ANNUAL REPORT OF THE INVESTIGATION BODY FOR RAILWAY ACCIDENTS AND INCIDENTS

2016

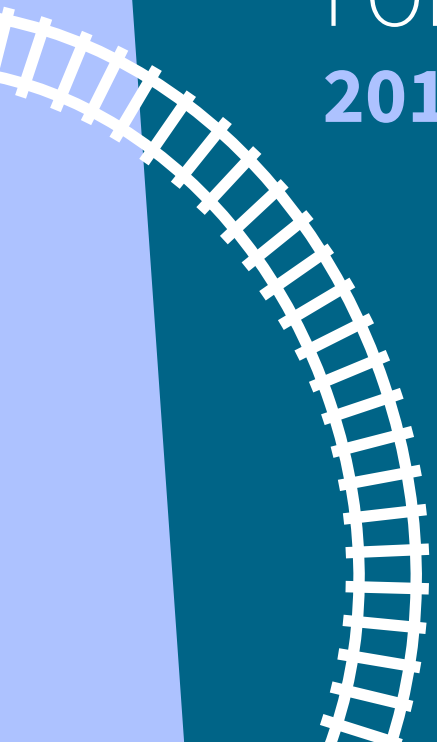

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Illustration photos taken by the Investigation Body for Railway Accidents and Incidents
during the «Festival Vapeur» organised by the association «Chemin de Fer à Vapeur des 3 Vallées» (C.F.V.3.V. asbl) - September 2016

1 | FOREWORD

The present annual report covers the achievements of the Investigation Body over the course of 2016.
Our objective is unambiguous: to promote safety.
To do this, we carry out investigations, we share our results and our experiences, we monitor how we operate, we innovate,...
The Investigation Body has completed 6 investigations including two which were opened in 2016.

WE INVESTIGATE

The accident or incident generally finds its cause in a human error: stopping at this finding does not allow the necessary lessons to be learned, does not allow the error to be avoided in the future, does not allow the consequences to be limited, etc. This is why we look at the direct causes as well as the contributing factors that allowed the accident to happen.
An investigation is nothing without the active collaboration of the actors concerned. We actively share with them the available information.
Our findings cannot be interpreted as attributing or determining the civil or penal liabilities. The questions and the reasoning, are posed with the IB's sole objective: promoting safety by encouraging actors to consult with one another, continuing to invest in and be involved in the improvement of safety on the Belgian railway network.
In the context of our investigations, we ensure that all people and organisations are treated with regard, with courtesy, with equality and discretion.

WE INNOVATE

- We have opened our first investigation into an accident on a museum railway line. There were no fatalities in this accident but several people were injured. The investigation allowed the circumstances of the accident to be understood as well as for members of the IB to familiarise themselves with museum railway lines.
  We have been able to count on the openness and the collaboration of volunteers from the operators of the museum railway lines.
- The investigation into the derailment that took place in September 2015 in Buizingen could not be completed in September 2016. The IB has published, for the first time, an interim report as provided for in the new European Directive 2016/798 not yet transposed.

WE SHARE

- In March, with the expertise of our British colleagues from the RAIB, we organised a training week, open to all investigation bodies: 10 nationalities were represented.
- In October 2016, we organised our first seminar on the theme of safety at level crossings. We consider that the seminar was rich in lessons for all parties; it allowed information to be shared on the way others work.
- Meetings for sharing of experience were held between the different investigation services Aviation - Maritime - Rail.

WE MONITOR THE WAY WE WORK

An audit by an external company started in December 2016, with the aim of measuring the level of satisfaction of our clients, to take measures to better meet their needs and to improve our exchanges.
The results of the audit are expected at the start of 2017.

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2 | THE INVESTIGATION BODY

2.1 LEGAL STATUS

The creation of an independent body responsible for investigating railway accidents and incidents for the improvement of safety is provided for by the European Directive 2004/49. This Directive has been transposed into Belgian law with one law and two implementing decrees.

THE LAW OF 30 AUGUST 2013 ON THE RAILWAY CODE

The Railway Code is intended to codify and assemble three laws on the railways in a single and coherent text. It finalises the transposition of certain directives and provides for the modifications to railway legislation made necessary by the experience acquired since adoption of the following three laws:

- The Law of 4 December 2006 on the use of railway infrastructure;
- The Law of 19 December 2006 on the safety of railway operations;
- The Law of 26 January 2010 on interoperability of the railway system within the European Community.

ROYAL DECREE OF 16 JANUARY 2007

The Royal Decree of 16 January 2007 has been amended by the Royal Decree of 25 June 2010 setting certain rules for investigations into railway accidents and incidents.

ROYAL DECREE OF 22 JUNE 2011

The Royal Decree of 22 June 2011 designating the investigation body (IB) for railway accidents and incidents and repealing the Royal Decree of 16 January 2007.
It stipulates in Article 4, that the lead investigator and the assistant investigator of the IB may have no link to the Department for Railway Safety and Interoperability (DRSI), or to any railway regulatory body or any authority whose interests could conflict with the investigation.

LAW OF 26 MARCH 2014

The Law of 26 March 2014 regulates all requirements on the operational safety of museum railway lines.
A museum railway line has the main function of tourist-passenger transport with historical rolling stock, such as steam trains. These are abandoned railway lines which have remained in place and which are generally operated by a company operating tourist trains.
To be able to operate a museum railway line, the operator must have authorisation, issued by the Safety Authority (DRSI).
This law stipulates that the operator of a museum railway line should immediately inform the IB of the occurrence of a serious accident, according to the means determined by the IB. It should also foresee that the IB carries out an investigation following every serious accident occurring on a museum railway line.

2.2 ORGANISATION AND RESOURCES

INDEPENDENCE

Since its creation in 2007, the IB has made some major advances.
The various legislative changes made since its creation allow the IB to work completely independently.
To keep the public's trust, the IB must be objective, independent and free of any conflict of interest.
The IB is hierarchically independent of the Minister for Mobility, the FPS Mobility and Transport, the Safety Authority, etc.
The hierarchical position of the IB reinforces its independence, to the extent that it is under the direct authority of the Minister for Small Businesses, Self-employment, Small and Medium-sized Enterprises, Agriculture and Social Integration, in charge of policy on the railway system and regulations on railway transport and aviation.

Our independence is not only linked to the hierarchical position.
It can be seen in our freedom to decide when to open investigations as well as how to conduct them, and also in the availability of financial resources.

The annual budget is established by the Lead Investigator in collaboration with the department for Budget and Management Control. He has the power to authorise various expenses within the financial limits mentioned, to finalise contracts etc. The Ministerial Decree of 4 October 2011 sets the powers which are delegated to the Lead Investigator in financial matters.

The Memorandum of Understanding made with the FPS Mobility and Transport allows not only use of its offices but also numerous services: legislative, personnel procedures, etc.

BUDGET

The creation of an organic budgetary fund by Article 4 of the programme act of 23 December 2009 is intended to guarantee the financial independence of the Investigation Body for railway accidents and incidents.

The funds are made up of contributions to the operational costs of the IB by the infrastructure manager and railway undertakings.
The King determines, by Decree, the amount of the annual IB budget, after consultation with the Council of Ministers.

Aside from general expenses (staff, offices, operations, equipment), there are also specific operational expenses foreseen which ensure the IB is able to fulfil its duties: regular external expertise and consulting, individual safety equipment, participation in specialised training and conferences etc.

TOTAL STAFF

On the 31 December 2016[1], the IB was made up of:

- a lead investigator,
- two permanent investigators,
- a trainee investigator.[2]

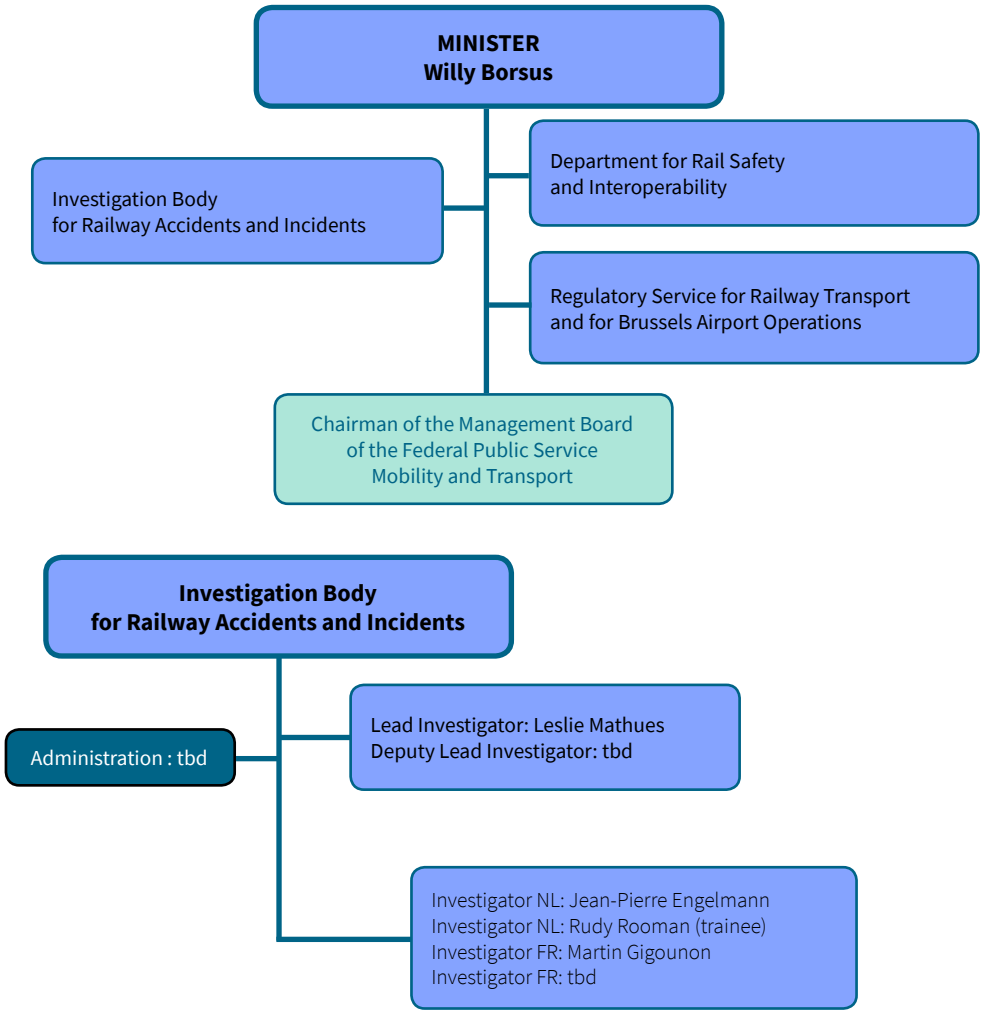
Investigations are led by the permanent investigators with the support of experts chosen according to the skills considered necessary.
To be able to carry out its duties effectively and with the level of quality required while remaining independent in its decision-making, the IB has an appropriate level of technical expertise internally in the railway domain and experience on the ground. Newly-recruited IB personnel generally have engineering skills and specialised knowledge in areas other than the railway.

The IB offers its personnel the opportunity to take regular training courses. The aim is for members of the team to be specialised in various disciplines, and for them to accrue and share experiences through a policy of knowledge transfer within the group.

LOCATION

The offices of the IB are situated in the offices of the Federal Public Service Mobility and Transport, rue du Progrès 56 (5th floor) in Brussels, close to the North station.

THE IB ORGANISATION CHART



1 An administrative assistant since 1st January 2017 and a new trainee investigator since 15 May 2017

2 The trainee did not continue collaboration.

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3 | OUR MAIN DUTIES

3.1 INVESTIGATIONS

The main task of the Investigation body (IB) is to investigate operational accidents considered serious, occurring on the Belgian railway network.
As well as serious accidents, the IB is allowed to investigate other accidents and incidents with consequences for railway safety.
The safety investigations carried out aim to determine the circumstances and causes of the event and not with apportioning blame.
They are separate from the legal investigation, which takes place alongside.
They are based on multiple aspects: infrastructure, operations, rolling stock, staff training, regulations, etc.
The results of the investigations are analysed, evaluated and summarised in the investigation report.
The investigation report is not a formal decision. It may contain safety recommendations for authorities, railway undertakings, the infrastructure manager or other publics.

The aim of these recommendations is to reduce the risk of similar accidents re-occurring in the future, but also to reduce the consequences.

The investigations opened and closed in 2016 are briefly described in chapters 6 and 7.

3.2 COMMUNICATION

The investigation reports are made public and are intended to inform the parties concerned, the industry, regulating bodies, but also the general public. This is why the IB publishes, in 3 languages, summaries giving details of the main elements of an investigation. The report outlines the elements that have allowed conclusions to be drawn.

The reports and summaries by the IB are available via the website of the Federal Public Service (FPS) Mobility and Transport at the following address:
http://www.mobilit.belgium.be/fr/traficferroviaire/organisme_enquete

Contact with the press is via the spokespersons of FPS Mobility and Transport, in accordance with the agreement protocol established between the FPS and the IB.

3.3 DATABASES

The IB receives from the infrastructure manager and the railway undertakings:

- reports, within 24 hours, on all incidents and accidents occurring on the Belgian railway network ;
- summary reports, within 72 hours, of operating incidents and accidents.

All the accidents and incidents reported by the infrastructure manager and by railway undertakings are recorded into two separate databases daily.

The information in the databases is essential for allowing the IB to analyse general safety trends and provide useful information in the context of investigations.
The data is either automatically transferred, or introduced directly in the database via an automatic electronic form by the railway undertakings and the infrastructure manager.
Access is managed by the IB.
The database is made available to the Safety Authority and allows common safety indicators to be determined, as foreseen by European Directives.
The safety, security and environment service of the Directorate-General for Sustainable Mobility and Railway Policy of the FPS Mobility and Transport also has access to the “report” database for accidents and incidents occurring at level crossings.

Currently the railway undertakings and the infrastructure manager do not have reading access to the database.

Automatic alerts have been put in place by the IB to draw the attention of IB investigators and DRSI personnel to certain types of events: death, derailment, collision, etc.

However, the database is not fixed, it evolves according to the experience gained, the reference points and identified needs. A budget is provided for improvement of functions and automations of the database.
In 2017 there is a plan to give access to the database and to monthly statistics on certain indicators to the RUs and the IM.

In 2016, the classification of events was subject to various discussions with the Safety Authority so as to be more in accordance with the tasks devolved to it.
Classification has also been discussed with the sector.
We have learnt of the existence of the COR project at a European level. The project would define a unique classification within the European railway sector, which would facilitate the task of railway undertakings active in several countries. The modification of classification within the database of the IB is therefore on hold.

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4 | OTHER ACTIVITIES OF THE IB

4.1 NATIONAL INVESTIGATION BODY NETWORK

The IB takes part in the activities of the network of national investigation bodies, which take place under the aegis of the European Railway Agency (ERA). The aim of this network is to allow an exchange of experiences and to work together on European harmonisation of regulations and investigation procedures. This international platform ensures an exchange of good practices between Member countries, as well as the development of guides so as to have a common vision and interpretation of the practical application of European Directives.
Our participation is active, whether this is in presentation of the available elements from investigations or the process of an investigation or in the sharing of results from human and organisational factor investigations carried out with the help of external experts.
As a result of new European directives, we participate with other NIBs and ERA in organising and improving the management of plenary meetings.

4.2 AAIU MAIU RAIU MEETINGS

The three investigation bodies for air, maritime and railway accidents and incidents are located in the same building of the FPS Mobility and Transport. Various meetings were held with our colleagues to share experiences on finalised investigations, procedures, experience, etc.

4.3 TRAININGS

EARTHWORKS AND DRAINAGE, DERAILMENT AND INFRASTRUCTURE TRAINING

In March 2016, the IB organised a training course for one week in Brussels in cooperation with the UK Investigation body (RAIB[3]). Training was given by experienced investigators from the RAIB.

The following are a few themes that were covered:

- *Types of derailment mechanism,*
- *Post site derailment analysis methods and tools,*
- *Track Faults,*
- *Inspection, testing and recording track,*
- *Switches and crossings function and construction,*
- etc.

This week allowed us an exchange with numerous colleagues from different European countries. We had also invited investigators from the infrastructure manager Infrabel, certain members of the DRSI, etc.

OTHER CONFERENCES

The IB participated in various conferences that allowed its knowledge to increase as well as to make contacts:

- *Human factor and safety management system* in Valenciennes and in Brussels;
- *International Rail Accident Investigation conference* in London.

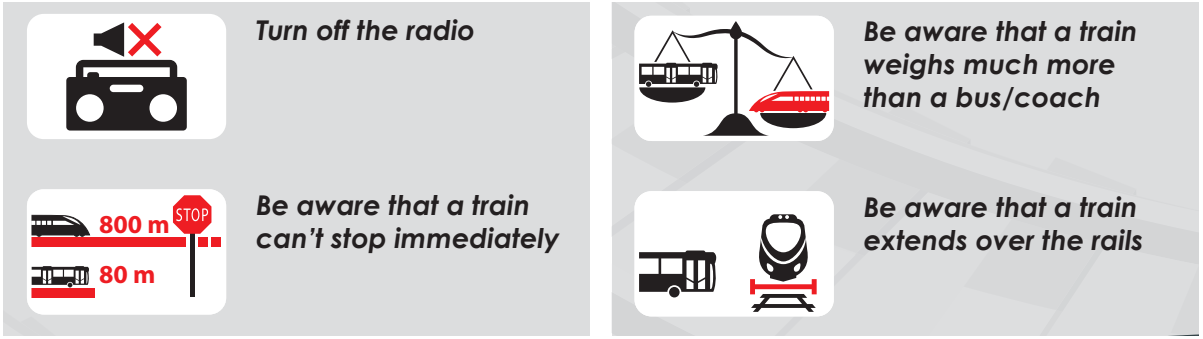
3 Rail Accident Investigation Branch

4.4 SEMINAR ON LEVEL CROSSING SAFETY

On 3rd October 2016, we organised our first seminar on safety at level-crossings.
The objective of the seminar was initially to increase awareness of the bus companies and bus driver training companies, of the risks and dangers of level-crossings.
The seminar did not stop at railway transport, but also covered the training courses taken by drivers, measures taken post-accident, European requirements in bus construction, etc.

Veiligheidsverslag Pittem	Onderzoekorgaan
Statistiques et fonctionnement des Passages à Niveau	INFRABEL
Signalisatie Overwegen : wettelijk kader	FOD Mobiliteit en Vervoer
Pourquoi des usagers franchissent les Passages à Niveau ?	Agence Wallonne Sécurité Routière
(Nood)uitgang en evacuatie van autobussen	VDL- group Coach
Courbes de freinage des trains	SNCB
Wegcode en Overweg	SPC
Interface Rail-Route	INFRABEL
Genomen maatregelen na het ongeval	DE LIJN
Basisopleiding en permanente vorming van buschauffeur	FCBO
Présentation Brochure UIC	INFRABEL

All presentations are available on our website: https://mobilit.belgium.be/fr/pittem_lessons_learned_presentation



We have retained some figures from the day:

PITTEM LESSONS LEARNED

90% des accidents ferroviaires

sont des accidents aux passages à niveau et des accidents de personnes hors suicide

0.09 % des accidents corporels entre 2011 et 2015 sur le réseau routier

2.9 % des victimes de la route entre 2011 et 2015 soit

49 décès lors de 157 accidents entre 2011 et 2015

30 accidents aux passages à niveau par an

84% des accidents ferroviaires

sont dus aux négligences et imprudences des usagers de la route

2 minutes

c'est le temps d'attente moyen estimé pour les usagers de la route à un PN

450 Euros et retrait de permis

c'est le montant minimum à payer. Slalom entre les barrières correspond à une amende du 4ème degré

800 mètres

c'est la distance d'arrêt nécessaire pour un train de voyageur roulant à 120km/h contre **150 mètres** pour une automobile. La distance est pratiquement doublée dans le cas des trains de marchandises

600 tonnes

c'est le tonnage moyen d'un train de voyageurs. Le tonnage d'un train de marchandises varie entre 1600 à 3600 tonnes

166 secondes

c'est le temps nécessaire pour l'évacuer tous les passagers d'un bus rempli à 2 portes

60 secondes

c'est la valeur maximum du temps d'annonce = temps entre l'avertissement des usagers de la route et le franchissement du PN par le train

A summary of presentations made on 3rd October 2016 is attached to the present report and is available on the website of the IB: https://mobilit.belgium.be/sites/default/files/OOOE/2015/pittem_lessons_learned_fr_pv_0.pdf

4.5 INVESTIGATION INTO ACCIDENTS AND INCIDENTS INVOLVING TOURIST TRAINS

During the steam festival organised by the non-profit organisation Stoom-Centrum Maldegem, the train made a journey from Eeklo to the station in Maldegem.
Just after the LC 35, the locomotive was travelling at around 10 km/h. At the bridge in Balgerhoeke above the Schipdonk canal, an explosion was heard and the driving post was filled with steam.
Four people were in the driving post: the driver from StoomCentrum (who had line knowledge) and 3 engineers from Mariembourg (who had knowledge of the rolling stock: the locomotive).

The accident does not meet the definition of serious accident but the IB decided to open a restricted investigation to determine the reasons for the accident that, under slightly different circumstances, could have led to a serious accident[4].

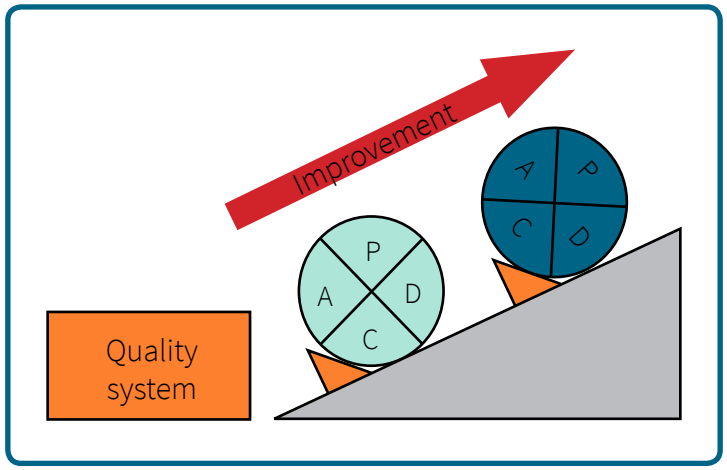
4 At the time of publication of the annual report, the investigation report has been finalised and is available on the website

4.6 CONTINUOUS IMPROVEMENT OF OUR OPERATIONS

To improve the quality of our organisation, we are using the principles of the Deming wheel which is an illustration of the quality management method called Plan Do Check Act.

The method involves four stages, each one bringing in the next. Its implementation should allow the continual improvement of the quality of a product, a work, a service, etc.

- 1. **P**lan : preparing, planning (that which we are going to carry out);
- 2. **D**o : developing, realising, implementing (most often, we start with a test phase);
- 3. **C**heck : controlling, checking;
- 4. **A**ct (or Adjust) : act, adjust, react (if we have tested at the do stage, we deploy during the act phase).



For the last few years, the Investigation Body has been organising, developing and implementing the investigation processes that are formalised in a manual of procedure.

An audit by an external company started in December 2016 to measure the level of satisfaction of our clients and take measures to better meet their expectations and improve our exchanges. The results of the audit are expected at the start of 2017.

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5 | INVESTIGATIONS

5.1 INVESTIGATION PROCEDURE

A. NOTIFICATION

The railway infrastructure manager immediately telephones the investigator on duty to inform them of serious accidents and incidents as well as all collisions and derailments on the main line. The practical formalities are sent by post to the infrastructure manager.
The Investigation body (IB) can be reached 24 hours a day, 7 days a week.
The decision by the IB to open an investigation is communicated to the European Railway Agency, to the Service for Railway Safety and Interoperability, to the railway undertaking and to the infrastructure manager concerned. The actors concerned are consulted from the beginning of the investigation.
The first phase of the investigation involves factual data collection by investigators on the site of the accident or incident. This involves looking for and collecting all the information, descriptive as well as explicative, likely to clarify the causes of an unsafe event.

B. INVESTIGATION

All the information, proof and declarations available and linked to the elements in a situation which have led to the accident or incident, are evaluated, so as to check what can be considered as proof or not. The most probable scenario is then established.
The careful analysis of a safety management system with three dimensions (technical, human and organisational) allows possible failures and/or inadequacies to be revealed. And this at different levels of the system and in particular in the management of risks, with the aim of preventing accidents.

C. RECOMMENDATIONS

The recommendations in the area of safety are proposals that the IB makes in order to improve safety on the railway system.

The recommendations are centred around the prevention of accidents. Their role is three-fold: minimising the number of potential accidents, limiting the consequences of an accident and finally to lessen the seriousness of resulting damage. The IB addresses, formally, the National Safety Authority with recommendations resulting from their investigation into the accident. If it turns out to be necessary due to the character of the recommendations, the IB also addresses other Belgian authorities or other Member States of the European Union.

D. INVESTIGATION REPORT

The investigation reports serve as a reminder as well as an archive, but also allow the lessons learned from accidents and/or incidents to be recognised. Their goal is to encourage the circulation of knowledge acquired in the course of different analyses.
The preliminary reports are generally sent twice to the actors concerned, so as to allow them get to know the analyses and to provide their comments. The goal is not to alter the content of the report but to add any necessary details. The conclusions and recommendations are a part of the draft final report sent to the actors concerned. The changes accepted by the IB are then incorporated into the reports.
Further investigations are sometimes necessary to remove any ambiguities or to verify new elements made available to the IB.

E. FEEDBACK ABOUT RECOMMENDATION'S APPLICATION

The law specifies that the addressees of the recommendations inform the IB, at least once a year, of the follow-up to the recommendations.
The inspection of the operational follow-up given to recommendations made are not part of the IB duties. The monitoring of this implementation falls to the National Safety Authority for the railways, according to Directive 2004/49/EC.

5.2 CASES SUBJECT TO AN INVESTIGATION

An accident is defined as an event which is undesirable, unintentional and unforeseen, or a particular chain of events of this kind, having detrimental effects.

According to Article 111 of the Law of 30 August 2013, the Investigation body (IB) carries out an investigation following every serious accident occurring on the railway system.
A serious accident is defined as any train collision or any derailment causing at least one death or at least five serious injuries, or causing major damage to the rolling stock, to the infrastructure or to the environment, as well as any similar accident having obvious consequences for the regulations or the management of railway safety.
"Extensive damage" means damage that the investigation body can immediately estimate to a value of least EUR 2 million in total.
As well as serious accidents, the IB can carry out investigations into the accidents and incidents which, in slightly different circumstances, could have led to serious accidents, including technical failures at the level of structural subsystems or interoperability constituents of the high speed or conventional railway system.

The IB receives from the infrastructure manager and the railway undertakings:

- reports, within 24 hours, on all incidents and accidents occurring on the Belgian railway network ;
- summary reports, within 72 hours, of operating incidents and accidents.

They are put into two separate databases: one with the reports and the other with the summarised reports.
The accidents and incidents are sorted in the database according to the elements provided by the railway undertaking and the infrastructure manager, according to 3 levels of seriousness: serious, significant and other.

«SERIOUS» ACCIDENT / INCIDENT LEVEL 1[5]

Any type of accident / incident resulting:

- in the death of at least one person or
- serious injuries to five or more persons or
- causing extensive damage to the rolling stock, to the infrastructure or to the environment; "extensive damage" meaning damage that the investigation body can immediately estimate at a value of least EUR 2 million in total.

«SIGNIFICANT» ACCIDENT / INCIDENT LEVEL 2

Any type of accident / incident resulting:

- in serious injuries to at least one person or
- causing damages assessed to be worth at least EUR 150,000 or
- suspension of rail traffic for over 2 hours.

«OTHER» ACCIDENT / INCIDENT LEVEL 3

Accidents and incidents that do not fall into the other two categories.
The decision to open an investigation is taken by the IB independently on the basis of this information, potentially supplemented by a preliminary enquiry.

5 Article 19 (1) of the Directive 2004/49

REPORT TYPES OPENED BY THE IB

Serious accidents	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Collision	1	1	0	1	0	1	0	0	0	1
Derailment	0	0	1	0	0	0	1	0	0	0
Accident at a level crossing	0	0	0	0	0	0	0	0	1	0
Accident involving a person caused by rolling stock	3	1	1	0	0	1	0	0	0	0
Fire in rolling stock	0	0	0	0	0	0	0	0	0	0
Significant accidents	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Collision	1	1	0	0	1	1	1	1	0	1
Derailment	1	0	0	0		2	1	0	0	0
Accident at a level crossing	0	1	0	0	0	0	0	0	0	0
Accident involving a person caused by rolling stock	0	0	1	0	0	0	0	0	0	1
Fire in rolling stock	0	0	0	0	0	0	0	0		0
Incidents	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	0	0	0	0	1	0	0	2	2	1
Tourist trains	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	0	0	0	0	0	0	0	0	0	1

NUMBER OF INVESTIGATIONS

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of investigations opened	6	4	3	2	3	5	3	3	3	4
Number of investigations closed	6	4	3	2	3	4[6]	3	3	2[7]	2

Since 2013, we have put a lot of effort into finalising investigations.
This has allowed a reduction of the backlog created by the putting into place of a body which is totally independent of the SNCB/NMBS group and the FPS Mobility and Transport.

NUMBER OF INVESTIGATIONS TOURIST TRAINS

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of investigations opened										1
Number of investigations closed										0[8]

6 The investigation into the derailment of a freight train in Melsele in 2012 is being finalised.
7 The investigation into the derailment which occurred in Buizingen in 2015 is now closed.
8 The investigation into the accident which occurred in Maldegem is now closed.

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6 | FOUR INVESTIGATIONS OPENED IN 2016

4 investigations were opened in 2016 : of these 4 investigations, one meets the definition of serious accident.

HERMALLE-SOUS-HUY

BRIEF OVERVIEW

On Sunday 5 June 2016 at around 23:04, the passenger train 3820 of the SNCB/NMBS struck the rear of the train 38535 of B-Logistics between the unattended stopping points of Amay and Hermalle-sous-Huy on line 125.
Following the collision, the first 2 cars of the passenger train derailed and landed on the tracks.
The accident caused the death of 3 victims (the driver of the passenger train and 2 passengers) and 9 seriously injured. Numerous damage was caused to the infrastructure and to the rolling stock.

MELSELE

BRIEF OVERVIEW

During the night of 14 to 15 October, line 59 was taken out of service to carry out works with mobile rail-road cranes. Just before 7am, procedures were put into place to put track B back into service.
At 07:26, a passenger train on track B went past one of the cranes on the adjacent A track. Suddenly, the arm of the rail-road crane turned, colliding with the train.
The rail-road crane was dragged by the train and hit a worker who was positioned next to the crane. The worker was seriously injured, leading to major consequences.
Major damage was caused to the railway infrastructure and traffic was suspended, causing delays and train cancellations.

BINCHE

BRIEF OVERVIEW

On Wednesday 13 January 2016 at around 20:53, the SNCB/NMBS empty passenger train ME3421 struck the rear of the SNCB/NMBS train E3440 when entering Binche station. There were no victims in the collision and the damage, which was only to the rolling stock, was relatively limited.

LANDEN

BRIEF OVERVIEW

On Thursday 18 February 2016, just before Landen station, a driver who had got down onto the tracks to inspect his train, noticed the train starting to move by gravity. The driver did not manage to get back onto the moving train, which ran away for around 12 kilometres until Tienen.

The investigations concerning the accidents that occurred in Binche and in Landen are closed : the results are presented hereinafter.

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7 | SIX INVESTIGATIONS CLOSED IN 2016

PITTEM (25/11/2015) - COLLISION OF A DE LIJN BUS BY A SNCB TRAIN ON A LEVEL CROSSING

BRIEF OVERVIEW

On 25 November 2015 at around 13:25, a bus from the company De Lijn came to a standstill on the tracks of a level crossing in Pittem. The driver of an SNCB/NMBS passenger train noticed when exiting a bend that there was a bus blocking the level crossing and engaged the emergency brake. In spite of the emergency brake, a collision could not be avoided. The bus driver was killed in the collision.

DIRECT CAUSES

The cause of the accident is the presence of a stationary bus on a level crossing during the passage of the train at this crossing.
Owing to a miscalculation, the bus turned onto the open level crossing - before the arrival of the train was announced - and became stuck against the level crossing signals.

Factors directly contributing to the bus becoming stuck on the crossing:

- the configuration of the roads and level crossing, and more specifically considering the bend of 135° in combination with the width of the road ;
- the configuration of the bus and, amongst others, the length of the articulated vehicle.

The bus met the legal requirements (turning circle), but simulations show that due to the curve of the crossing, only a very limited number of starting positions could be taken.

INDIRECT OR OPERATIONAL CAUSES

- the lack of communication between the driver and Dispatching ;
- the failure by the bus driver to follow the arranged route.

ORGANISATIONAL CAUSES

Insufficient awareness by the bus drivers and their employers of the risks associated with deviating from the planned route.
Insufficient awareness by the bus drivers and their employers of the risks associated with level crossings.

https://mobilit.belgium.be/sites/default/files/OOOE/2015/summary_pittem.pdf

BINCHE (13/01/2016) - COLLISION BETWEEN TWO SNCB/NMBS PASSENGER TRAINS

BRIEF OVERVIEW

On Wednesday 13 January 2016 at around 20:53, the SNCB/NMBS empty passenger train ME3421 struck the rear of the SNCB/NMBS train E3440 when entering Binche station. There were no victims in the collision and the damage, which was only to the rolling stock, was relatively limited.
The first findings at the scene showed that the rear of the struck train was still in the gauge of the track that the other train had been travelling on. The analysis of the data and signalling commands allowed it to be concluded that there was no irregularity in the automatic route tracing or in the commands made by the block 11 operator.
The analysis of the data recorded on board the trains allowed it to be concluded that the drivers of the two trains respected the signals and the regulations.

DIRECT CAUSE

The collision between the two passenger trains was made possible due to the position of an insulated connection on a track circuit ensuring the detection of trains: while the train E3440 had released one part of its route by passing this connection, the train was still in the track gauge of the adjacent track II. The track circuit being released, the movement of the train ME3421 onto track II was authorised: the front of the train ME3421 collided with the rear of the train E3440.

INDIRECT CAUSE

In 2011, the installations in Binche changed to EBP/PLP. The parameter setting of installations did not require any works or adaptations on the ground. There was no procedure for verification foreseen: the 1002 plan was not altered.
The change of technology (TCO Video/PLP → EBP/PLP) and the change of logic (introduction of flexible transit) are changes requiring study and verification procedures: the error in the 1002 plan was not picked up in these changes.

https://mobilit.belgium.be/sites/default/files/OOOE/2016/summary_binche.pdf

The parameter-setting of installations was therefore carried out based on the 1002 plan and the insulated connection 21U was considered as a release point.
The released track circuits may be used in the route tracing of another train, increasing operational flexibility.

SYSTEMIC CAUSE

The parameter-setting in EBP at Binche station was carried out according to experience at the time, without formal written procedures being foreseen and followed. This way of proceeding does not allow risks linked to the use of a new technology (switch to EBP) to be taken into account.
According to the DRSI, this switch to another technology constitutes a major change that, according to Regulation 402/2013 (or previously 352/2009):

- should be evaluated by taking into account all changes linked to safety;
- should require the exhaustive application of the Common Safety Method (CSM) in relation to the evaluation and assessment of risks.

REMERSDAEL (25/01/2012) - DERAILMENT OF A FREIGHT TRAIN

BRIEF OVERVIEW

On Wednesday 25 January 2012 at about 20:46, the freight train E47544 from the railway undertaking SNCB/NMBS Logistics was travelling on track B of line 24 from Montzen to Visé. The driver noticed a complete emptying of the automatic brake pipe at Remersdael. During inspection of the train, he noticed the derailment of the third wagon: the wagon was inclined on the side between the tracks with a risk of obstruction of track A. The load of the wagon spilt between the tracks and on track A.

DIRECT CAUSES

According to the theory retained by the investigation body, the direct cause of the derailment was the loss of contact between the rails and the wheels due to the "lifting" of the rear wheels of wagon 3.

This loss of contact was made possible by:

- the numerous longitudinal deformations noticed at the track level in the zone just before the derailment area;
- the fact that these deformations are presented in the form of "waves" of the same length. They correspond to the distance between the axles of the derailed wagon;
- the reverse cross levelling in the bend (design of the track did not provide for superelevation in this area);
- the weight limit of the wagon that derailed;
- the height limit of the wheel flange (the height of the flange is 26 mm = minimum height authorised for the flange) ;
- the type of suspension of the single-axle wagon;
- the speed of 80 km/h.

All of these factors bring together the conditions that could lead to a derailment without an irregular situation having been noticed for each of the elements taken separately.

https://mobilit.belgium.be/sites/default/files/OOOE/2012/verslag_remersdaal_2012.pdf

INDIRECT CAUSES

The rapid deterioration of the geometry of the track was certainly noticed and reported in several consecutive routine inspections, but the deformations were not measured. In the inspections, the rail deflation, which was noted after the accident, was never observed or measured with a rail deflation measuring device to monitor the development.

The manager took the decision to ensure a better monitoring of analyses of recordings of the geometry of the track.

The risks linked to the phenomenon of cyclic top were not identified by the infrastructure manager.
The manager is carrying out an examination of the behaviour of the single faults and in particular the levelling peaks. The analysis will also be expanded concerning the presence or not of cyclic top (2016).

LANDEN (18/02/2016) - RUNNING AWAY OF AN SNCB/NMBS TRAIN BETWEEN LANDEN AND TIENEN

BRIEF OVERVIEW

On Thursday 18 February 2016, just before Landen station, a driver who had got down onto the tracks to inspect his train, noticed the train starting to move by gravity. The driver did not manage to get back onto the moving train, which ran away for around 12 kilometres until Tienen.
According to the IB analysis, the incident was an unexpected movement of the train which became a runaway for around twelve kilometres.

DIRECT CAUSES

The direct cause of the running away of the train was the releasing of the brakes following sufficient pressure in the ABP after the driver had closed the pneumatic valve.
The elements contributing were:

- the lever was not in «brake» or «emergency brake» position;
- the parking brake was not engaged during the inspection of the train by the driver;
- the grade of the track which allowed the train to start moving by gravity;
- the AM80 did not have a system preventing runaway which could have stopped the train.

INDIRECT CAUSES

- non-compliance with the HLT procedure by the driver for stopping his train while he was inspecting it;
- the untimely movement of the lever of the pneumatic release valve allowed an air to escape from the main reservoir of one of the cars, resulting in a pressure drop in the ABP.

https://mobilit.belgium.be/sites/default/files/OOOE/2016/report_landen.pdf

ANTWERPEN (01/01/2015) - DOUBLE OVERRUNNING OF SIGNALS BY AN INTERNATIONAL TRAIN

BRIEF OVERVIEW

On 1st November 2015 around 10:49, at the exit of the Antwerpen-Centraal tunnel, the E9227 train overran the signals G-R.12 and J-R.12, in a closed position, on the L.25.
No route was defined towards the L.12: the train continued its journey on the L.4 where it came to a standstill after the intervention of surveillance staff from Block 12 Antwerpen-Berchem.
There were no victims or material damage.

https://mobilit.belgium.be/sites/default/files/OOOE/2015/report_luchtbal.pdf

DIRECT CAUSES

The Investigation Body has retained the following hypothesis: the double overrunning of a signal caused by a state of hypovigilance due to fatigue.

INDIRECT CAUSES

The overrunning of the signal was made possible by:

- the absence on-board the locomotive of driving assistance TBL1+ or ETCS Level 1 or 2 cab signalling.
- the fact of taking into account the idea of "driving without conflict": if the risk of meeting a signal at danger is reduced, logically the risk of SPAD[9] is reduced. The risk of encountering a signal at danger may be reduced by ensuring the elimination of conflicts in the planning and maintenance of timetables.

SYSTEMIC CAUSES

- The absence of an LMRA[10] or a vigilance detection system for train drivers.
- The implementation of a quality FRMS (Fatigue Risk Management System) increases the probability of detecting a driver's unfitness as well as the problems linked to an eventual loss of vigilance during driving.

9 SPAD = *Signal Passed At Danger*
10 LMRA = *Last Minute Risk Analysis*

SCHAERBEEK (10/10/2014) - FACE TO FACE BETWEEN TWO SNCB/NMBS-TRAINS

BRIEF OVERVIEW

On Friday 10/10/2014 in Schaerbeek, at around 20:42, the train E3340 (Essen - Bruxelles Midi) passed the signal at danger T-M.8 of the track B - Line 25 and stopped between the 2 sets of points 33L and 32L, around 105 metres from the signal T-M.8 at danger.
The points 33L were positioned to the right and the stopped train was in the gauge of track A of line 25; the driver immediately sent a GSM-R alarm.
The train E4519 (Charleroi-Sud - Antwerpen), travelling in the opposite direction, entered Schaerbeek station. The driver of the train received the emergency call and immediately initiated an emergency brake. The train E4519 stopped on track A of line 25 at 158 metres from the train E3340.
There were no injuries or material damage, but several trains were delayed or cancelled due to the overrunning of the signal.

INVESTIGATIONS

This incident does not fit the definition of serious accident or the definition of accident. The management of the evacuation of passengers after the incident attracted our attention initially. The study of voice recordings showed the various failures in communication.
Our subsequent investigation was led by statistical analysis. Following the decrease seen between 2011 and 2013, the number of signals passed at danger (SPAD) again showed an increasing trend for all types of tracks. This developed the scope of the investigation on the management of overrunning of signals.

Finally, in the course of the investigation into the accident in Wetteren, the IB had recommended the implementation of a management system for "Fatigue risks" within railway undertakings. During this investigation and following the increasing number of signals passed, we underline the impact of working hours on health and safety. Tiredness is a serious danger created by human factors and therefore has repercussions on safety.

MANAGEMENT OF PASSENGER EVACUATION

Initially, the divergence between messages transmitted to the conductors of the two trains involved aggravated the atmosphere among the passengers, who were receiving incorrect information and were stuck in the trains for several hours.
After continuing the study, we noted that the incident described as the passing of a signal at the start of communications then turned into a face-to-face situation between two trains followed by a nose-to-nose between two trains and then finally a collision between two trains; all of which had an impact on the personnel sent by the various services involved.
Neither the personnel of the investigation services of the railway undertaking nor the personnel of the investigation services of the infrastructure manager carried out the study of voice recordings.
The voice recordings have purposely not been re-transcribed in our report. The aim of this report is to allow railway actors to take the necessary measures in order to avoid the incident reoccurring.
Finally, in the course of our investigation, certain problems were noted in the management post-incident on the ground: we consider it important that the role and responsibilities of the intervention coordinator of the railway undertaking are known and complied with to the correct level.

https://mobilit.belgium.be/sites/default/files/OOOE/2014/summary_schaerbeek.pdf

MANAGEMENT FOR SIGNALS PASSED AT DANGER (SPAD)

Since 2009 and in a more accelerated way since the Buizingen catastrophe in 2010, one of the measures taken by the sector in order to reduce the number of SPAD involves installing ATP systems (Automatic Train Protection) on the tracks and on board rolling stock.

The SNCB/NMBS committed itself to equipping all its vehicles with TBL1+ by the end of 2013, the planning has been respected.
At the level of its rolling stock (works trains), Infrabel was supposed to modify its own rolling stock: by the end of 2015, 99% of stock was equipped with the TBL1+ system (100% of special units and 99% of locomotives). At an infrastructure level, Infrabel had decided to accelerate the timetable of TBL1+ implementation. In December 2015, Infrabel had installed TBL1+ in the tracks as the IM had planned.

However the TBL1+ system has its limits known by both companies and considered “acceptable” considering that the TBL1+ system is only the first step in the ETCS masterplan.

The known limits are as an example:

- The system does not remove the risk of reaching a dangerous point: the incident in Schaerbeek has highlighted one of the TBL1+ limits. The speed of the train at the TBL1+ beacon placed 300 metres before the signal at danger did not allow the train to be stopped before the signal, or before the points which constitute a dangerous zone.
- The TBL1+ systems on board the rolling stock and at the level of the infrastructure should be compatible: the train was braked by the TBL1+ system.
- Not all the signals were equipped with TBL1+. Infrabel had calculated an efficiency cover (99.9%) according to various criteria (number of passengers, reference speed, number of signals to be respected by a train crossing a nodal point, complexity of the installation).
- TBL1+ is not a requirement. What is more, for freight trains the distance of 300 metres separating the beacon from the signal is not adapted to freight trains.

While it has contributed to the improvement of railway safety, the driving assistance system TBL1+ can only be considered as a partial/transitory solution towards a more efficient management system.
ETCS is an answer to certain known limitations to TBL1+, and, due to its interoperability, should constitute a more adapted technical response for the RUs operating on the Belgian and European railway networks.

At a railway infrastructure level, Infrabel has decided to opt for components that are partially compatible with ETCS/TBL1+: the ETCS that Infrabel is implementing is based on the beacons deployed for the TBL1+, for which there is compatibility and compliance with ETCS specifications.
The calendar adopted by Infrabel for installation of ETCS refers to availability of ETCS on the whole of the network by 2022.

However, Infrabel's ETCS masterplan foresees installation of 2 levels of ETCS (levels 1 and 2) and 2 modes of operation (Full Supervision (FS) and Limited Supervision (LS)), according to the needs and specific characteristics of the network.

Convergence in a homogeneous version of level 2 ETCS is foreseen, according to this masterplan, for the years 2030-2035.
ETCS level 2 represents, at this stage of technological developments, the best solution for carrying out the functional and safety objectives determined, but the infrastructure and all rolling stock need to be equipped with it.

Until there is convergence in ETCS level 2, three systems will coexist on the Belgian network, requiring, amongst others, transition zones between the systems.
This transition is even more important when a train goes from a zone with cabin signalling (ETCS) to a zone with trackside signalling (LS, TBL1+, Memor).

The various analyses and/or studies carried out by the railway undertakings or by the infrastructure manager should be shared:

- malfunction of the beacons: the split of certain beacons at transition zones, with automatic emergency brake in case of malfunction;
- methodology used for informing the train driver that he must follow trackside signalling;
- the risk induced for train drivers in case of transition between systems during the same journey, …

FATIGUE RISK MANAGEMENT SYSTEM

We have largely documented the issue of fatigue in chapter 3.6 of our report.
The impact of fatigue on performance has been documented in numerous works in laboratory but also in real situations. The results show that subjects displaying periods of falling asleep are slower to react and make more errors, have reduced consciousness of a situation and have difficulty making decisions and prioritising pertinent information.
We have underlined problems linked to the awake-sleep rhythm, the influence of the circadian rhythm and concentration.

The railway undertakings and in particular the SNCB/NMBS are obliged to respect European Directives and Belgian laws on timetable management.
However these regulations are qualified as unidimensional to the extent that they do not only apply to a single dimension of time.
The “posted” and atypical timetable has the particularity of interfering with the chronological dimensions of human operation which creates major variations in cognitive functions and the capacity for recovery.
It is difficult to evaluate one’s own level of tiredness.

Apart from the effect of sleep-deprivation and the time of day on fatigue, the nature of the activity may also contribute to significantly reducing the level of wakefulness.
Fatigue has repercussions on safety producing more serious errors and reducing performance. It is therefore important to identify the potential dangers linked to fatigue.

A Fatigue Risk Management System (FRMS) is developed to implement new knowledge from the science on fatigue and safety. The procedures enable detection of dangers linked to fatigue and implementation and evaluation of attenuating organisational and personal strategies

Neither European directives nor the Belgian law require railway companies to put in place a fatigue risk management system.
In the domain of aviation, fatigue risk management systems are documented by the ICAO (International Civil Aviation Organization) for companies implementing the system as well as a manual for authorities.

The FRMS, a resource managed using data allowing continuous monitoring and management of the risks for safety linked to fatigue, based on principles and scientific knowledge as well as on operational experience, aims at ensuring that the personnel concerned carry out their jobs with a satisfactory level of concentration.

The implementation of a fatigue management system may bring an added value to the current system, initially by progressive use of “Fatigue risk Index” software. As an example to evaluate the level of fatigue of drivers involved in SPAD/accidents/incidents, atypical timetable, etc. not in the context of a repressive system but to make initial reports and to target priorities. The data collected will have to be analysed and must allow ,if necessary, taking the measures to reduce the risk linked to fatigue created by service rotations, service times, home-work journeys, etc.

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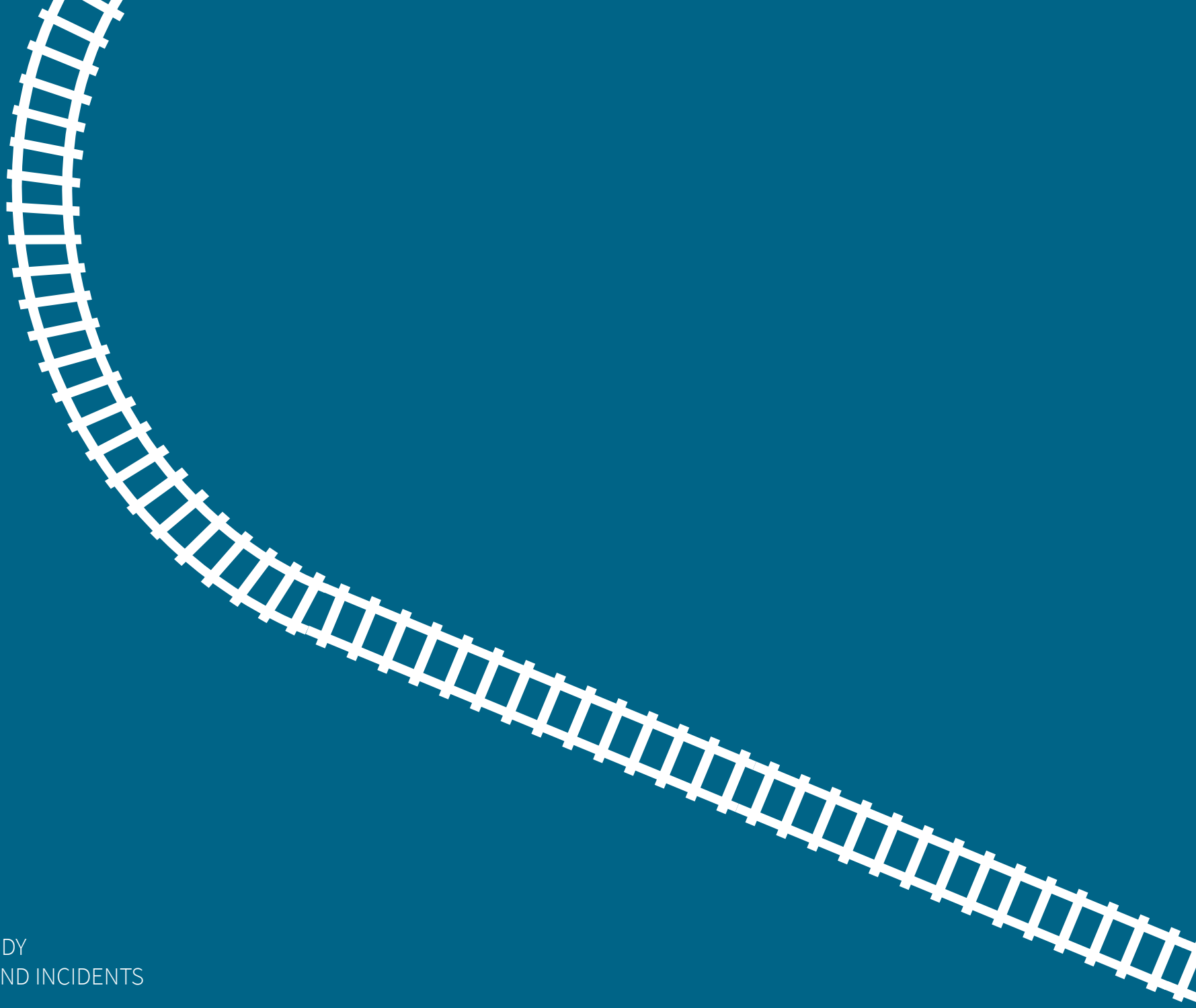
8 | RECOMMENDATIONS

THE RECOMMENDATIONS

The recommendations follow-up is carried out by the National Safety Authority, the DRSI. According to procedures defined by the DRSI, the actors concerned are responsible for providing an action plan 6 months after the publication of the IB investigation report.
On the date of publication, we had not yet received a summary of the measures taken, underway or planned.



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