the transport infrastructure,
- transport companies,
- railway undertakings
- the organisation determining railway tariffs,
- the organisation distributing routes,
- the safety authority and
- all regulators in the field of railways.

Under the national law, the civil servants of TSB shall not be the owners, senior officials or employees of the above mentioned organisations.

The Director-General and the Investigating Committee of TSB shall not be instructed in their scope of duties concerning the safety investigation.

2.2 Accident investigation philosophy of TSB Hungary

Under the Hungarian regulations, TSB shall investigate serious railway accidents.

The definition of 'serious accident' under the national regulations - in accordance with the Railway Safety Directive 2004/49/EC – is as follows:

'*Any train collision or derailment of trains, resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment of at least HUF 500 million and any other similar accident with an obvious impact on railway safety regulation or the management of safety*'.

Apart from serious accidents, the national regulations permit TSB to investigate other occurrences – at its own discretion – that may have an impact on the safety of rail transport as well as on the regulations and management of railway safety.

TSB availed itself of the opportunity provided by the regulations to decide which occurrences – apart from serious accidents – are to be investigated. TSB based its decisions regarding which occurrences require investigation on the following fundamental principles:

- **occurrences resulting in serious injuries to persons, extensive material damage and/or hindering railway transport significantly,**
- **the latent danger of the occurrence can be considered significant – irrespective of its actual consequences,**
- **accidents or incidents recurring at the same site or in the same manner**

should be investigated.

When deciding which occurrences to investigate - besides the ones with serious consequences - it helps a great deal that the Railway Department regularly requests information from railway undertakings and relevant authorities on occurrences which are not investigated in details. The collection and evaluation of these data provides the possibility to be able to discover recurrence and certain tendencies in the accidents. These observations can create basis for further investigations.

In order to increase efficiency in decision making, it is necessary to gain as much information as possible. The institution of accident investigation of the operator has been introduced in the railway sector as well. Positive experiences of the accident investigation system of the operator, well established in the aviation sector, can be effectively applied to enhance safety in the railway sector also. Therefore, according to the new regulation for occurrences not included in the serious accidents category required to be investigated by NIB, in case NIB takes decision on not conducting a safety investigation of the occurrence, the safety unit of the railway undertaking will be requested to conduct the investigation of the operator and inform NIB on the results in a report.

2.3 The investigation process of TSB

The Duty Services of TSB (dispatchers) receive the reports of the occurrences 24 hours a day.

The members of the Investigating Committee (IC) are appointed by the Director-General or by his deputy on duty. The IC consists of one field investigator technician and at least one accident investigator. In case of more serious or complicated occurrences, one of the heads of department on duty and/or the spokesperson of TSB may be present on the site.

If an occurrence is not obliged to be investigated under the law, the head of the concerned department advises the Director General to decide whether or not to conduct an investigation.

The Investigating Committee carries out the site survey (parallel with other authorities) and decides on the direction of the investigation, the required technical and technological examinations as well as selecting the organisations and/or experts to be initiated in the investigation if necessary.

During the process, the IC conducts investigative interviews, tests. IC asks external consultant or expert when a special issue cannot be managed. IC often consults with organizations which were involved in the occurrences and with NSA.

The draft reports on the occurrences are discussed by a board made up of the heads of departments of TSB.

The relevant parties of the investigation may make reflections on the draft report within 60 days from the date of receipt which is to be evaluated when compiling the final report. After this 60-day-period, TSB convenes a meeting for a final discussion with the participation of the representatives of the persons and organisations concerned. The purpose of the final discussions is that all concerned parties can hear the comments sent in reflection to the draft report as well as the viewpoint of TSB regarding the comments before the completion and publication of the final report. According to Hungarian law, the investigators may decide whether or not to include the parties' comments in the final report, the comments of an NIB of a Member State have to be included. Subsequently, the final report is made public.

If there is no agreement, and stakeholders requests, their opinion is published in a separate chapter.

All the three major departments of TSB have a separate ‘Investigators’ Manual’ which lays down the methodological and technical requirements based on which the investigations shall be conducted by the investigators of TSB, taking the special characteristics of the given mode of transport into account.

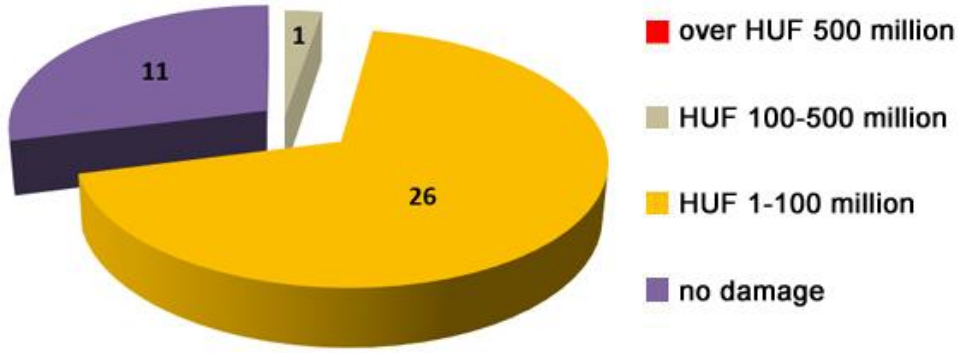
3. INVESTIGATIONS / RECOMMENDATIONS

For practical reasons, this chapter deals with the closed investigations together with the safety recommendations issued in the course of or after the completion of the investigations.

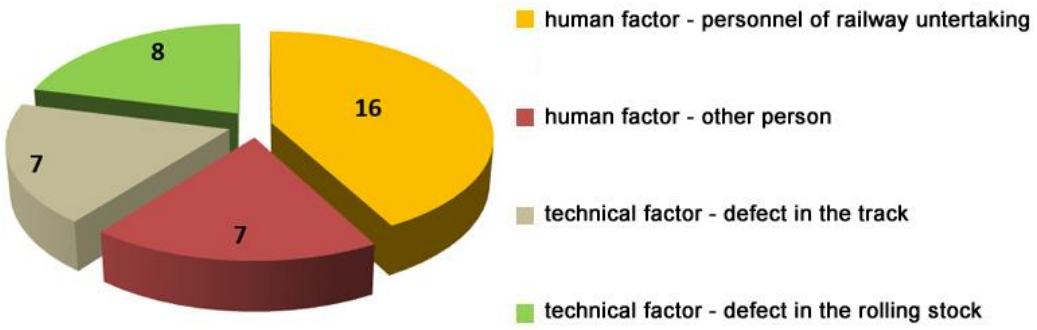
3.1 Overview of investigations conducted by TSB

In 2015, there was one serious railway accident in Hungary which TSB was obliged to investigate. TSB conducted investigations – at its own discretion – on 37 further occasions (29 accidents and 8 incidents), based on the fundamental principles listed in 2.3. This is 18% more than in 2014, but 3 % less than in 2011, with regard to the finding of the ERA Assessment carried out at the TSB.

Investigations commenced in 2015 by the amount of damages:



Investigated occurrences in 2015 by their presumed cause (based on the reports):



Number of investigations lasting longer than one year over 2007-2015

TSB								
at the end of 2007	at the end of 2008	at the end of 2009	at the end of 2010	at the end of 2011	at the end of 2012	at the end of 2013	at the end of 2014	at the end of 2015
12	11	7	1	7	12	14	12	9*

* In 6 cases the draft report was already sent out.

3.1.1 Overview of investigations by operators

In 2015, TSB invited operators to investigate 69 occurrences. In the railway sector, since 2012 – similarly to aviation – TSB has the opportunity to request information from operators on the causes of railway occurrences which need no investigation by TSB but may offer a lesson to learn in connection with general safety on rail transport. Today, the conditions of investigation by the operator are given: In 2014, the 160-hour accident investigator training sessions have been finished in order to meet the personal requirement of the performing of investigation by operators. Two training organizations submitted their training syllabuses to TSB, our organization evaluated both, and the first training sessions are running since 2013.

Since 2013 to the end of 2015 about 180 person participated the training. The reports show higher quality than in the previous period, and the reports often contain corrective and preventive measures as proposals.

3.2 High priority topics in 2015

In year 2015 we put more emphasis on investigating the human and organizational factors.

In the final report of the ERA Assessment held in 2012, the investigating of human and organizational factors was an area to be improved. In order to the develop our ability, one member was delegated to the ERA Human Factor Network by the TSB. In the Network many good practices, methods and models can be get known and the exchange of views, opinions is possible. However, the Network members also helped the TSB shaping in field of investigation of the human and organizational factors with their advice and assistance.

The TSB each year looks for books, literature in this topic, and the dissemination of methods helps to develop our abilities, and form our viewpoint in associated with human factor.

As next step, an investigator was sent to carry out the "Investigating Human Performance" course at the University of Cranfield. Thanks to the support of the ORR this colleague could attend on their inspectors' training in this topic. Later in autumn this training was attended by another investigator as well.

Based on the ERA Human Factor Network, literatures and trainings now at the TSB there are two investigators, who can recognize, investigate and understand the role of the human factor in the accidents.

When deeper expertise is needed during an investigation, the TSB ask for expert a psychologists, who is registered on the ERA website, as a human factor expert. The common work with this expert is not only to ensure the understanding, but also to support the broadening of investigators' knowledge.

Our findings about the human and organizational factors in the occurrences were published in the final reports. In addition, on our regular open seminar day, presentations are held for the railway companies. On training sessions and meetings held with our contribution the human and organizational factors and their assessment are always significant topics.

Having regard to the fact that ca. 30% of the significant accidents on the railways occur on level crossings (collisions with road vehicles, running over people), in 2015 TSB continued to put special emphasis on the investigation of such accidents using the previous years' experiences as well as paying special attention to accidents occurring at other places during which people were run over.

The number of significant accidents occurring at LCs was 26. After a significant decrease in 2012 (-28%), the annual number of these occurrences seemed to be constant (31-33) between 2012-2014. The decline of the number of these kind of accidents got new power in 2015, more than 20% loss in last year, 40% loss in last 5 years.. However, the number of collisions with cars and runover of trespassers was dominant, but accidents involving motorcycles, bicycles or agricultural tractors also occur. All these accidents can be related to human factors when drivers do not pay sufficient attention or break the rules on purpose.

It was found during the safety investigation of accidents at level crossings on one occasion in year 2014 that the operation error of the barrier system contributed to the accident. No similar contributing factor occurred among the causes of occurrences between 2010 and 2012, while it occurred twice in 2013. In 2015 happened again 3 occurrences, where the operational failure of the LC protection system played a role in the accident. One of these happened on a track under construction, the other two occurrences has been investigated by the TSB.

In other cases, the accident is typically attributable to the careless, negligent behaviour of users of the level crossings. Besides this the lack of visibility triangle, lack of required visibility to the signals, inadequately placed signposts, etc. were also contributory factors in few cases to which the Investigating Committees drew the attention in their safety recommendations.

Having evaluated data of last years, it can be established that the number of accidents when road vehicles or pedestrians ran into trains (e.g. into one of the wagons of a train) increased. These accidents can almost solely be related to the inattention of LC users.

The geographical distribution of the accidents in the last year shows no new level crossing where accidents would repeatedly occur, and there were no new accidents in those level crossings where we found repetitions previously.

Learning from the experiences of accident investigations, it may be advisable to complete (in addition to the subject of upgrade of level crossings) future transportation safety campaigns with a survey and related action plan on level crossings that are not safe due to their design (e.g. parallel road nearby, poor visibility conditions, etc.) and could be replaced by neighbouring level crossings with appropriate design. Driving morals could be improved by eliminating these level crossings and also those still operating on inaccessible track sections, abandoned for decades, since these usually constitute one of the factors contributing to the occurrence of accidents on LCs. By closing down unnecessarily operating LCs, there would not be such ideas in drivers' minds that 'signals can sometimes be ignored', which result in bad practice that may lead to accidents on other LCs operating normally.

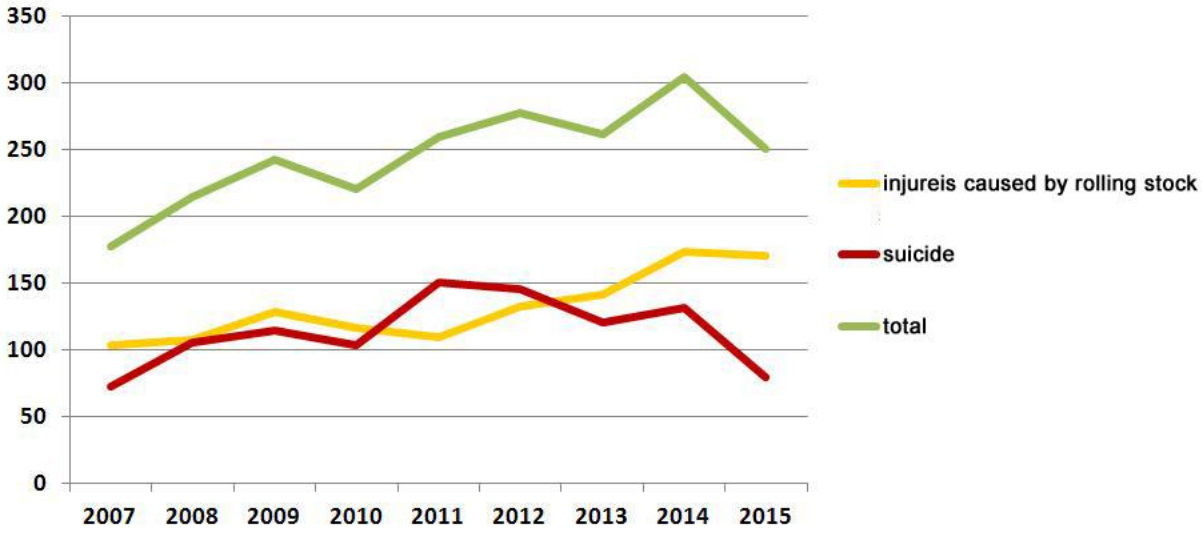
In the cases when the train derails or there is the possibility of a signalling system failure during a LC accident, the TSB always carrys out an on-site investigation, and after it decides about the necessity of a full safety investigation.

When investigating accidents involving pedestrians, it is difficult to ascertain whether or not the person wanted to commit suicide. However, only such cases are regarded as suicides in which the relevant authority unambiguously states the fact of intentional self-harm.

The number of injuries to persons caused by rolling stock in motion increased significantly (22%) in 2014 (141→173), and it seems to stay constant for 2015170 occurrences. Evaluation should also take into account, however, that the number of significant accidents in this category decreased by 20% in 2013, and there is a further decrease in 2014 by 4%, and it stayed constant for 2015 (69 occurrences). The

underlying cause here is the extreme increase in the number of notifications in the area of tram transport where this kind of occurrence is fairly frequent but rarely has a serious or fatal outcome.

After a significant decrease of the number of suicides in 2013 (145→120), this number increased again to 135 in 2014. In 2015 there was a very strong loss in the number of suicides on railways, there happened 80 cases (40% loss). The causes of such decrease may be found outside the railway sector, in the social-societal area. In Hungary also the total number of suicides showed a significant loss in last year.



The number of injuries to persons caused by rolling stock in motion (indicated with yellow) and that of suicides (indicated with red)

According to our experiences, the police still tends to close cases in which persons are run over with the statement that 'no sign of criminal act has been found' and wilful self-harm is not mentioned or only mentioned as a possible cause. In statistics, this increases the number of injuries caused by rolling stock in motion and indicates latency with regard to suicides.

Data of 2015 reinforce previous experiences, according to which, the most dangerous areas of the Hungarian railway network from this point of view are the following:

- Section between Debrecen and Apafa stations: 15 occurrences between 2007 and 2009; 9 occurrences between 2010 and 2012, 6 occurrences in 2013, 7 occurrences in 2014, and 4 occurrences in 2015.
- Section between Kőbánya-Kispest and Monor stations: 23 occurrences between 2007 and 2009; 17 occurrences between 2010 and 2012, 8 occurrences in 2013 and 8 occurrences in 2014., and 6 occurrences in 2015.

The experiences of the reported occurrences and the safety investigations of the past year conducted in accident category with injuries to persons caused by rolling stock in motion has drawn the attention to the door operation problems of passenger carriages. There were several technical safety investigations conducted where the passenger got out of the rolling stock in motion through doors that should have been closed and blocked by emergency lock. In many cases the investigations proved that the doors were not opened by the operation of the emergency lock but, due to technical deficiencies, they were open or could be opened by the normal procedure.

No similar phenomena were revealed among the occurrences of 2014 and 2015, but it often occurs on vehicles without centrally locked doors that passengers sustain

severe injuries when falling out through the open door or while getting off or on the moving train.

Therefore, considering the available resources, efforts should be done to modernize and equip passenger carriages that still have not operated such systems and to check the proper and continuous availability and usage of the systems that have already been operated.

A remarkable achievement in the Hungarian railway transport is that there has been only one serious railway accident since 2008. However, to maintain this positive tendency, it is essential that all participants of the sector learn from the occurrences whose consequences were close to serious, and more serious outcome was avoided largely by chance.

On 16th August 2015 a passenger train from Acsa-Erdőkürt station departured without any authorization and on the open line collided head to head with another passenger train, 4 passengers and 1 staff injured seriously. The direct cause was that the train driver ignored the written command, which authorized the movement only to station Acsa-Erdőkürt. During the process the IC investigate questions on organizational level too (e.g.: the traffic control by the line-management, safety critical communication, communication tools etc.)

Therefore, TSB decided on a number of occasions to investigate accidents or incidents which did not have serious consequences but created rather dangerous situations or could have a significant impact on railway safety. Such cases occurred, among others, at Kápolnásnyék and Nagykanizsa station, primarily due to human factors, and at Békéscsaba station (under contrusction), where the design failure of the signalling system played an important role.

On 9th August 2015 on station Kápolnásnyék a passenger train stopped, and after the boarding the train departured and passed the exit signal “Danger!”. The signaller planned the traffic of two trains in queue, and has changed the sequence in the last moment.

Two days later a freight train stopped at Nagykanizsa station in order to be informed by a written command. Upon receipt the written document the train departure without any authorization and passed the exit signal “Danger!”.

In both incident, the direct cause seems to be the human factor related to the train drivers, but the role of missing safety critical communication is also under investigation.

On 6th September 2015 a freight train was arriving at Békéscsaba station, when on the down side end of the station collided with the end of another freight train standing on the next track. The last wagon of the train was out of the stabling limit sign. At the time of the accident on the station was the pilot period of the new signalling system. The signalling system did not perceive the train out from the limit sign, and allowed to give free on the signal for the arriving train. The focus of the investigation is on the planning process of a new signalling system.

All these investigations will be closed and published in 2016.

Cases of SPAD

The passing of signals at danger in itself belongs to the category of railway incidents. But taking a look at them as latent sources of danger in terms of potential consequences, they call our attention to phenomena which may have a significant effect on transport safety. SPADs may always be attributed to human factors but experiences from the safety investigations show that several other, unusual events/circumstances precede their appearance in most cases.

During the investigations almost always there was problem with the safety-critical communication: the transfer of important information was missing, there was not accurate communication, or not the right people have communicated with eachother.

The consequences of reported SPADs

Year	Without consequences	Splitting points open	Trains in opposing direction on same track	Running trains to already occupied track	Crossing LCs in open position	Total
2009	3	3	3	2	-	12
2010	6	3	2	1	1	13
2011	12	5	6	-	-	23
2012	10(+3)	3(+0)	1(+5)	-	1(+0)	15(+8)
2013	4(+12)	3(+0)	3(+3)	-	3(+0)	13(+15)
2014	6(+14)	3(+1)	2(+0)	4(+0)	-	15(+15)
2015	22(+10)	3(+0)	1(+0)	0(+0)	0(+0)	26(+10)

The numbers in the brackets show the occurrences of the urban railway systems from 2012

3.3 Investigations commenced in 2015

Date 2015	Occurrence	Category
01.06.	Budapest – 5th coach of the passenger train No. 4093 (suburban train) derailed with its two axles. Nobody was injured.	Railway accident
01.16.	Szolnok – The locomotive hauling the freight train No. 45423-2 derailed with its one axle. Nobody was injured.	Railway accident
01.19.	Budapest – Tram No. 14 derailed at Lehel tér stop. Nobody was injured.	Railway accident
04.05.	Budapest, Keleti station - Passenger train No. 3059 was not able to stop and collided with a buffer stop at the end of the track. Three passengers of the train were slightly injured.	Railway accident
04.07.	Budapest, Jánoshegy (heritage railway) – The locomotive hauling the passenger train No 30233 derailed. Nobody was injured.	Railway accident
04.08.	Nógrádszakál - One of the wagons of freight train No. 83331 has derailed due to an operational failure. In consequence of a failure the bogies of the wagon ran on separate track at the switch No 1 and the wagon derailed at the other side of the station. Nobody was injured.	Railway accident
04.20.	Pécel – One of the wagons of the approaching freight train No. 65822-1 derailed due to a broken axle at the station. Nobody was injured..	Railway accident
05.12.	Budapest (heritage railway) – Last coach of the passenger train No. 30118 derailed with its two axles between Jánoshegy and Szépjuhászné stations. Nobody was injured.	Railway accident
05.19.	Szombathely - Train No. 97002 collided with lorry at a level crossing protected with warning lights and half-barriers between Szombathely and Ják-Balogunyom stations. In consequence of the accident the locomotive hauling the train and the first wagon derailed. The driver of the lorry, the driver of the train and two shunters suffered minor injuries.	Railway accident
05.29.	Szajol – Locomotive hauling freight train collided with a broken steady arm (OLE). The failure was not recognized properly and the following train running on the neighboring track also collided with it. Nobody was injured.	Railway accident
06.01.	Budapest, Nyugati station - Passenger train No. 2329 was not able to stop and collided with a buffer stop at the end of the track.	Railway accident
06.29.	Nagyigmánd-Bábolna station - Load of the wagon No. 31 55 542 4623-3 running in the freight train No. 91869 caught fire between Komárom and Nagyigmánd-Bábolna stations Nobody was injured.	Railway accident
07.01.	Budapest, Rákospalota-Újpest station - Incoming freight train (No.44471) ran on the track occupied with a stopping shunting unit at Rákospalota-Újpest station. The driver of the train realized the dangerous situation and applied emergency breaking. There was no collision between the vehicles.	Railway incident
07.01.	Miskolc, Gömöri station – Incoming passenger train No. 5433 stopped before a point, which was run-through before approaching the train. Nobody was injured.	Railway incident
07.03.	Uzsa - Incoming passenger train (No. 19603) run on the track occupied with passenger train No. 9616 at Uzsa station. The driver of the train No. 19603 realised that the point Nr 3 leads his	Railway incident

	train in wrong direction and immediately applied the emergency break. There was no collision between the trains.	
07.07.	Kecskemét – First and second wagons of the freight train No.73729 derailed at the point No. 28. Nobody was injured.	Railway accident
07.23.	Csorna – Passenger train No. 9912 collided with a car at a level crossing protected with warning lights and half-barriers at Csorna Station. In consequence of the occurrence four people sitting in the car died at the site of the accident.	Railway accident
07.27.	Záhony - Two loaded wagons of the freight train No.68151 has derailed between Záhony and Mándok stations with their one-one bogies. Nobody was injured.	Railway accident
07.28.	Komárom - Three wagons of the freight train No 42200 has derailed at Komarom station with their one-one bogies. Nobody was injured.	Railway accident
08.09.	Kápolnásnyák - Passenger train (Nr 3543) passed a signal at Danger at Kápolnásnyák station. The train run through the point Nr 8 which was set incorrectly for the train. Nobody was injured.	Railway incident
08.11.	Nagykanizsa - Freight train (Nr 94880) passed a signal at Danger at Nagykanizsa station. The train run through the point Nr 43 which was set incorrectly for the train. Nobody was injured.	Railway incident
08.16.	Two passenger trains collided between Acsa-Erdőkürt and Nógrádkövesd. Train Nr. 33512 service running from Aszód to Balassagyarmat was given a written order to run only to Acsa-Erdőkürt station, but the train left the station without any permission. (At Acsa-Erdőkürt station there is no station personnel.) When the train left Acsa-Erdőkürt station, the other train, Nr. 33517 service running from Balassagyarmat to Aszód, had already departed from Nógrádkövesd station. In consequence of this two trains became on the same track. The two train drivers realized the dangerous situation immediately applied the emergency brake, but they could not manage to avoid the collision. At the moment of the crash the velocity of the trains were 23 km/h and 28 km/h. Five passenger on the trains suffered serious injuries.	Serious railway accident
08.27.	Fertőboz - Passenger train (Nr 9912) passed a signal at Danger at Fertőboz station. The train run through the point No. 1 which was set incorrectly for the train. Nobody was injured	Railway incident
09.06.	Békéscsaba - The train No. 44463-2 arrived on the track 12, but the last wagon of the freight train remained on the last switch. The locomotive of the following freight train (no. 44471-2), which was incoming at track 11 collided with this wagon. Nobody was injured.	Railway accident
09.15.	Záhony – Third wagon of the freight train No.68158 derailed between Záhony and Mándok stations with its one bogie. Nobody was injured.	Railway accidect
10.07.	Sopron - Passenger train No. 7726 collided with a car at a level crossing protected with warning lights between Sopron station and the state border. In consequence of the occurrence the driver of the car died at the site of the accident.	Railway accident
10.21.	Délegyháza – 14th wagon of a shunting unit derailed with its one bogie at Dálegyháza station. Nobody was injured.	Railway accident
11.01.	Budapest – Trainset of the cogwheel railway derailed wits its one bogie at Orgonás station. Nobody was injured.	Railway accident

11.04.	Almásfüzitő – The locomotive (98 55 0478 306-1) which was hauling freight train (No..45284) caught fire between Almásfüzitő and Komárom stations. Nobody was injured	Railway accident
11.06.	Debrecen - Passenger train No. 36628 collided with a car at a level crossing protected with warning lights and half-barriers between Tócóvölgy and Hajdúböszörmény station In consequence of the occurrence the driver of the car died at the site of the accident.	Railway accident
11.09.	Budapest - Tram collided into the rear part of another tram in Budapest. The first vehicle was standing before the final station because that was occupied by another vehicle. The following tram, which one was under testing, was not able to stop before the standing vehicle and run into it. Nobody was injured.	Railway accident
11.10.	Szeged – Two trams collided at a switch in the city center of Szeged. Nobody was injured.	Railway accident
11.19.	Hatvan – Five wagons of the freight train No. 53769 derailed at Hatvan station. Nobody was injured.	Railway accident
11.24.	Kaposmérő - The dispatcher on Kaposmérő station authorized the departing the train No. 28258 before arriving of the train No. 28299 from the opposite direction. (Single line) The drivers of the trains realized the dangerous situation and stopped their vehicles. Nobody was injured.	Railway incident
11.28.	Budapest (heritage railway)- Locomotive hauling passenger train No. 30234 and the first coach of the train derailed Between Hárshegy and Hűvösvölgy stations. Nobody was injured.	Railway accident
11.30.	Sopron - Ágfalva - Passenger train No. 7737 collided with a car at a level crossing protected with warning lights between Sopron station and the state border. In consequence of the occurrence the passenger of the car died at the site of the accident.	Railway accident
12.01.	Miskolc – Three wagons of the freight train No. 49892 derailed at Gömöri station. Nobody was injured.	Railway accident
12.19.	Jákó-Nagybajom - Freight train (Nr 45083) passed a signal at Danger at Jákó-Nagybajom station. The train run through a point which was set incorrectly for the train and stopped 590 m after the station. Nobody was injured.	Railway incident

3.4 Investigations completed in 2015 with the issued recommendations

In 20154, 37 final reports were compiled and published on the website of TSB, in which 44 occurrences were investigated**. Further 8 draft reports were compiled and sent** to the relevant parties for reflections. The above investigations were closed and the final reports were published at the beginning of 2015 considering the 60 days provided by law for the relevant parties to reflect on the draft report.

The final reports issued in 2015 analysed occurrences of the following types:

- Collision 2 occurrences
- Derailment 16 occurrences
- Accident at LC 7 occurrences
- Fire in rolling stock 3 occurrences
- SPAD 6 occurrences
- Movements approaching each other 2 occurrences
- Runaway of vehicles 1 occurrence

Investigations closed in 2015

2012-315-5:

The last six wagons of the train No. 90552 running between Ferencváros and Miskolc derailed on the right-hand side track in section 398+80 between Gödöllő and Aszód stations; five of them left the track and tipped to their side. No one was injured.

The derailed wagons had carried hydrochloric acid; they were empty but uncleaned at the time of the accident. The IC attributed the accident to a combined effect of track defect, the system of introduction of speed limits, and human factors.

Based on the facts explored, the IC issued a safety recommendation relating to the revision of the track maintenance system.

Factual statements directly connected to the occurrence of the accident

- Following the track adjustment performed as part of a troubleshooting procedure during the night between (2nd and 3rd of May) a direction defect beyond the tolerance was left in the track, and despite that, the technical manager of the adjustment task returned the track to service for speeds up to 90 km/h.
- The track adjustment work was not inspected by the client upon completion, there was no delivery and acceptance procedure, and thus, the client had no immediate information on the remaining track defect.
- The line inspection performed on 4th May 2012, as well as the FMK measurement performed on 7th May recorded the track defect, so the railway operator was unambiguously aware of it, but no action had been taken by 11th May to eliminate it or to introduce a speed limit, so the track was being damaged continuously and fast.

Factual statements indirectly connected to the occurrence of the accident

- The speed restriction signal was not signposted, which made it more difficult to enforce, and practically impossible for those engine drivers who had not been notified of the speed restriction.
- The system operator service failed to notify the station the traffic managers in Ferencváros and Rákos stations of the introduction of the speed restriction signal on time, so the trains departing from there travelled over the track defect at the originally permitted speed of 90 km/h.
- Nineteen trains had travelled over the defective track section at speeds significantly exceeding the limit, which further damaged the track.
- The size limits are not indicated on the record of the ASA 141 device, which makes the evaluation of the explored defects more difficult.
- The locomotive driver of the train No. 90552 did not take action to stop traffic immediately after clarifying the situation because he had left his mobile phone on his locomotive.

Other risk factors

The IC identified no such factors.

Safety recommendation issued after the investigation

BA2012-315-5-1 *The IC found during the investigation that, in the case of the track works performed (in track possession) by external contractors, the person doing the work and the person of the* infrastructure manager *are different, as a subcontractor is involved. The relevant rules only require that the infrastructure manager and the entity performing the work must evaluate the record in a joint effort upon completion of the works, however, this is not a condition of terminating the track possession which may be done independently by the entity performing the work. This implies the risk of returning the track to service even if joint inspection is omitted, and without the infrastructure manager's (who supervises the infrastructure and is responsible for the operable state of the tracks) ensuring that the track is in serviceable state.*

TSB Hungary recommends National Transport Authority to review the rules relating to track maintenance works performed by contractors and to the acceptance of such works, and to take action as necessary.

In the opinion of the IC, in the case of accepting and implementing the above recommendation, the accidents occurring due to similar causes may be eliminated, and thus, the risk of occurrences caused by track defects remaining after track adjustment works can be reduced significantly, and the infrastructure manager's accountability for the continuous serviceable state of the track can be actually enforced.

Accepted, implemented

2012-483-5

Overview of the occurrence

The train No. 4560 running the line Budapest-Déli pályaudvar – Érd Felső – Székesfehérvár passed the Stop! signal displayed by the entry signal F at Tárnok station, then went on, burst the points No. I/14 open, and stopped on the points. At the time of the incident, an entry route was set for the train No. 19712 arriving from the direction of Érd Alsó. When realizing the occurrence, the traffic manager at Tárnok station issued a Stop! signal to the entry signal for the train No. 19712, so the train stopped in front of the signal.

The train that stopped on the points

The IC attributed the occurrence to human factors on the part of the locomotive driver and the senior ticket inspector, but also mentioned indirect causes such as the role of a human factor related to the traffic manager at Érd-elágazás and Tárnok station, the poor visibility of the signal in Section 14, and some shortcomings of the notification to locomotive drivers.

Based on the aforesaid, the IC issues safety recommendations suggesting that the visibility of the signal in Section 14 be provided, and that the system of notifications to the locomotive drivers be changed.

Factual statements directly connected to the occurrence of the accident

1. The locomotive driver disregarded the signal displayed by the entry signal F.
2. The senior ticket inspector on the train misinterpreted the traffic situation which developed at the time of the occurrence. S/he misinterpreted the role of the entry signal F, and realized her/his mistake too late.

Factual statements indirectly connected to the occurrence of the accident

1. The required visibility of the entry signal F at Tárnok station was not provided.
2. The crew of the train were informed incorrectly on the speed restriction between sections 26 and 30 at Budapest Déli pályaudvar, as the specified place was not Tárnok station but a place between Érd-elágazás and Tárnok stations. The false information was suitable for misleading the train crew.
3. The traffic manager at Érd-elágazás gave incorrect information by issuing a notification on the closed state of the road crossing in Section 15, which gave grounds to misunderstanding of the situation and misleading of the train crew.
4. The traffic rules require the notification of the train crews in the Written Instruction of the changed track situation and reconstructions for 14 days only. No notification is issued after 14 days even if such changes are not included in the basic line knowledge documents.

Other risk factors

1. The temporary safety installation at Tárnok station did not provide adequate side protection.
2. The slope angle value between Érd-elágazás and Tárnok stations is given differently in the Technical Tables and in the Station Instructions of Tárnok station.
3. The colouring of the manual control of the switch No. I/14 was white and red despite the fact that it was a centrally controlled switch.
4. The required visibility of the block signal No. 14 between Érd-elágazás and Tárnok stations is not provided.
5. The names ‘Érd-elágazás’ and ‘Érdi-elágazás’ are used alternatively in the (Timetable Handbook, Service Timetable, Station Instructions, Site Drawings, Route Book, Technical Tables) received by the IC during the investigation.

Safety recommendation issued during the investigation

BA2012-483-5-01A: *The IC concluded that the design of the temporary safety installation at Tárnok station is not appropriate, and for this reason, TSB recommends that:*

National Transport Authority should obligate the infrastructure manager to immediately eliminate the shortcomings of side protection on the temporary safety installation at Tárnok station. Until reconstruction of the safety installation, MÁV Ltd. should organise traffic to exclude similar occurrences in station-to station mode.

In the opinion of TSB, in the case of accepting and implementing the above recommendation, the risk of accidents occurring due to similar causes may be reduced significantly.

Rejected

Safety recommendation issued after the investigation

BA2012-483-5-02 *The investigation performed by the Investigating Committee of TSB found that the Train Loading and Running Instructions No. F.2 requires the traffic management crew to notify the train crews of a changed track, safety installation etc. situation on the Written Instruction for 14 days only, regardless of whether such information has been entered in the basic line knowledge documents (Timetable Handbook, Route Book).*

TSB Hungary recommends National Transport Authority to obligate infrastructure managers to notify the locomotive drivers of affected trains of any change in the infrastructure situation for 14 days starting from the date of publication of the details on the website of the infrastructure manager.

In the opinion of TSB, in the case of accepting and implementing the above recommendation, the train crew would always have current information on the state of the infrastructure during reconstructions and reorganisations.

Rejected

BA2012-483-5-03 *The Investigating Committee of TSB found that the required visibility of the entry signal 'F' at work at the time of the occurrence and the block signal No. 14 installed after the occurrence is not provided, as the signal is visible only from a distance of 250 m instead of the required 400 m; i.e. the installation of the signal does not comply with the requirement specified in Point 3.1.1.2 of Annex I to Decree 103/2003 (XII. 27.) of the Minister of Economics and Transport on the interoperability of traditional railway systems and in Point 1.2.39. of the Signalling Regulation No. F.1, which significantly increases the risk of unauthorised passing of signals.*

TSB Hungary recommends National Transport Authority to obligate infrastructure managers to provide the legally required visibility of the block signal in Section 14 between Érd-elágazás and Tárnok stations.

In the opinion of TSB, in the case of accepting and implementing the above recommendation, the train crew would have more time to check the signal and evaluate the information displayed on them, and, in cases of changes in the displayed information, the risk of unauthorised passing of signals could be reduced significantly.

Accepted, implementation in progress

2013-141-5

The driver of a number 41 tram on its way from Batthyány tér to Kamaraerdő perceived irregular movement of the vehicle in the subway below the Széchenyi Chain Bridge. She/he reported to the dispatcher service of BKK that the guard plate in the front boogie was touching the wheel. The dispatcher service reported the event as a door defect to the technical crew, and they organised the replacement of the vehicle at the terminal station.

However, the tram derailed prior to the terminal station after the rim fell off the front right wheel. No personal occurred, and there was no significant damage to property, except for the wheel.

The investigation could not find clearly the reason why the rim came off the wheel, but probable contributory factors were the material of the rubber elements in the wheel, and the irregular fluctuations of the deflective forces and the driving and braking momentums acting on the wheel.

The IC also concluded that the tasks of traffic management, reporting of technical malfunctions and service organising are commingled. The crew receiving notifications of technical defects do not have the necessary technical knowledge, which contributed to the distortion of the information on a starting hazardous defect, and so no action could be taken in time. Relating to that, the IC reaffirms a safety recommendation issued earlier.

Factual statements directly connected to the occurrence of the accident

Presumably, the material of some rubber elements had gone through a change (compaction) which reduced the clamping force between the wheel parts, and the wheel fell apart, and, consequently, the tram derailed (**Hiba! A hivatkozási forrás nem található.**).

Factual statements indirectly connected to the occurrence of the accident

The unexplored control error in the vehicle caused skipping which may cause anomalous displacement and wear of the rubber parts of the wheel, especially in those track sections which require larger deflective forces (**Hiba! A hivatkozási forrás nem található.**).

The traffic managing crew, who are entitled to relay the technical fault notifications to the maintenance crew have no technical knowledge, and they forwarded the information incorrectly, in a misleading way (**Hiba! A hivatkozási forrás nem található.**).

Other risk factors

The traffic management tasks are not performed by a railway company.

The local railway system under review has no organisational unit which could manage tram traffic in compliance with the relevant statutes of law (**Hiba! A hivatkozási forrás nem található.**).

2013-458-5

Overview of the occurrence

On 19th June 2013, three wagons of the freight train No. 94010 derailed on the crossing turnout No. 16 while accessing Track V at Devecser station. As a consequence of the occurrence, the crossing turnout and the derailed wagons were damaged (the wagons to a minor degree).

The IC found that the worn-out technical state could cause derailment while it may have contributed to the event that the wheel flange thickness was close to the lower limit (though within tolerance).

The review of the track maintenance system found that the worn-out state of the sleepers (which led to the occurrence) in the affected turnout had not been explored, and the resources and materials required for proper track maintenance are not available; performing of track maintenance tasks are hindered by complicated and slow decision processes. The maintenance processes do not comply with the expectations specified in the infrastructure manager's safety management manual either.

TSB upholds an earlier safety recommendation relating to the dimensional specifications for turnouts, and issues a new recommendation relating to the inspection of the operation of the safety management system.

Factual statements directly connected to the occurrence of the accident

There had been a gauge widening in the rail track at the location of the derailment, and the track structure could not resist the impacts which caused additional flexible gauge widening. The wheel dimensions of the wagon complied with the requirements.

Factual statements indirectly connected to the occurrence of the accident

The affected turnout sleeper was in poor repair, so the speed restriction applied was insufficient to reduce the risk implied by such poor state.

The worn-out sleepers had not been replaced; the infrastructure manager does not have the necessary resources and materials to maintain the turnouts properly.

Within the area of track maintenance processes, the decision making personnel is not the same as the personnel having information (responsible personnel). The procedures specified in the safety management system are not followed.

The wheel dimensions of the derailed wagon were at the lower limit of tolerance, and the bogie was running in wrong orientation (crosswise).

Other risk factors

There are no requirements specified regarding the restrictions to order relating to turnouts in function of the dimensional alterations of such turnouts. Consequently, the risk of the decisions left to subjective judgements by the track maintenance crew was not assessed.

The irregular running of the axles of the derailed wagon accelerated the wearing of the wheel flanges, and so the wagon became more sensitive to gauge widenings.

SAFETY RECOMMENDATION

BA2013-458-5-01: *It was established during the investigation that, in the course of the maintenance of the turnouts, the measures and limitations to be introduced in function of size deviations in fact depend on the track maintenance personnel's subjective judgement.*

TSB Hungary recommends National Transport Authority to inspect whether the internal processes and requirements of MÁV Ltd. are suitable from the aspect of achieving the safety goals specified in the Safety Management Manual, with special regard to the identifying and evaluation of the safety risks caused by the size deviations found during maintenance of the turnouts, and to regulated management of the risks identified.

In the case of accepting and implementing the above recommendation, a more accurate internal regulation may develop. Subjective judgement may be excluded when performing the actions necessitated by the outworn state of the track, which may reduce the probability of accidents potentially caused by the size deviations of the turnouts.

Accepted, implemented

2013-766-5

While departing on Track V of Kelenföld Station, the train No. 4542 passed the second exit signal (No. V6) at danger without prior authorisation, burst the Side A of the crossing Points No. 19 open (which was in incorrect position for it), and travelled towards the left-hand side track, thus moving toward the train No. 819 which was approaching the home signal of Kelenföld Station on the left-hand track from the direction of Háros Station.

Upon realising the bursting open of the points, the traffic manager at Kelenföld Station took measure to stop the trains. After detecting the danger, the two trains stopped, at a distance of ca. 130 metres from each other.

The IC found during the technical investigation that the incident can be attributed to human factors. The driver of the train No. 4542 significantly exceeded the applicable

speed limit after departing from Kelenföld Station, passed the exit signal (No. V6) at danger, did not perceive the incorrectly set points, burst such points open, and continued its movement toward the left-hand side track without the written instruction which would have been necessary in this situation.

Factors contributing to the occurrence were the lack of reduction of the track capacity to the extent justified by the current traffic situation, the inappropriate traffic management at Kelenföld Station, as a result of which subsidiary signals were issued (or issuance was ordered) to three signals (two exit signals and one home signal) almost simultaneously at the down side end of the station, which is not allowed.

Factual statements directly connected to the occurrence of the accident

The occurrence may be attributed to human factors; the locomotive driver of the train No. 4542:

- exceeded the speed limit (by ca. 100%) after starting, so he had significantly less time left to scan and evaluate signals;
- passed the second exit signal although it was at danger i.e. showed ‘Stop!’;
- burst open the points wrongly set for him, he did not realise it, and continued his travel;
- rolled on toward the wrong track, but did not realise it, and continued his travel.

Factual statements indirectly connected to the occurrence of the accident

- Call Signal was issued to three trains simultaneously at Kelenföld station.
- The safety distance of 50m was not provided between the end of the path of the train No. 4542 and the path of the train No. 819, but the Train Loading and Running Regulations No. F.2 does not classify this dangerous situation as forbidden simultaneous movement, so it contains no relevant limits.
- The train No. 4542 was authorised to depart, i.e. the train was not transferred to Track VI.a in the form of a shunting movement.
- The locomotive driver of the train No. 4542 failed to observe the display on the exit signal prior to his authorisation to start, and he did not enquire either.
- Due to the station-to station mode, the locomotive driver had to turn the train control system while staying next to the platform already, and so, the system was not able to warn the locomotive driver of his mistake and to stop the train.

- The traffic managers and the train crews do not have a checklist which would effectively support their work in extraordinary situations.
- There is no working co-operation between the infrastructure manager and the railway undertakings with access right in the case of capacity narrowing in order to harmonise reduced capacity and the number of trains allowed to run.
- Despite the jam situation, Kelenföld station authorised a light engine to move, which caused delay to trains of higher priority.

Other risk factors

- The log-book of Háros station was not available to the IC during the collection of documents.
- The movement of the train No. 24358 was not indicated in the log-book of Kelenföld station.
- The log-book of Kelenföld station used on the day of the occurrence is unfit for analysis due to illegibility of the hand-written entries in it.
- At Kelenföld station, a support was placed under the relay of the insulated track section for the home signal “G”.
- The conversations (receiving and issuing orders) between the chief traffic manager and the control panel operator at Kelenföld station cannot be replayed because there is no voice recording.
- The Centralised Traffic Control and Overhead Contact Line Remote Control system (KÖFE-FET) does not provide reliable recording of signal handling operations.

Safety recommendations issued after the investigation

BA2013-766-5-01: *In the case of extraordinary events and capacity narrowing, the Network Statement specifies obligations for the infrastructure manager only, but none for the railway undertakings with access rights. Consequently, the railway undertakings are not obliged to co-operate and reduce the number of moving trains in such cases, and so, it is difficult to prevent and manage the accompanying traffic jams.*

Transportation Bureau of Hungary recommends Rail Capacity Allocation Office Ltd. to elaborate a regulation which will obligate railway undertakings to co-operate and take actions in extraordinary situations in order to make traffic management as efficient as possible.

With the accepting and implementation of the safety recommendation, the duration of managing and eliminating of traffic jams may be reduced significantly through the co-operation of the railway undertakings.

Accepted, implementation in progress

BA2013-766-5-02: *At those stations in the national rail network where the departure of a train only affects one switching zone and maximum one exit signal, the authorisation issued partly or wholly by hand signal device also implies the information that the train may enter the interstation section. At those stations where a departing train passes several exit signals the above situation does not occur, which may easily lead to a mistake because the train crew will not receive a pre-signal relevant to the next exit signal.*

Transportation Bureau of Hungary recommends National Transport Agency to take into account during approval of the next revision of

the Train Loading and Running Regulations No. 2 that in the case of paths involving more than one exit signal if the first exit signal does not display a clear signal and the second exit signal is at danger ("Stop!") then the rule of interoperability of conventional railway systems specified in Section 3.1.1.3.2 of the GKM Decree 103/2003 (XII.27) cannot work.

With the accepting and implementation of the safety recommendation, the risk of accidents due to the engine drivers' mistakes may be reduced significantly.

Rejected

BA2013-766-5-03: *The Train Loading and Running Regulations No. 2 Does not require a safety distance of 50 m between simultaneously set up departure and arrival paths; it only requires such safety distance in the case of two arriving trains, although both situations imply similar danger, i.e. the risk of collision of the trains.*

Transportation Bureau of Hungary recommends National Transport Agency to take into account during approval of the next revision of the Train Loading and Running Regulations No. 2 the risks of transacting simultaneous movements which jeopardise each other.

With the implementation of the safety recommendation, the setting up of the currently unregulated, mutually dangerous simultaneous movements (paths) would be limited, which would reduce the risk of accidents in the case of incidental running over the end of a path.

Rejected

BA2013-766-5-04: *Currently, there is no such source of information at the stations in the national railway network which contains the details relating to the existence of safety distances to be observed when setting up paths, although the Train Loading and Running Regulations No. 2 requires its availability.*

Transportation Bureau of Hungary recommends National Transport Agency to check how the regulation – which is part of the Safety Management System – is enforced in this aspect.

With the accepting and implementation of the safety recommendation, the traffic manging personnel can make safer decisions in possession of appropriate information when planning simultaneous movements.

Accepted, implementation in progress

BA2013-766-5-05: *There are individual exit signals at the down-side end of the tracks "III.a", "IV.a", "V.a", and "VI.a" at Kelenföld station. The locomotive drivers of the passenger trains stopping in front of these signals must be authorised by previous signal handling and a hand signal device, according to the relevant rules. Such authorisation does not actually take place.*

Transportation Bureau of Hungary recommends National Transport Agency to inspect the enforcement of the relevant rule and to check the enforcement of the relevant rule at Kelenföld station, and to obligate the infrastructure manager to take appropriate measures.

With the accepting and implementation of the safety recommendation, the current technology, which does not comply with the rules (but is efficient) would meet the regulation.

Accepted, implementation in progress

2013-821-5

Overview of the occurrence

On 29th September 2013, at 16:11 hours, the trailing half (starting with the 18th wagon) of the train No. 88843 accessing Track II of Szenta station was guided to Track I by points No. 3. Having turned crosswise and running between Track I and II, a wagon pushed over an exit signal, two overhead wire posts and a lamp post. Several wagons derailed and the track was also damaged.

The occurrence was caused by changing over up the points No. 3 under the arriving train by the pointsman.

The position of the IC is that, in addition to the pointsman's non-compliant work, the malfunction of the safety installation also contributed significantly to the occurrence.

The IC found it unnecessary to issue a safety recommendation but the occurrence offers several lessons to learn, so the IC suggests that it should be included in the training syllabus as a case study.

Factual statements directly connected to the occurrence of the accident

The IC attributed the occurrence to human factors on the part of the pointsman, as he did not wait for the train to arrive completely but started the process earlier using the safety installation, so the points finally began to work under the running train.

Factual statements indirectly connected to the occurrence of the accident

The traffic manager did not wait for the report on the complete access of the train but opened the track route block field relying exlusively on the safety installation, making it possible for the pointsman to change over the points under the running train.

The safety installation failed to prevent the changeover of the points due to malfunction.

This sort of malfunction of the safety installation may only be detected during irregular activity, so the crew do not report it due to potential sanctions even if they identify it.

Other risk factors

The IC intends to publish no such factor.

2013-824-5

At the dawn of 1st October 2013, seven trailing wagons of a laden freight train running through Vasvár station derailed on a straight track section after the station, and the wagons partly tipped to the wood along the embankment.

Following the automatic stop, the locomotive driver suspected a breaking of the coupling and performed backing movement with the leading part of the train, and then realised that the detached part of the train had in fact derailed.

The IC found that there was a plane distortion in excess of the tolerance at the location of the derailment, and that the track supervision activities performed prior to the occurrence were not followed by effective and demonstrable action in proportion to the shortcomings identified.

A further precondition of the actual derailment was the irregular operation of the running gear of the freight wagon: the turning motion of the bogie was hindered.

Factual statements directly connected to the occurrence of the accident

There was excess cant beyond the limit in the rail track at the location of the derailment, plus a plane distortion with an extreme value of ca. 40 mm which could actually be measured against the bogie pivot pitch of the derailed wagon.

The sliding elements of the bogie of the wagon did not allow free motion, so the movement of the wagon became less flexible, which made it more sensitive to track defects.

Factual statements indirectly connected to the occurrence of the accident

Due to the lengthy public procurement procedure relating to mechanical rail track adjustment, the unsafe condition of the track lasted for a longer time.

The track defects representing a cause for restrictions were identified three months before the occurrence but it was not followed by substantial repairing the track defects or introduction of restrictions.

Other risk factors

After the occurrence, the locomotive driver performed backing movement to the uncontrolled track section without guidance, thus causing the danger of collision with the wreck or derailing on the damaged track.

The detailed content of the manual track repair performed is unknown due to lack of documentation.

2013-887-5

On 17th October at the terminal station in Vörösmarty tér, two axles of the underground train No. 31 derailed on Turnout No. 1 (in turnout position, touched from a direction opposite the switch tongue) while the train was travelling (without passengers) from the turnout track to the left track to the place where passengers get on. No one was injured but there was minor damage to the track and the vehicle.

Within a month after the occurrence, similar derailments occurred in the same switching zone (on Points No. 2) on two occasions (30th October; 31st October).
The IC attributed the series occurrences to an unfavourable interaction between the track and the vehicles.

In the course of the investigation, TSB issued a safety recommendation to National Transport Authority, proposing that the rail lubrication technology in place in the switching zone of Vörösmarty square should be reviewed and changed as necessary.

National Transport Authority disagreed with the contents of the safety recommendation issued, but BKV Ltd. implemented it. No more derailments have occurred.

Factual statements directly connected to the occurrence of the accident

Due to its design, the wheel flange lubrication equipment installed on the Millfav vehicles is ineffective in the switching zone of Vörösmarty square.

After the machining of the wheels, the unfavourable friction rising between the wheels and the rails in the small-radius arc increases so much that the wheels jumped onto the rails.

Factual statements indirectly connected to the occurrence of the accident

The IC identified no such factors.

Other risk factors

The IC identified no such factors.

Safety recommendation issued during the investigation

BA2013-887-5-01A: *The investigation found that the lubricating equipment installed on the vehicles is ineffective in the area of the turnouts No. 1 and 2 due to the design of the lubrication equipment and the position of the turnouts, so the switch tongues of the points are not lubricated. As a result, the friction factor between the vehicle wheel flanges and the switch tongues increase, which in turn increases the risk of jumping of the wheel on the rail, i.e. the risk of derailment.*

TSB recommends National Transport Agency to review (and modify as necessary) the rail lubrication technology in place in the switching zone of Vörösmarty square.

With the accepting and implementation of the safety recommendation, the risk of accidents due to similar causes could be reduced significantly.

National Transport Agency disagreed with the contents of the safety recommendation issued (i.e. the cause of derailment), but BKV Ltd. implemented it.

Rejected

2013-980-5

Despite a preliminary notification of extraordinary stopping, and without permission, the freight train No. 62579-2 travelled through Mád station, thus moved towards the passenger train No. 35235 coming from the opposite direction according to timetable. The traffic manager of Mád station took action by telephone to stop the trains immediately. The two trains stopped at a distance of 2300 m from each other.

Factual statements directly connected to the occurrence of the accident

The train No. 62579-2 travelled through Mád station despite the preliminary notification to the train crew and the lack of permission, and the mistake was not realised by the locomotive driver or the shunter.

Factual statements indirectly connected to the occurrence of the accident

The chapter relating to the stopping of trains in the Train loading and running regulations No. F.2 does not require giving manual signals to the train if the train crew was notified in advance of a stop not included in the timetable.

Other risk factors

The service timetable of the trains running according to a prompt timetable is formally identical with the service timetable of the trains running on specified paths, despite the fact that the safety critical traffic data indicated in the former is not based on real facts. Thus, this document may mislead the train crew.

Safety recommendation issued after the investigation

BA2013-980-5-1 *The investigation performed by the Investigating Board of TSB found that at the railway stations (in the national network) without exit signals accompanied by distant signals, the main rule for stopping trains that cross according to timetable requires preliminary notification only. In the case it takes place, there is no other activity at the station to remind it to stop, while in the case it no such notification takes place then the train crew's attention is attracted by several activities (blocking at the signal, giving manual signal). For this reason,*

TSB Hungary recommends National Transport Authority to review in the safety management system of MÁV Ltd. whether the rules applying to the stopping of the trains that cross according to timetable give adequate answer to all risks, and to take action as necessary.

According to the Investigating Committee, if the main rule is completed and, at the stations without exit signal, specific activities are performed to remind the train crews to stop, then the risk of repetition of occurrences caused by similar attention errors could be reduced significantly.

Rejected

BA2013-980-5-2 *The investigation performed by the Investigating Board of TSB found that the format of the service timetables delivered to the trains running by prompt timetable fully corresponds with the format of the specified timetables despite the fact that the safety critical traffic data (e.g. the direction of entry to stations without safety installation) included in the former type may not necessarily reflect the real situation, so they may mislead the train crew. For this reason,*

TSB Hungary recommends National Transport Authority to review in the safety management system of MÁV Ltd. the risk in the similarity of the formats of the service time table for the trains running by prompt timetable and the specified service timetable, and to take action as necessary.

In the opinion of TSB, in the case of accepting and implementing the above recommendation, the differentiation of the formats of the service timetables including false data as well will call the train crew's attention more efficiently to interpret the data indicated therein appropriately.

Accepted, implementation in progress

2013-1045-5

On 2nd December 2013 at 11:20 hours, the temporary safety installation applied due to reconstruction of the station indicated apparent occupied status. The traffic manager in charge of the safety installation did not identify the cause of the error, so her/his action to eliminate the error was inappropriate and fruitless; she/he evaluated the feedback from the equipment (new for her/him) incorrectly, and thus she/he permitted the train No. 2114 to depart through inappropriately set up points.

The train No. 2114 was notified via Written Instruction of the malfunction of the exit signal, and permitted to leave the station via manual signal issued near the single exit signal.

The train No. 2114 passed the unserviceable exit signal, and travelled towards the temporary points. When reaching the switching zone, its locomotive driver realised that the points are in wrong position, guiding the train to the left (wrong) track; however, he/she did not stop but accessed the wrong track.

In the meantime, the train No. EC273 Departed Verőce station on the left track, so the two trains were now travelling on the same track towards each other.

The two locomotive drivers visually realised the dangerous situation, and both of them stopped their respective train. The distance between the two stopped trains was 245 meters.

The passengers travelling on the train No. 2114 were able to get off because the train stopped at Kisvác station, and MÁV-START Ltd. carried them on from there by buses.

The IC attributes the occurrence to human factors on the part of the traffic manager and the locomotive driver of the train No. 2114. However, the significantly changed operation also contributed to the occurrence.

The IC does not propose the issuance of safety recommendations.

Factual statements directly connected to the occurrence of the accident

The employees working on the track evoked an apparent occupation signal by moving their manual vehicles improperly.

The IC attributes the occurrence to human factors on the part of the traffic manager who failed to check the actual position of the points before permitting the train No. 2114 to move.

On the other hand, the IC attributes the occurrence to human factors on the part of the locomotive driver who failed to stop the train in front of the points guiding the train onto the wrong track.

Factual statements indirectly connected to the occurrence of the accident

The Written Instruction was not legible and there was no time to interpret it prior to departure.

The mobile phone could not provide communication due to lack of signal.

The traffic manager was not sufficiently experienced with the operation of the safety installation and with the interpretation of feedback from it, so could not identify the actual situation.

The overlapping pattern of the feedback image appearing on the display of the safety installation makes interpretation more difficult, especially for an inexperienced operator.

The traffic manager received no support with solving the control problem because support personnel availability had not been organised properly.

The duration of the training courses for the operation of the new safety installation had been significantly reduced in comparison with earlier practice, without a risk assessment for identifying and properly managing the associated risks.

The availability of the required/necessary screen had not been enforced.

Other risk factors

The Station Instructions are not delivered to the workplaces on time to leave sufficient time for preparation to perform them.

The practical exam of the training in the operation of the safety installation only incuded theoretical questions, i.e. the acquisition of operation of the installation in practice was not tested.

2013-1118-5

On 23rd 2013, a car travelling from the direction of Ikrény towards Szombathely got stuck in the level crossing protected with warning lights No. AS 1458 near Győr-Öttevény station.

The driver of the car notified the police, and they tried to take action by calling the railway company to stop traffic. However, due to inaccurate identification of the location, the traffic was stopped on a different line, and the stuck car was hit by a train.

The car caught fire after the crash, and the fire spreaded over to the locomotive as well. As the overhead wire was made dead only 103 minutes after the occurrence, fire extinguishing was delayed, and the locomotive was seriously damaged in the fire.

The IC proposes the issuance of safety recommendations relating to the identification of level crossings and to a possible revision of the procedure of disconnection of overhead contact wire voltage.

Factual statements directly connected to the occurrence of the accident

The car included in the accident accessed the rail track and got stuck there, presumably due to some technical defect or driving error.

After receiving notification of the problem, the police did not manage to contact the traffic manager at Győr station in order to make them stop traffic, and they did not even try to contact Öttevény station. Instead, they got the traffic manager in Kapuvár station to stop traffic on another line nearby.

Factual statements indirectly connected to the occurrence of the accident

The driver of the stuck car could not specify clearly and unambiguously enough the location of the level crossing involved.

The available fire extinguishing agent cannot be used to put out fire in electrical equipment of 25 kV.

The relevant rules and the intervention system of the infrastructure manager allow a dangerous situation involving overhead wire installations to last for 75 minutes starting from receiving notification by the organisational unit responsible for intervention.

The earthing rods which may be transported by road vehicles are stored in such manner that they cannot be deployed fast in an emergency situation.

The people present at the scene of the accident (firefighters, locomotive driver) are not entitled to perform earthing, and actually they do not have the necessary tools either.

The clarification of the traffic situation and the slow issuance of the written instruction substantially delayed the disconnection of overhead contact wire voltage.

Other risk factors

The IC identified no such factors.

Safety recommendation issued after the investigation

BA2013-1118-5-01: *In the case a road vehicle gets stuck or any other emergency occurs in a level crossing the people involved have no reliable cues to clearly identify the level crossing.*

Transportation Safety Bureau recommends the minister responsible for transport to specify the identification of level crossings and the displaying of the method of distress calls at level crossings.

In the case of accepting and implementing the above recommendation, it would be easier and faster to take appropriate action in the cases of obstructions in level crossings in order to prevent accidents.

Accepted, implementation in progress

BA2013-1118-5-02: *Earthing of the wire and written certification thereof are preconditions of commencing fire extinguishing under (in the vicinity) of the overhead line, but, with the current technology, it may take so long that the firefighting task may become unnecessary in the meantime.*

TSB recommends National Transport Authority to review the process of emergency earthing of the overhead line in the safety management system of the infrastructure manager (people entitled to do it, providing the necessary resources, rules), and to take action as necessary to make the process substantially faster.

In the case of accepting and implementing the above recommendation, fire extinguishing can be started sooner under (in the vicinity) of the overhead line, and the resulting damage may be reduced; danger to life may also be reduced in certain accidents.

Accepted, implementation in progress

2013-1141-5

On 31st December 2013, at about 16:25, between Békéscsaba and Murony stations, fire started in the wagon No. 51 55 2080 028-2 attached as the 4th wagon in the train No. 72-1; the senior ticket inspector did not manage to put it out using the fire extinguisher, so the fire spreaded over the whole wagon.

The train was stopped on Track II at Murony station at 16:30 hours, and the passengers (86 people) got off.

Five fire vehicles of the Békéscsaba fire department started to extinguish the fire at 16:50 hours. The fire was finally extinguished at 20:16 hours.

A 10-metre section of the rain cover over the passenger platform at the station was damaged as a consequence of the heat impact from the burning vehicle.

No one was injured as a consequence of the occurrence.

Based on the investigation following the occurrence, the IC supposes that the fluffy debris in the heating ducts was heated up, caught fire, and the glowing substance was carried by the air flow to the passenger area where it caused fire.

The safety system detected the overheating of the heating system: the thermal cutoff fuse worked but it was not able to turn the heating circle off due to excessive damage to its armature.

Deliberate fire-raising cannot be fully excluded but the investigation found no evidence to support this suspicion.

Factual statements directly connected to the occurrence of the accident

The condition of the safety system of the heating system of the wagon affected in the occurrence probably was not good enough before the occurrence to efficiently intervene into the operation of the system in the case of a possible malfunction of the heating system.

- The regulation of the heating system of the passenger wagon did not work, which allowed the system to overheat.
- The integrated protective system detected the overheating of the heating system: the thermal cutoff fuse worked but it was not able to turn the heating circle off due to excessive damage to its armature.

- The debris in the air duct began to glow as an effect of the heat, and facilitated the starting of fire.

Factual statements indirectly connected to the occurrence of the accident

The seats are made with wooden structure which is directly heated and dried by the heating air, i.e. the glowing debris blown in by the hot air met a readily inflammable material.

Other risk factors

The IC identified no such factors.

2014-143-5

On 10th February 2014, the tram departing Erdőkerülő u. terminal station (37 minutes before the occurrence) indicated that the switch accessed by it from the direction of the switch tongue was not in the appropriate end position. The driver checked the switch, adjusted it using the setting rod, and then the tram rolled over it without derailing; then reported all these to the traffic manager.

Both axles of the leading bogie of the tram No. 1553 arriving later derailed on the same switch. The vehicle was slightly damaged but no one was injured. Traffic was stopped for 112 minutes.

The investigation found that:

- the hazardous situation had been known prior to the accident but no action was taken to restrict traffic and to order increased care;
- prior to accessing the switch, the tram driver did not realise that the gap between the switch tongue and the stock rail had slightly widened.

The former problem is related to the fact that the traffic managing tasks are not performed by the railway company, and there is no efficient information connection between the traffic management and the personnel actually involved in traffic.

Factual statements directly connected to the occurrence of the accident

Prior to accessing the switch, the tram driver did not detect that the gap between the switch tongue and the stock rail had slightly widened.

Factual statements indirectly connected to the occurrence of the accident

the hazardous situation had been known prior to the accident but no action was taken to restrict traffic and to order increased care.

the traffic managing tasks are not performed by the railway company, and there is no efficient information connection between the traffic management and the personnel actually involved in traffic (vehicle drivers, maintenance personnel).

Other risk factors

The question whether the derailed tram was obstructing traffic was not dealt with properly after the occurrence.

Following the occurrence, the traffic was controlled by various people, independent of one another, through actions conflicting one another.

2014-186-5

On 23rd February 2014, at Hatvan station, two axles of the locomotive No. 91 81 1116 009-2 hauling the departing train no. 90556 derailed between the turnouts Nos. 453 and 14.

Factual statements directly connected to the occurrence of the accident

Based on the information available, the IC attributes the occurrence to the fact that the worn-out track could not bear the force from the running vehicle, and the anchoring parts and the sleepers were not able to provide the necessary rigidity of the track.

As an effect of the dynamic loads received, the rail track was pushed apart under the moving vehicle, and, according to the track geometry, the left side (according to the direction of movement) wheels fell between the rails.

The track section had not been excluded from traffic despite the track gauges (measured in the track section preceding the location of the derailment) exceeding the “closing down” limit.

Factual statements indirectly connected to the occurrence of the accident

At the time of the occurrence, the speed of the train No. 90556 slightly (by 5 km/h) exceeded the restricted speed it introduced due to the worn-out state of the track.

The axle load of the locomotive excessed the limit allowed for the given track.

Other risk factors

The IC identified no such factors.

SAFETY RECOMMENDATION

BA2014-186-5: *The mix of locomotives running on the Hungarian railway network has changed significantly during recent years. In many cases, the axle performances of the locomotives which recently appeared on the network are higher than 21 tons (210 kN), the value typical of the major part of the railway network. There are “islands” of track sections built for heavier axle loads, however, many tracks rated for axle loads below 210 kN are also present, and occasionally different axle load limits apply to the various tracks within a station.*
Based on the technical investigation and previous experience, the IC concluded that the regulations (Technical Tables, Part II. (Track Data Tables) Table 5) relevant to the traffic of locomotives and light engines are too general, apply to the railway network level, and do not indicate in detail the axle load data of each track section or track.
As a result of those above, it occurs (as in the occurrence under review) occasionally that a vehicle with higher axle loads represents unbearable load to a track which is designed for lower loads and may also be worn, and thus imply higher safety risk.

The Translation Safety Bureau recommends the National Transport Authority to review the safety management systems of railway infrastructure companies to see whether the applied rules provide for the keeping record of sufficiently detailed, current axle load data of the network and for the usage of such data in the planning of routes and in traffic management.

By implementing the above recommendation, sufficiently detailed and current axle load data could be made available, and could be taken into consideration both by the infrastructure manager and the users of the rail network when planning and transacting traffic.
A properly designed system would also provide the possibility to introduce and enforce local axle load limits in the case of the worn-out state of a track section.

Accepted, implementation in progress

2014-216-5

On 3 March 2014, at the level crossing No AS19 protected with warning lights, the passenger train travelling between Szegvár and Szentes collided with a truck which was transporting corn and had broken down at the level crossing.

As a consequence of the crash, the train pushed the road vehicle off the road along the axis of the track. The railway vehicles derailed, and the railcar hauling the train was heavily damaged. The truck driver was injured severely, and eleven of the passengers on the train as well as the driver of the locomotive sustained slighter injuries.

The IC attributed the accident to the disadvantageous geometry of the level crossing and to the lack of the sight triangle. In addition, the IC found that the truck was overloaded, but this did not contribute to the occurrence, due to the technical layout of the truck.

During the technical investigation, the TSB issued a safety recommendation to the Inspectorate of Transport of Csongrád County Government Office. The Inspectorate had taken action to have the level crossing repaired and provide the sight triangle independent of this. The Government Office ordered the affected parties to perform the aforesaid measures.

Factual statements directly connected to the occurrence of the accident

The layout of the road relevant to elevation allows a low structural element of a road vehicle to get caught on it.

The clearance of the landing gears of the semi-trailer was lower than that of a similar motor vehicle with good shock absorption.

Factual statements indirectly connected to the occurrence of the accident

Despite an order from the authorities, the height of the road surface had not been corrected by the time of the accident, and truck traffic on the road had not been limited either.

The reduced sight triangle was not available at the level crossing, and thus, the engine driver was only able to detect the obstacle within the braking distance of the train only.

Other risk factors

The total mass of the road vehicle exceeded the limit specified for it when using the public road network.

No specification is available for comparison of the mobility of a truck, namely, the position of the landing gears of the semi-trailer in this case.

SAFETY RECOMMENDATION

Safety recommendations issued during the investigation

BA2014-0216-5-01A: *It was found during the investigation that, at the road crossing situated in Railway Section No. 19, the layout of the road (height) is hazardous for long and low road vehicles although such vehicles occur quite frequently here due to certain business sites located nearby.*

Transportation Safety Bureau therefore recommends the Inspectorate of Transport of Csongrád County Government Office to take action to initiate correction of the layout of the road and temporary limitation of motor vehicle traffic as necessary until completion of such correction.

In the case of accepting and implementing the above recommendation, the risk of accidents occurring due to trapping of road vehicles can be reduced significantly.

Accepted, implementation in progress

2014-0216-5-02A: *It was found during the investigation that, at the level crossing situated in Railway Section No. 19, the required visibility is not provided due to the flora covering the area along the railway track which area is not used by the railway undertaking; the reduced sight triangles are not provided, and thus, the road crossing does not comply with the provisions in the Annex to Decree No. 20/1984. (XII. 21.) of the Minister of Transport. Consequently, the drivers of road vehicles cannot perform safely their obligation to watch out in the case of malfunction of the warning lights.*

Transportation Safety Bureau therefore recommends the Inspectorate of Transport of Csongrád County Government Office to obligate the owners of the affected real estates to remove the plants which impair visibility in the sight triangle.

In the case of accepting and implementing the above recommendation, the hazards occurring in the case of malfunction of the warning lights can be reduced, and any obstacle in the level crossing would be visible to the engine drivers from larger distances.

Accepted, implemented

2014-223-5

On 5th March 2014, at 11:50 hours, the wagons Nos. 50 55 2105 106-8 and 50 55 2105 110-0 in the train No. 22339 derailed (with two axles each) on the turnout No. 517 when accessing Track VI AB at Rákosrendező station. No one was injured and the railway traffic was not obstructed.

Following the hoisting and repairing operations, the track was returned to service, with a speed restriction of 5 km/h, at 17:15 hours.

The investigation by the IC found that, during the track maintenance works performed on the station, the rail track had been loosened (without ordering track possession) to such extent that the track was displaced under the moving train, which led to the derailment of vehicles.

Taking into consideration that similar occurrences can be prevented by observing the rules and requirements specified in the relevant railway instructions and technical guides, the IC proposes no safety recommendation relating to the occurrence.

Factual statements directly connected to the occurrence of the accident

Based on data available, the IC attributes the occurrence to the fact that the rail track had been loosened to such extent during the track maintenance works that the railway superstructure could not bear the weight of the train accessing the loose section, which led to the derailment of rolling stock.

Factual statements indirectly connected to the occurrence of the accident

The IC found that, despite the availability of opportunity, there was no communication between the personnel performing the works and the station crew performing railway traffic relating to the fact that, at a point in time, the rail track was disassembled to such extent that traffic should have been suspended temporarily on that track.

Immediately before the occurrence, no action was taken to stop the train approaching the impassable track section, although the opportunity was available.

Other risk factors

The IC identified no such factors.

2014-315-5

The train No. K16, moving from Puskás Ferenc Stadion station in the direction of Keleti pályaudvar, stopped and became immobile in a tunnel between the two stations because of a cover which had broken off the vehicle. The passengers were evacuated on foot through the tunnel to Keleti pályaudvar station. The immobile train was hauled by the next train, No. K11, to the site in Fehér út.

The investigation explored that the occurrence may be attributed to the lock structure of the broken cover.

Factual statements directly connected to the occurrence of the accident

Th threaded rods of the lock structures had broken, and, as a result, the cover of the input box was only held by two earthing wires. Bumping into the structural

elements along the track, the loose cover began to swing, and then its rising corner caused short circuit, and its hanging corner damaged infrastructural elements along the track.

Factual statements indirectly connected to the occurrence of the accident

Due to the design and location of the locks, their open or closed position can only be checked from a service pit, and their intact condition can only be checked after opening them.

Other risk factors

The IC identified no such factors.

2014-343-5

The No. 1 axle journal of the freight wagon No. 33 53 532 1098-2 attached as wagon 25 in the freight train No. 91759-2 running from Bicske to Makó broke prior to the derailment.

The train stopped on Track VI at Ferencváros station in order to receive a written instruction. While the train was leaving the station, the wheel pairs of the leading bogie of the wagon with damaged bearing derailed. The broken axle journal of the derailed bogie fell on the track together with the bearing box. Notified by telephone, the locomotive driver stopped the train by emergency braking.

Track VI of the station was damaged as a consequence of the derailment, so the track was excluded from traffic.

During the investigation, the IC found that, as a consequence of incompliance with the rules of electric arc welding, the load-bearing surface of the bearing was damaged, as well as the rolling elements. Those damages were not explored, and the process of wearing became faster during subsequent use, which led to extreme heating and malfunction of the bearing and, as a consequence, to breakage of the axle journal.

Factual statements directly connected to the occurrence of the accident

The IC attributed the accident to the following immediate causes:

- the leading axle of the wagon No. 33 53 5321 098-2 became uncontrolled as a consequence of breakage of the axle journal No. 1,
- during the (not specifically identifiable) maintenance of the wagon, significant current flowed through the bearings of the affected pair of wheels (due improper arc welding technique), which caused a defect associated by heat generation,
- the inner friction in the bearing increased due to damage to the roller races and rolling elements, which generated significant extra heat,
- the significant excess of the speed permitted to the train substantially increased the developing heat load (the train did not exceed the speed permitted for the track and the vehicles attached),
- as a result of the heat load, the mechanical properties of the axle journal impaired, and finally it broke.

Factual statements indirectly connected to the occurrence of the accident

The IC identified no such factors.

Other risk factors

The IC identified no such factors.

2014-379-5

On 16th April 2014, at about 07:50 hours, the train No. 6160 passed the entry signal B at danger without prior authorisation at the upside end of Püspökladány station. When moving on, the locomotive driver realised that the (trailing) point No. 8 in the path of the train was in the wrong position. He applied sharp braking but was not able to stop the train already, so it burst the point open and then stopped in section No. 1772+87 on the switch tongue of the (facing) point No. 10. The train control system was not activated after the train passed the signal at danger.
Simultaneously, the freight train No. 63251 started from Track XVIII of the station with prior signal handling and authorisation by hand signal. The traffic manager in charge realised that the train No. 6160 passed the entry signal at danger, and took action to stop the freight immediately. The two trains stopped at a distance of 206 metres from each other.
The cable replacement works, i.e. “Phase Zero” works of the reconstruction of the station were in progress at the location of the occurrence; these works are regulated by an implementation order (“Végrehajtási Utasítás”, special edition) and a shutdown instruction (“Kikapcsolási Utasítás”).
The IC attributed the occurrence to human factors on the part of the locomotive driver of the train No. 6160, and to the operation of the signal system used at the station.
The IC issued safety recommendations relating to the delivery and acceptance of safety installations works and to the regulation of works associated to the reduction of the levels of service of safety installations.

Factual statements directly connected to the occurrence of the accident

The occurrence may be attributed to human factors.
The locomotive driver of the train No. 6160

- did not find the yellow light of the block signal No. 1760a of the entry signal or the ”---„ sign of the digital driver’s cab perilous,

- could not evaluate the pattern displayed by the entry signal: he guessed it was dark, and still he passed the signal, and
- detected the wrong position of the point to late, so he burst it open.
- The entry signals did not convey the required pace towards the block sections.
- The brightness of the entry signals was below the requirements, and the reserve red light was in operation in the entry signal “B”.

Factual statements indirectly connected to the occurrence of the accident

- There was no delivery and acceptance procedure between the contractor and the operator during the reconstruction of the safety installation of the station, so the defects of the works had not been detected before the accident.
- No traffic management technology was developed and used in order to transact traffic in a compliant and safe way during the scheduled reconstruction of the safety installation.

Other risk factors

- The entry signals of Püspökladány station worked as not automated, non-interlocked signals. The mast of the signals invariably indicated interlocked signals.
- Station-to-station mode was introduced in the block sections affected, but the relevant train crews were not notified of it.

Safety recommendation issued after the investigation

BA2014-379-5-1: *During the investigation performed, the Investigating Committee of TSB found that there had been no delivery and acceptance procedure between the contractor and the operator during the temporary reconstruction of the safety installation of Püspökladány station, so several defects of the works remained undetected.*

> **TSB Hungary recommends National Transport Authority to review the rules relating to the acceptance of the works on safety installations by external contractors in the Safety Management System of MÁV Ltd. to see whether such rules include delivery and acceptance procedures guaranteeing safe operation of the infrastructure, and to take action as necessary.**

In the opinion of the IC, in the case of accepting and implementing the above recommendation, accidents occurring due to similar causes can be prevented, and thus, the defects occurring during the execution works of temporary reconstruction of the safety installation can be explored, and the risk of occurrences resulting from such defects can be reduced significantly, and the responsibility of the infrastructure operator for the operable state of the signal and safety installations can really be enforced.

Accepted, implementation in progress

BA2014-379-5-2: *During the investigation performed, the Investigating Committee of TSB found that, during the reconstruction of the safety installation of Püspökladány station, the entry signals of the station did not work as interlocked signals, but the colours of the signal masts were not altered, no traffic management technology was developed and used in order to transact traffic in a compliant and safe way in this situation, so the safety rules specified for such cases were not applied (e.g.: the train crews were not notified of the changed situation).*

TSB Hungary recommends National Transport Authority to review the rules of designing, introduction and execution of the reconstruction of safety installations in the Safety Management System of MÁV Ltd. to see whether such rules provide for the safe transacting of train traffic, and to take action as necessary.

In the opinion of the IC, in the case of accepting and implementing the above recommendation, accidents occurring due to similar causes can be prevented, which in turn can significantly reduce the risk of occurrences associated to the reduction of the levels of service of safety installations, and the relevant provisions in Train loading and running regulations No. F.2 *can really be enforced.*

Rejected

2014-430-5

On 3rd May 2014, the fast train No. 5108 in service between Budapest-Keleti and Miskolc-Tiszai stations crashed with an automobile in the level crossing No. AS142 protected by warning lights and half-barrier between Rákos and Pécel stations.

At the moment of the crash, the warning lights No. AS142 and the half-barrier were in breakdown state (the lights were off, and the arms of the half-barrier were in vertical position). The sight triangle was not provided from the direction of the arriving road vehicle towards the direction of the movement of the train.

The road vehicle hit over the mast 'a' of the half-barrier. Its driver and the passenger occupying the seat next to the driver had severe injuries.

The mast 'a' of the half-barrier, the arm, and the driving apparatus of the half-barrier were severely damaged.

The IC attributed the occurrence to the combined effect of the breakdown state of the warning lights and half-barrier and to the activity (failure to stop and looking around) of the driver of the road vehicle.

The frequent breakdown states of the warning lights and half-barrier are probably caused by the slight rollback of the trains which stop close to the point of action. The phenomenon has been eliminated by the infrastructure operator by relocating the point of stopping.

Another contributing factor to the occurrence was that about 1 minute lapsed between the moment of detecting the breakdown state and the occurrence of the accident, and this period of time was not sufficient for the traffic managing service to notify the locomotive driver of the train No. 5108.

Factual statements directly connected to the occurrence of the accident

The IC attributes the accident to the following factors:

- The train approached the broken-down warning lights and half-barrier at a speed of 100 km/h.
- The 1 minute between the moment of detecting the breakdown state and the occurrence of the accident was not enough time to notify the locomotive driver.
- The reduced sight triangles were not available in the given situation, but the available visibility should have been sufficient for the automobile to use the level crossing with due care on the part of its driver.
- The road vehicle accessed the level crossing without stopping at the specified spot, and failed to make sure that crossing would be safe.

Factual statements indirectly connected to the occurrence of the accident

Traffic managers have a solution at hand to prevent similar occurrences: they can notify the locomotive driver of the expected emergency situation by setting the block signals to danger, but it was not applied in the given situation.

The radio set in the locomotive was not used either, although it provides a faster way to contact the locomotive driver provided that it works properly.

Other risk factors

Due to limitation of the sight triangle, larger and slower road vehicles (coaches, trucks, combination vehicles) stopping in front of the level crossing and starting again from a stationary position may not finish crossing before the arrival of an unnotified train moving at the speed allowed for the given track.

2014-441-5

On 7 May 2014, at 04:50 hours, at the level crossing without technical protection in the railway section No. 197 between the Stations Veresegyház and Őrbottyán, the train No. 2429 collided with an automobile arriving from the left (according to the direction of travel of the train). The train pushed the automobile off the track embankment to the right, and the automobile stopped upside down. The driver of the automobile died on the spot.

The IC attributed the accident to human factors on the part of the driver of the automobile.

The IC revealed shortcomings in connection with the layout of the level crossing which did not contribute directly to the accident but implies safety risk in itself; for this reason, during the investigation, the TSB issued a safety recommendation suggesting immediate action.

Factual statements directly connected to the occurrence of the accident

Despite the fact that a train was approaching and it could have been seen from appropriate distance, the car accessed the level crossing and could not leave it before the train arrived there.

Factual statements indirectly connected to the occurrence of the accident

The IC identified no such factors.

Other risk factors

The layout of the level crossing did not comply with the requirements.

- the reduced sight triangle was not available in those three quarters of the space which were not affected by the accident,
- there is street lighting in the vicinity of the level crossing, however, the level crossing itself is not illuminated,
- a speed limit threshold was installed on the asphalt at each side of the level crossing (at a distance of 4 m).

However, these shortcomings did not contribute to the accident.

SAFETY RECOMMENDATION

2014-441-5-01A: *It was found during the investigation that, at the level crossing in Railway Section No. 197 between Veresegyház and Őrbottyán Stations, the required visibility is not provided due to the terrain and flora along the track, and the reduced sight triangles are not provided, and thus, the road crossing does not comply with the provisions in point 26.3 g) of the Annex to Decree No. 20/1984. (XII. 21.) of the Minister of Transport. Further, there is a speed control device (speed bump) at each side 4 m before the "Beginning of railway crossing" sign which may distract the attention of the drivers who are approaching the level crossing, and increases the time of driving through in the case of longer vehicles, thus increasing the risk of jam. The "Beginning of railway crossing" sign placed at the eastern side of the level crossing is bent, the "Caution, level crossing" warning signs are shadowed by plants, and the "Level crossing" sign at the terminal point side of the level crossing is missing.*

Transportation Safety Bureau therefore recommends the Inspectorate of Transport of Pest County Government Office to review the layout of the level crossing and, as necessary, obligate the interested parties to provide the conditions specified in the relevant regulations.

In the opinion of the IC, in the case of accepting and implementing the above recommendation, the risk of accidents occurring due to similar causes can be reduced significantly.

Accepted, implemented

2014-455-5

On 12th May 2014, at about 16 hours, the train set of wagons of the train No. 915 arriving at Track VIII of Keleti pályaudvar was hauled to the holding siding, and then the locomotive (No. 91 55 0480 020-1) hauling the train moved to a section beyond Point 300 on Track 80 in the form of an authorised shunting movement.

During its movement, the vehicle bumped into a 4-ton concrete element in the section No. 10+80. The concrete element, moved by a crane on a bridge, was 30 cm above the ground in that moment. The movement of the load was controlled (in addition to the sling) by a worker using a rope. During this activity, the worker stumbled, slightly pulled the rope, and so the load entered the clearance gauge of the track, and bumped into the front left step of the shunting locomotive.

The locomotive was slightly damaged, but no one was injured.

According to the opinion of the IC, the occurrence may be attributed to human factors, as the hoisting of the concrete element from the bridge should have been performed with track possession. The instructions relating to the performing of the work had been included in the operator's contribution issued in advance to the unit executing the work.

Factual statements directly connected to the occurrence of the accident

- The occurrence may be attributed to human factors, as the hoisting of the concrete element from the bridge should have been performed with track possession because it affected the clearance of a track occupied by traffic, but the track possession permitted to the unit performing the reconstruction did not include this track section, and the unit had not requested to been given permission to perform the activity (hoisting by crane) which contributed to the occurrence.
- The worker controlling the load by a rope stumbled, and inadvertently moved the load in an unintended direction.

Factual statements indirectly connected to the occurrence of the accident

- The watchman was staying in a place where he could not do his job properly due to a train moving in front of him, so he could not notify the workers of the approaching train or take action to get the train stopped in the danger situation that had developed.

Other risk factors

The IC identified no such factors.

2014-558-5

On 7th June 2014, the train No. 2-08 running between Széchenyi-hegy and Városmajor stations departed from Svábhegy station despite danger aspect of Signal C protecting the block section, and accessed Point No. 2, which was in wrong position for it, burst it open, and derailed on it.

The IC found that the said departure was also influenced by the fact that, after the arrival of the train from the opposite direction, the screen of the FUTÁR equipment displayed the instruction “Kérem induljon” (Please start”). In the meantime, however, the Signal C protecting the block section showed the danger aspect, and the Point No. 2 situated in the path of the train had not been set up for the train No. 2-08 yet.

Factual statements directly connected to the occurrence of the accident

The driver started the train without checking the “Stop” aspect of the light signal or checking the position of the points.

Factual statements indirectly connected to the occurrence of the accident

The instruction “Kérem induljon” (Please start”) may be displayed on the screen of the FUTÁR equipment even when the appropriate traffic conditions are not given. Due to this, the instruction type display may guide the vehicle driver into a situation which makes it easier to a wrong decision in a safety critical issue.

Due to the construction of the turnouts of rack railways, a vehicle accessing the inappropriately set point in the trailing direction will almost certainly derail.

Other risk factors

The IC identified no such factors.

2014-572-5 and 2015-365-5

2014-0572-5

On 10th June 2014, the third axle journal of the 8th wagon in the freight train No. 53015 running between Bükkábrány and Visontai Kombinát stations broke while in motion, and the wagon derailed. The derailed pair of wheels got stuck in the level crossing situated in Section 1265, the coupling of the train broke, and braking was applied automatically. The trailing part of the train jammed at the derailed wagon, and three more wagons derailed. No one was injured. The track and the overhead line system were seriously damaged. The affected wagons were damaged, and part of their load (coal) was spilled. The affected section of the track was excluded from traffic.

2015-0365-5

At the dawn of 20th April 2015, an axle journal of the 21st wagon in the freight train No. 65822-1 broke, and the wagon derailed in Section 212. As accessing the station, the wagon was guided aside on the turnout No. 7, the brake system broke, and the train stopped automatically. There was no injury or damage to goods, however, the track was damaged in a length of ca. 300 m.

The investigation performed by the IC found that the axle journals and the inner rings of the associated wheel bearings were not fitted properly. It was clearly seen with the occurrence No. 2014-0572-5 that pitting formation occurred on the tread surface and rolling elements of the bearings due to incompliance with the requirements of electrical arc welding performed during maintenance sessions. As a result, the wearing process became faster, which led to malfunction of some bearings.

Factual statements directly connected to the occurrence of the accident

The IC attributed the occurrence to the following immediate causes:

- during assembly, the internal bearing rings were fitted with less overlap than required,
- notwithstanding, surface imperfections were formed on the tread surfaces and rolling elements of the bearing due to the inappropriate welding technology used during maintenance,
- the debris which was present in the bearing damaged the tread surface of the axle journal and the bearing,
- due to the aforesaid damage and contamination of the bearing, its internal friction increased, which started increasing heat generation; as an effect of the heat difference caused by the increasing heat load, the overlap provided during the assembly of the bearings disappeared, the internal ring of the bearing got loose and began to slide, thus causing further damage to the bearing, and increased the heat load further,
- as a consequence of the heat load, the mechanical properties of the material of the axle journal impaired, and it broke;
- the axles of the affected wagons became uncontrolled and derailed due to breakage of the axle journals.

Factual statements indirectly connected to the occurrence of the accident

- The hot-box detector did not work in front of the scene of the occurrence; the excess heat of the bearing was not detected, so no action was taken to stop the train.

Other risk factors

- The decreased wheel load resulting from asymmetric wheel loading in itself may lead to derailment, while increased wheel loads may cause damage to the track, especially to the switching parts of the turnouts.
- The signalling and alarm limit values of the eRDM equipment for asymmetric wheel loads were not set to evaluate all such disorders which could be detected and indicated by appropriate evaluation of the data measured.

2014-605-5

Within a short interval of time, two locomotive (with the same type of undercarriage) derailed with one axle on the railway line of Lillafüredi Állami Erdei Vasút (Lilafüred State Forest Railway) five times while hauling passenger trains. No injury or damage occurred during the occurrences, however, after the third occurrence, TSB decided to start an investigation with regard to repetition.

According to the findings of the investigation, the technical condition of the track does not comply with the applying rules, but did not cause the derailments; on the other hand, such rules are also outdated and unreasonably strict.

Both derailed locomotives had technical defects which cause uncertain running and may lead to derailment.

The IC found that monitoring of the technical condition of vehicles, and accordingly, the elimination of hazardous defects, is not safely provided by the vehicle maintenance system and by the technical resources of the railway company.

As the railway company took actions to eliminate the shortcomings of vehicle maintenance during the investigation, the IC does not find it necessary to issue a safety recommendation, but calls the attention of the railway company to the necessary actions.

Factual statements directly connected to the occurrence of the accident

The springs integrated into the renewed (a few months before the occurrences) bogie of the locomotive which derailed in occurrences No. 1 to 3 were softer than required. The bogie pivot of the locomotive involved in the occurrences No. 4 and 5 was defective.

Significant plane distortion was demonstrated at the location of the derailment in Section 31.

Factual statements indirectly connected to the occurrence of the accident

The repair workshop of the railway company was pulled down without providing a substitute solution in advance. There are organised vehicle maintenance procedures (requirements, resources, documentation) in place, and the devices necessary for the inspection of the vehicles are not available.

When the spiral rings to be integrated underneath the locomotive were ordered, the order did not indicate specific properties, and compliance was not checked upon receipt; such specification of properties is not even available.

Other risk factors

The inspection of the railway track dimensions takes place according to outdated rules of another railway company. The available rules of track maintenance are unreasonably strict, which hinders compliance with them (or the enforcement of compliance by all means may result in risk of accident in other areas due to uneven resource allocation).

Some of the vehicles operated by the railway company exceed the axle load permitted for the railway tracks (the of axle load value which the railway tracks can actually bear safely is not known).

2014-617-5

On 21 June 2014, at 08:05 hours, at the level crossing without technical protection in the railway section No. 1609 between the Stations Búcsúszentlászló and Zalaszentmihály-Pacsa, the railcar No. of the 50 55 5429 295-3 of the train No. 9872-1 collided with the rear trailer of an agricultural tractor pulling two trailers, and the railcar derailed with two axles. A male passenger aged 73 years on the train and the engine driver had slight injuries.
In the course of the technical investigation, the IC concluded that the reduced sight triangles are not available at the scene of the accident. The length of the road combination vehicle and the lack of the sight triangle did not provide safe crossing at the level crossing. The agricultural tractor entered the level crossing when a train was approaching, and was not able to leave the level crossing before the train arrived. The lack of sight triangles increased the danger of accident, and made crossing impossible for a longer combination vehicle.

Factual statements directly connected to the occurrence of the accident

The agricultural tractor accessed the level crossing when the train was approaching, and the tractor was not able to leave the crossing before the train arrived.

The possibility of safe crossing was not provided due to limited visibility of the railway track and the dimensions and performance data of the combination vehicle.

Factual statements indirectly connected to the occurrence of the accident

The IC identified no such factors.

Other risk factors

The IC identified no such factors.

SAFETY RECOMMENDATION

BA2014-617-5-01A: *The technical investigation established that the required sight is insufficient at the unprotected level crossing in Railway Section No. 1610 between Búcsúszentlászló and Zalaszentmihály-Pacsa stations due to the terrain features and vegetation along the railway; the minimal sight triangles are insufficient, and thus the level crossing does not comply with Section 26.3 g), Annex to KM Decree 20/1984 (XII. 21.).*

TSB recommends the Inspectorate of Transport of Zala County Government Office to review the design of the level crossing and obligate the responsible entities to provide the conditions required in the relevant rules of law.

In the case of accepting and implementing the above recommendations, the risk of accidents occurring due to similar causes may be reduced significantly in the opinion of the IC.

Accepted, implementation in progress

2014-702-5

The fourth wagon of the train No. E15 accessing Nyugati pályaudvar station began to emit smoke after powerful sound and light effects in the tunnel. The passengers got off at Nyugati pályaudvar station, and the station was evacuated.

The disaster management personnel eliminated the smoking of the wagon, as well as the glowing of the oil sludge found in the tunnel.

Following the accident, National Transport Authority commenced a proceeding *ex officio*, during which they obligated BKV Ltd. to eliminate the shortcomings revealed, and BKV Ltd. took action accordingly. BKV Ltd. took measures to eliminate the shortcomings revealed during the investigation into the occurrence, so the IC does not find it necessary to issue a safety recommendation.

Factual statements directly connected to the occurrence of the accident

A long, thin metal part (originating from the wearing of rail) got between the collector shoe and the ring support of the bogie, and caused short circuit. The arcing and sparking accompanying the intensive heat effect caused by the short circuit ignited the sheathing of the nearby cable bunches of the hauling motor. Falling on the soft plastic programszőnyeg, the hot drops of molten metal made the accumulated oil sludge glow.

Factual statements indirectly connected to the occurrence of the accident

Large quantities of oil sludge accumulates regularly at the bottom of the vehicle and on the programszőnyeg. The removal of this contamination from the programszőnyeg is not part of the regular maintenance activity. At the same time, the oil sludge accumulating on the track presents fire hazard because the arcs and sparks generated regularly in the third-rail contact type electric hauling may easily set the oily, dusty mix on fire.

Other risk factors

The IC identified no such factors.

2014-777-5

On 8th August 2014, after 12 a.m., the type UNIMOG road-rail vehicle owned and operated by MÁV KERT LLC. was performing scheduled weed control work at Balassagyarmat station.

During the work, they were permitted to roll on Track III from the upside to the downside end of the station. The driver was driving the vehicle in reverse gear, and did not stop at the shunting limit signal: it rolled on, and trailed the point No. 11 which was in the wrong position for this vehicle. The vehicle reset the switch tongues (burst the point open) and stopped on them, i.e. it did not leave the point.

The crew of the vehicle then checked the point and found no damage to it; then they moved back within the shunting limit signal. They did not report the bursting of the point.

In the meantime, the traffic manager issued an order to set a path for the train No. 33615 for Track II. The pointsman did not check the point on the spot, so the bursting open of the point remained undetected, and the pointsman reported clear pathway to the train No. 33615 despite the fact that the point No. 11 was in the wrong position for the train.

The locomotive driver of the arriving train realised that a vehicle was staying at the shunting limit signal, and stopped his train. The distance between the two vehicles was 15 m after the train had stopped.

The vehicles were kept stationary after clarification of the situation and detecting the burst-open point, and the passengers were asked to get off. After reporting the incident, the system operator in charge permitted that the scene be restored.

The IC attributes the occurrence partly to human factors on the part of the driver of the UNIMOG vehicle because he failed to observe the point of stop specified in the permission, to check visually the position of the point before accessing it, and to report the bursting of the point open.

On the other hand, the IC attributes the occurrence partly to human factors on the part of the pointsman who failed to check the points after the specifying of the entry path for the train, so he did not realise that the point had been burst open.

The IC does not propose the issuance of a safety recommendation.

Factual statements directly connected to the occurrence of the accident

The IC attributes the occurrence partly to human factors on the part of the driver of the UNIMOG vehicle who left the permitted section of Track III despite the wrong position of the point No. 11 and without waiting for the manual signal from the pointsman.

On the other hand, the IC attributes the occurrence partly to human factors on the part of the pointsman on duty at the No. 1 pointsman's workstation of Balassagyarmat station, who failed to perform the safety actions to be taken after the specifying of the train path, namely the on-site check of the point No. 11 after specifying the path for the train No. 33615, and he did not inspect the area, so he did not realised that the point was burst open, he included it in a path, and handled a signal.

Factual statements indirectly connected to the occurrence of the accident

the point lock type points cannot indicate the bursting open of the point to the person in charge of the points.

Other risk factors

Due to its location, the screen of the feedback monitor of the backwall camera installed in the UNIMOG vehicle is partly covered by the steering wheel, i.e. its visibility is insufficient.

2014-823-5

While leaving the shed, the driver stopped the tram in front of the locally controlled Points No. 26 of the shed. She got off the vehicle and operated the points; the door of the tram closed in the meantime, and the vehicle started to move. The tram left the shed, and its pantograph broke off on its way near the gate of the shed site. It travelled ca. 670 metres in the city traffic, then lost speed and stopped at "Vásárhelyi Pál Rd." stop (Kossuth L. Ave.).

The technical investigation revealed that, due to its construction, the driver's cab can be left after a switching operation which may lead to erroneous start of the vehicle as described above. The driver, presumably inadvertently, performed that switching operation before leaving her cab; in addition, she failed to switch the

reversor (reverse lever) into middle position which is a necessary safety measure to be done before getting off the tram.

The railway company installed a driver presence detection system in the vehicles within 2 months of the occurrence; that function excludes similar occurrences.

Factual statements directly connected to the occurrence of the accident

The occurrence may be traced back to a human factor related to the tram driver as she left the driver's cabin after an inadvertent erroneous switching operation, and did not set the reversor to '0' position.

Factual statements indirectly connected to the occurrence of the accident

In a concrete conjunction of switching operations in the vehicle, the protection against inadvertent start does not work; it closes the doors automatically, and then starts moving inadvertently, with constant acceleration.

The driver did not manage to operate the external door opening switch on the runaway tram.

The personnel did not use the emergency disconnect switches of the overhead contact line at the shed site, and the marking of those switches is not conspicuous enough.

Other risk factors

The tram driver set the points with her back to the tram, so she did not perceive that it had started to move toward her and directly endangered her bodily integrity.

The traction circuit of the tram remains in operation after the disconnection and subsequent reconnection of the overhead contact line.

2014-859-5

On 3rd September 2014, at 08:47 hours, the motor train set No. 24149 (Reg. No.: KIAG-629) passed the entry signal C at danger at Százhalombatta station by ca. 30 m, stopped. The driver (hereinafter referred to as "D1") got off the train, and walked to the shunting frame No. 1, where he talked to the traffic manager by telephone. Then D1 called the rest of the train crew by mobile phone and, misunderstanding the order received, he ordered them to reverse back behind the signal, towards the open track. While another member (hereinafter referred to as "D2") of the train crew who was a qualified driver (but did not have a licence for the given locomotive type) performed D1's order, the passenger train No. 839 was approaching on the same track from the direction of Dunai Finomító station. Due to the emergency braking manoeuvre by the train control system, the train No. 839 stopped about 100 metres ahead of the motor train set staying in front of the entry signal C. Then the motor train set passed the signal at danger, accessed Track II of the station (again without relevant authorisation), and stopped in front of the passenger building.

The incident did not lead to collision, and the delay of the train No. 839 caused no significant damage.

The IC found that the motor train set No. 24149 passed the entry signal "C" at danger due to human factors (lack of adequate attention). Then, after negotiation with the traffic manager, they misunderstood the order received, and reversed back within the signal and, during this manoeuvre, they approached each other with the passenger

train No. 839. Finally, they accessed the station again (passing the entry signal at danger), and stopped on Track II.

The position of the IC is that the occurrence could have been avoided by observing the applicable rules, so it is not necessary to issue any safety recommendation.

Factual statements directly connected to the occurrence of the accident

The IC found that the driver of the motor train set No. 24149 did not pay attention to the entry signal “C” of the station. Almost certainly misunderstanding the order received from the traffic manager, the motor train set reversed back within the signal (thus causing changes to the scene of the incident), and approached each other with the passenger train No. 839.

Based on the aforesaid, the IC attributed the occurrence to human factors.

Factual statements indirectly connected to the occurrence of the accident

D1 ordered D2 to drive the vehicle despite the fact that the applicable rules excluded it. D2 performed the manoeuvre with the vehicle according to the instruction received, although he did not have the appropriate licence.

The traffic manager participated in the attempt to conceal the incident, thus taking further unforeseen risk, due to which a more hazardous situation developed than the original one (passing the signal without actual consequence).

Other risk factors

The IC identified no such factors.

2014-864-5

The motor car of the train no. 36913 running between Karcag and Kunmadaras was on its way to Karcag when it collided with the trailer of an agricultural tractor at an unprotected level crossing in section No. 35. The motor car derailed due to the collision, and its driver had mild injuries. None of the road vehicles was damaged. The IC attributes the occurrence to human factors on the part of the driver of the road vehicle. The layout of the level crossing complies with the relevant rules, but the traffic signs, warning of the level crossing from the direction of the arrival of the road vehicle, as well as the “Start of level crossing” sign, do not comply with the applicable regulation.

Factual statements directly connected to the occurrence of the accident

The driver of the agricultural tractor did not make sure of the possibility of safe crossing in the right place and time, so he realised the approaching train too late.

Factual statements indirectly connected to the occurrence of the accident

The IC identified no such factors.

Other risk factors

The traffic signs placed in the direction of the arrival of the agricultural tractor are worn out, and the sign with two stripes is missing.

2014-949-5

The motor car No. 414 012 hauling the suburban train No. 2354 between Budapest-Nyugati pályaudvar and Vác stations caught fire at Sződ-Sződliget station.

The senior ticket inspector detected smoke in the motor car situated at the trailing end of the train, and notified the driver by mobile phone. After stopping the train at Sződ-Sződliget station the driver went to the trailing motor car, and saw flames

shooting out of the smoothing inductor board. The driver put out the fire using the fire extinguisher, but smoke continued to flow through the inverter ventilation.

Factual statements directly connected to the occurrence of the accident

The IC attributed the occurrence to the following immediate causes:

- The smoothing inductor supplying the current inverter No 2 of the motor car No. 414 012 overheated due to insufficient cooling, and fire started,
- the upper spacing lamellas slipped towards the centre of the coil, which reduced the cross section of the internal air duct, which in turn led to insufficient cooling.

Factual statements indirectly connected to the occurrence of the accident

The IC attributed the occurrence to the following indirect causes:

- the locomotive driver did not identify the actual signs of the potential defect at Felsőgöd station, and continued his way without exploring the cause of smoke emission detected.

Other risk factors

The key to the earthing board of the motor car is not included in the accessories to the motor car, so the locomotive driver could not earth the high voltage equipment of the motor car. The work permit required for starting to extinguish the fire was issued to the firefighter unit 71 minutes after the detection of the fire.

2014-1189-5

The train No. 38715 collided with a combination road vehicle loaded with corn at the level crossing protected with (operable) warning lights (No. AS515) situated between Bátaszék and Hidas-Bonyhád stations.
The senior ticket inspector suffered mild injury, while the locomotive driver was severely injured and died soon after being taken to hospital. The passengers or the driver of the truck were not injured.
The trailer tipped over, its load (corn) was spilled, and the trailer was damaged.
The leading axle of the motor car of the train derailed and was heavily damaged.
The IC attributed the occurrence to human factors on the part of the truck driver.
The IC does not find it necessary to issue a safety recommendation in connection with the occurrence.

Factual statements directly connected to the occurrence of the accident

The driver of the truck accessed the level crossing without stopping, despite the fact that, due to the current light conditions, he could not see anything displayed (flashing red lights) by the warning light apparatus.

Factual statements indirectly connected to the occurrence of the accident

The current light conditions (sunshine) made the checking of the warning lights (which worked properly) difficult.

Other risk factors

The IC identified no such factors.

2014-1361-5

On 17th December 2014, at 09:09 hours in Könyves Kálmán körút, Budapest, two axles of a combined tram derailed on the junction points of a shed situated in Ferencváros, on its way to that shed (without passengers). The leading tram of the combination was hauling another (inoperable) tram. The derailed vehicle fully blocked traffic on the right side of Könyves Kálmán körút.

No one was injured in the accident.

At the investigation of the scene following the accident, the IC found that the occurrence can be traced back to a combination of human factors and a technical cause. It turned out that, without being asked, a tram driver, on his way home from service, handled the points control device installed at the tram stop near Ferencváros railway station, but he failed to check in advance if the points were free, which is against the relevant rules.

The structural layout of the equipment at the time of the accident allowed the equipment to check the occupation status of the points by counting the pantographs of the passing vehicles as they were arriving and leaving. However, this layout works in such manner that if a tram hauls another tram with lowered pantograph (for technical

reasons) then the equipment will allow the changing of the points position after checking the pantograph of the leading tram out, i.e. before the trailing vehicle (rolling with lowered pantograph) leaves the points.

Thus, due to lack of careful circumspection, the above situation allowed changing of the points position under the vehicle rolling with its pantograph lowered, which resulted in derailment of the vehicle.

Having reviewed the circumstances of the occurrence and the fact that the track connection at the scene and the associated equipment regulating the traffic of the trams and checking the occupation status of the points were modified during the investigation, the IC does not propose issuance of any safety recommendation.

Factual statements directly connected to the occurrence of the accident

The opinion of the IC is that the occurrence can be attributed to a combination of human factors and a technical cause:

- A person, who was not on duty but had a valid driving licence for trams and used it on a regular basis in his work, set the points (guiding the trams to the shed in Ferencváros) to straight direction (using the point control button) at the tram stop near Ferencváros railway station before the last bogie of a tram, i.e. when the vehicle was still on the points.

- The layout of the equipment at the time of the accident was not suitable for detecting the occupation state of the points in cases where a vehicle rolled lowered pantograph over the points.

Factual statements indirectly connected to the occurrence of the accident

The IC identified no such factors.

Other risk factors

The IC identified no such factors.

2014-1382-5

On 22nd December 2014, the driver of a number 3 tram approaching the terminal station at Gubacsi út changed the points at the moment when the tram reached an overhead line section isolator structure. Simultaneously, there was a power failure in the overhead line, which interrupted the changing of the points halfway.

The driver of the tram did not pay due attention to the position of the points, so he drove his vehicle on them, and the vehicle derailed. No injury or technical damage occurred.

The IC attributed the occurrence to human factors on the part of the tram driver, but the interruption of power supply also contributed. As similar cases can be avoided by observing the relevant rules and paying attention by the driver, the IC proposes no safety recommendation.

Factual statements directly connected to the occurrence of the accident

The changing of the points was interrupted halfway by an interruption in the power supply.

The tram driver did not pay due attention to the position of the points (changed halfway), and the tram derailed on the points when rolling over them.

Factual statements indirectly connected to the occurrence of the accident

The layout of points control and energy supply allows the changing of the points to stop halfway in the case of an interruption in the power supply.

Other risk factors

Due to his work schedule, the tram driver had no sufficient resting time.

2015-0023-5

During the arrival of the train No. 4093 consisting of six wagons, at the stop in Tímár street, two axles of the leading bogie of the fifth wagon (No. 774) derailed. The derailed bogie travelled ca. 50 metres in the bedding, damaging the sleepers, sleeper screws, the platform edge and the cables of the safety installation on its way.

During the investigation of the scene, the IC found no alterations or defects in the track or the vehicle which could have caused the derailment, so the IC performed further inspections of the track and the vehicle, and the operator sent several parts of the vehicle to a laboratory for testing.

The investigation found that the parts built in were not compliant: the spring systems were asymmetric. During the investigation, the operator developed a program to improve the maintenance system and the running properties of the vehicles, and started implementation.

The trail track showed a minor plane distortion which had not been eliminated (perfectly) 3 weeks before the accident. The IC proposes the issuance of a safety recommendation relating to the evaluation of the plane distortions.

Factual statements directly connected to the occurrence of the accident

No such direct cause was identified which could have been clearly related to the derailment.

Factual statements indirectly connected to the occurrence of the accident

The dimensions and rigidity properties of the springs built into the vehicle were different (slightly in the case of the spiral rings, and significantly in the case of the rubber springs). The shock absorbers used were not suitable.

The maintenance system of the railway company does not cover the inspection of compliance of springs and shock absorbers, so incompliant parts are also used occasionally.

The maintenance unit has no reliable measuring procedure for measuring wheel loads.

Plane distortion and direction error was demonstrated in the track at the scene of the derailment. The track was not adjusted (or the adjustment was not durable) during/after the maintenance works performed three weeks before the derailment.

There was a control error causing skipping in the derailed vehicle.

Other risk factors

During track measuring, plane distortions are not evaluated against the wheelbase dimensions of the trains which work almost exclusively on the line.

SAFETY RECOMMENDATION

BA2015-0023-5-01: *The IC found that, although the plane distortions of tracks measured during line supervision activity in the network of BHÉV are evaluated, but only on the base lengths applied in the practice with national networks, which is not suitable for the wheel bases of the bogies of the trains running on this line.*

TSB recommends National Transport Authority to initiate a revision (and modification as necessary) of the railway line supervision rules and practices specified as part of the safety management system relating to the railway network of BHÉV for the sake of applying a base length which is appropriate for the wheel base of the trains using the line.

In the case of accepting and implementation of the recommendation, the conclusions drawn from the evaluation of plane distortions can be aligned with the actual risks of derailment arising.

Accepted, implementation in progress

2015-0056-5

On 16th January 2015, one wheel of a freight train derailed (a few metres before the planned point of stop) while the train was accessing Track X of Szolnok-Rendező station.

The IC found that the derailment was due to the worn-out condition of the track.

In addition, the axle load of the train slightly exceeded the value permitted for the given line, which cannot be related directly to the accident, but is a risk-increasing factor. Upon recommendation by the IC, the infrastructure manager put the issue of axle loads of the locomotives sing the network on the agenda.

Factual statements directly connected to the occurrence of the accident

At the scene of the accident, the sleepers in the track were not able to maintain the wheel base due to their worn-out condition, and the rails moved apart under the locomotive.

Factual statements indirectly connected to the occurrence of the accident

The IC identified no such factors.

Other risk factors

The train exceeded the speed restriction specified for the train in the section preceding the derailment.

The type licence and the permit for putting into service of the locomotive are not in accord: the permit for putting into service differs in the more dangerous direction.

The movement of locomotives with slightly exceeded axle loads takes place in the main line network on a routine basis, without special actions or permissions.

3.5 Other recommendations

On 2 further occasions, TSB issued 2 safety recommendations suggesting immediate preventive actions before the completion of the investigation, based on the initial findings. Both recommendations has been implemented by the addressee.

2015-0729-5-01A

During the investigation of the scene, the IC established that the road signs warning of the level crossing are incomplete, damaged, and difficult to see. In addition, the recorded wheel prints show that usually there are trucks waiting at the north side of the level crossing, which hide the road signs warning of the level crossing, and make it more difficult to see the lights.

TSB recommends the Inspectorate of Transport of Győr-Moson-Sopron County Government Office to review the design and environment of the level crossing and to take actions as necessary to have the road signs repaired and to provide uninterrupted visibility of the level crossing warning lights.

In the case of accepting and implementing the above recommendations, the risk of accidents occurring due to similar causes may be reduced significantly in the opinion of the IC.

Accepted, implemented

BA2015-0527-5-01A:

The investigation by the IC into this occurrence has found so far that pressing the arms of the brake application valve D12 in the locomotive by little force (e.g. leaning on it) increases pressure in the main brake pipe (see attached the main brake pipe diagram taken on the test), which influences the brake force on the train, and the expected brake force cannot be achieved, especially in the braking position.

TSB Hungary recommends MÁV-Start Ltd. to inspect the vehicles equipped with D brake application valves out of turn, in run position and two braking positions as a minimum, in order to detect this type of defect.

Implementation of the above recommendation would exclude the occurrence of a brake release not intended by the locomotive driver due to operating possibly defective brake application valves during movement.

Accepted, implemented

3.6 Experiences of the safety investigations

The Railway Department has been in operation since March 2006. Based on the experience that have been gathered since then, the following observations can be made:

- Similarly to the previous years, a typical cause of the occurrences is **human factors** (this trend is the same in other branches of transport – aviation and marine – in which TSB conducts investigations). Among the technical causes, track deficiencies are still dominant. Other causes were faults in vehicles (wheel or axle, bearing fault, fastening failure of engine cover, door operating system, breaking system), questions of visibility, inadequate signposting and insufficient design of LCs.
- It is a new tendency that the effects of the changes necessarily accompanying reconstructions and renovations played a role in several occurrences (e.g.: safety installations providing reduced services, temporary track connections, modified order of traffic, higher workload for the personal, or failure of new designed systems, etc.)
- Situations where trains were at risk but the occurrences had no consequence shows quite a high number for years. Such occurrences were **SPAD**s and trains running on the same track in opposing direction. These kinds of incidents carry the possibility of more serious consequences; therefore more attention should be drawn to them. The main cause of these incidents is human factors, which highlights the acute need to use modern signal boxes, train control and communication systems. These developments cannot always be executed - due to financial difficulties - and are not done parallel to track reconstructions. Furthermore, railway staff should be well-prepared to deal with unexpected situations in which the signal box fails and the traffic has to be controlled very differently from the normal practice. In these occurrences often plays a role the lack of of failure of safety relevant communication.
- It may be concluded on the basis of the findings of the safety investigation that erroneous human decisions often imply in the background that the specified procedure or technology does not support adequately the making of good decisions. The same person is expected to apply different procedures in similar situations at different points of the network, which makes it easy to make a mistake.
- Regarding injuries caused by rolling stock in motion the experiences of the investigations of previous year's occurrences drew the attention to an operation problem of carriage doors. There were more investigations in the last few years related to cases in which passengers involved in the accident had fallen off (or left) the trains in motion through the doors of carriages with central door operating system – these doors should have been locked and only emergency open should have been possible during travel. Safety investigation established in these cases that no emergency open had been applied to open the doors, the doors had been open or normal opening of these had been possible due to technical deficiencies. In addition, such occurrences have appeared where the centrally operated door pinches the passenger's part of the body (typically a hand or arm), and the system does not detect it. Detailed investigation of the door operation, technical failures and maintenance of the vehicle type concerned revealed that majority of the failures could be repaired by minimal intervention (fuse replacement, setup of the door, etc.). The investigation however revealed deficiencies also in the process of detection of the failure – maintenance – take-over after maintenance, these having been eliminated by the improvement of the relevant technologies

and trainings of the personnel involved. Recommendation in this topic was already accepted, the implementation is in progress.

- In the last two years the Hungarian passenger transportation railway companies purchased new EMU trains. On these trains there is central door operation system, so the passenger-safety could step on higher level.
- When resolving the problems detected during the technical safety investigations, adapting the lessons learned to regulations and creating a transparent regulatory structure there is a problem that, in spite of EU commitments, the national railway safety legislation and the basic rules of railway operations have been only partly constituted in Hungary. In practice this means that certain basic rules are not laid down in legislation but only in internal regulations and orders of a railway undertaking or only as a regulation 'adopted' from another railway undertaking. The authority to constitute these rules is laid down in the act on railway transport, but the legislation has been pending for years. In this context the transport authority's role remains, it does not prepare the legislation but only approves it. For this reason there were several feedbacks to TSB's safety recommendations or during the consultations when a recommendation was accepted by the National Transport Authority but there was no possibility to implement it. The maintainer of the rules, the organization recommended the modifications was one of the railway undertakings that should have been the addressee of the recommendation.
- **International cooperation** has become more common in the investigation of railway accidents. TSB provides and receives assistance in the investigation of accidents in which the railway vehicles, their maintenance company, the staff, the railway undertaking or the location of the occurrence are in different countries. The cooperation provides a lot of new opportunities during investigations however it creates challenges as well, primarily in language knowledge aspects.

3.7 International cooperation

In 2015, the international practice was similar to the previous years, namely that the investigating bodies contact each other in relation to concrete accidents when more Member States are concerned (from the operator's, manufacturer's, maintenance's side or staff, etc.), or to discuss any actual topic, and ask for each other assistance.,

Collaboration with other NIB because of investigation was not necessary this year. We are proud that NIB, the transport safety organisation of Croatia established contact with us, and paid a working visit to Budapest during the initial building of their organisation and organising their activity. In the course of the cooperation, we shared the developed and planned procedural methods, defined possible interfaces during our activities, which was very informative for both parties, and grounded the efficiency of a potential cooperation in the future.

TSB continued to participate actively in the work of the European Railway Agency (ERA) The cooperation with ERA (with its costs covered by the EU) offers the opportunity for TSB to participate in compiling the system and methodologies of the assessment of National Investigation Bodies, The possibility to participate the Human Factor Network was very useful, because the human factor plays an important role in an overwhelming majority of the occurrences but we have the least investigation experience in this area. The meetings of Technical Expert's Network was very important, because we was given the possibility to be informed about the new rules, practices in the EU, and about the practice of other NIBs in special topics, it would be useful to have this possibility again.

TSB was the first NIB, which was object of the NIB Assessment program of the Agency in 2012. The assessment had a dual purpose: on the one hand the assessment of the work of the Hungarian accident investigating body, assistance in identifying what should be improved and defining improvement plans, on the other hand the improvement of the methodology of the assessment system and the control of its operation.

Considering the report, TSB has prepared a development and action plan. The follow up meeting of ERA was held in December 2013. Its purpose was to overview the planned and accomplished development efforts, owing to which the actions still pending were given a new impetus. The improvement based on the assessment findings is continuous, it has also long term elements, which will last for years.

Outside of the ERA, some of the European investigating bodies (e.g. Germany, Austria, Switzerland, Czech Republic, The Netherlands, Luxemburg, Denmark, Estonia etc) established a regional cooperation forum whose work TSB also participates in. Within the framework of this forum – besides discussing local problems and making recommendations towards ERA – there is an opportunity to learn about the investigation procedure of certain accidents and gain experience in the investigation of various types of rarely occurring occurrences.

4. SUMMARY OF RECOMMENDATIONS

In 2015, the addressee of the safety recommendations was primarily the National Transport Authority. TSB deviates from this practice only when it issues safety recommendations to organisations which are not under the scope of authority of the NTA (e.g. rescue services), or the supervision rights are at a regional authority (e.g. supervision of level crossings). This way it could be achieved that when the addressee of the recommendation is a railway undertaking, the response would not come from the addressee itself for which the implementation would involve considerable work and/or financial sources but an outside, impartial professional organisation would respond to the recommendation. The other advantage is that

when the recommendation suggests eliminating conditions/factors that are unlawful or pose risks to transport safety, the NTA has the possibility to oblige the relevant parties with deadlines to take action, which would increase efficiency in the implementation of recommendations. Disadvantage of this process – laid down in the RSD – is that it brings delay in the implementation process, and there are some cases, when the NTA has no legal right to take action in topics, which could be solved easily by the IM or RU.

In 2015 the Railway Department of TSB published 37 final reports investigating 44 occurrences, including 23 safety recommendations, 6 of them were already issued earlier, during the investigation process. 4 of these recommendations have been implemented, implementation of 12 recommendations is in progress 7 of them were rejected by the addressee.

On 2 further occasions, TSB issued 2 safety recommendations suggesting immediate preventive actions before the completion of the investigation, based on the initial findings. Both of these recommendations have been implemented by the addressee .

Summary of responses to safety recommendations issued in 2007-2015

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Accepted and implemented	4	15	11	3	25	15	9	9	4
Accepted and partially implemented	2	2	-	-	-	-	-	-	-
Accepted, implementation in progress	7	3	7	17	2	8	4	6	10
Accepted, no information on implementation	-	3	-	-	-	-	-	-	-
Rejected	2	4	3	1	-	1	2	1	5
No answer	-	1	3	-	-	0	0	2	-

Section 3.4 contains a detailed list of the safety recommendations issued.