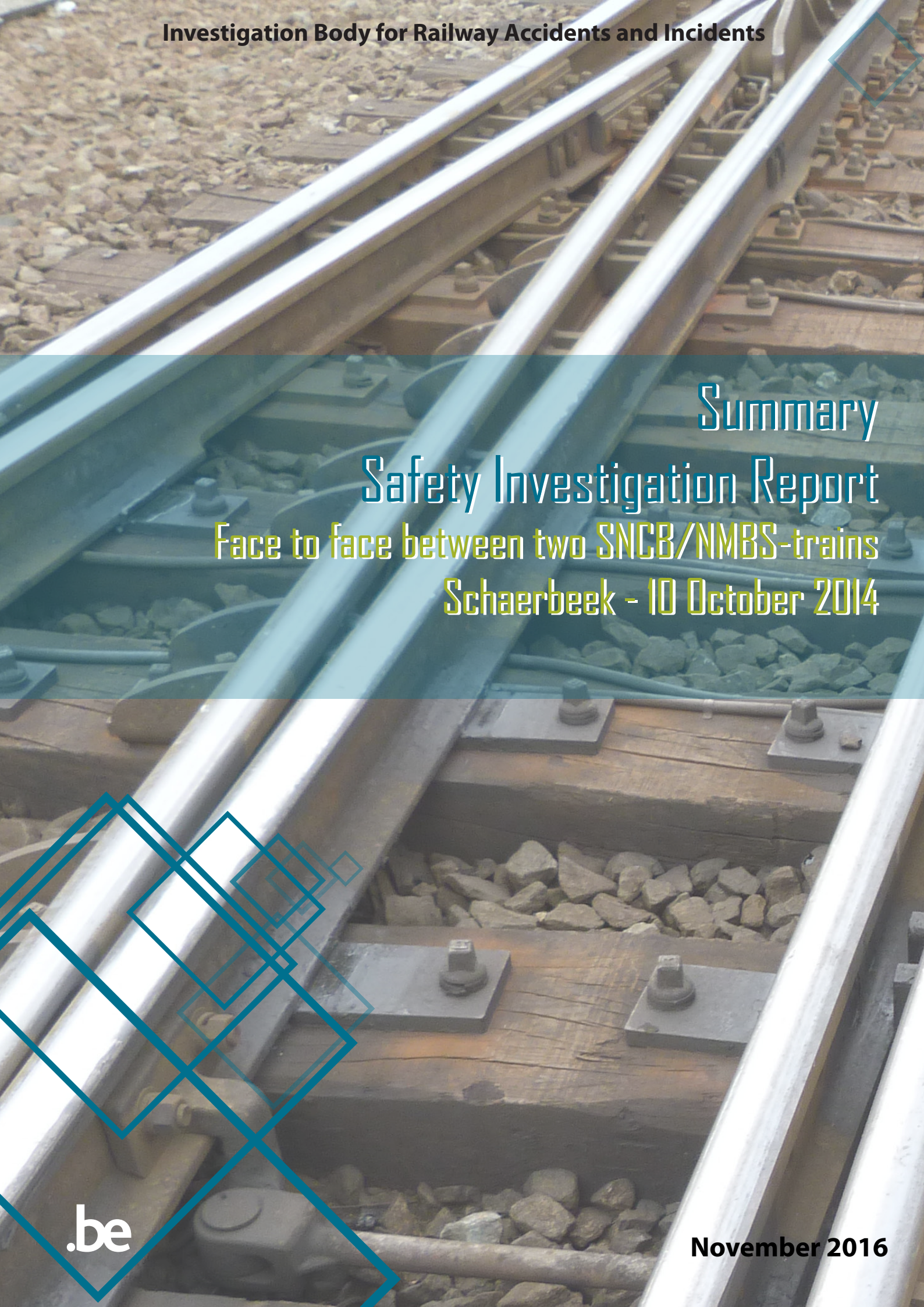
Investigation Body for Railway Accidents and Incidents



Summary
Safety Investigation Report
Face to face between two SNCB/NMBS-trains
Schaerbeek - 10 October 2014

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November 2016

SUMMARY

On Friday 10/10/2014, after a planned stop at Vilvoorde station, the passenger train E3340 (Essen - Bruxelles-Midi) continued its journey on track B of line 25 in the direction of Schaerbeek and Bruxelles-Nord.
Due to planned works in the North-South junction, line 25 was out of service between Schaerbeek and Bruxelles-Nord: the train E3340 was diverted to track B of line 27 via track A of line 25.

The train E4519 (Charleroi-Sud – Antwerpen-Centraal), coming from the opposite direction, was also diverted towards track B of line 27.
After Schaerbeek station, the train would be redirected towards track A of line 25.

To avoid conflict between these two trains operating at the same time on the same tracks, the train E3340 would be stopped by a signal at danger.

At around 20:40, the train E3340, travelling at a speed of 116 km/h, passed a warning signal showing double yellow. The signal was equipped with a TBL1+ beacon: the beacon emitted a telegram depending on the "double yellow" aspect of the signal and this information was recorded by the TBL1+ equipment on the train.
The driver acknowledged the restrictive aspect of this signal using the push button in his driving cab but continued traction and did not slow down the train.

At around 20:41, the train E3340 passed the IBG TBL1+ beacon linked with the signal T-M.8 and situated 300 metres before this signal. From the closed aspect of the signal, the role of the beacon was to emit a message captured by the TBL1+ equipment on the train, to check that its speed was lower or equal to 40 km/h (CVR mode). The speed of the train was then 118 km/h and the TBL1+ equipment automatically engaged the emergency brake.

Despite the automatic emergency brake, the train E3340 passed the signal at danger T-M.8 and points 33L.

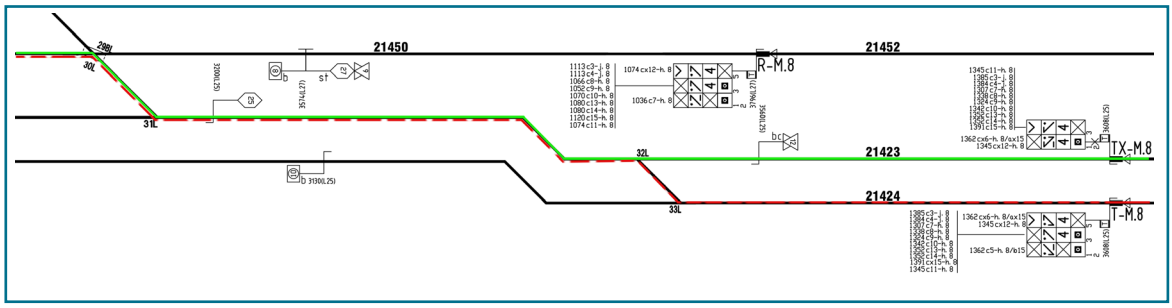
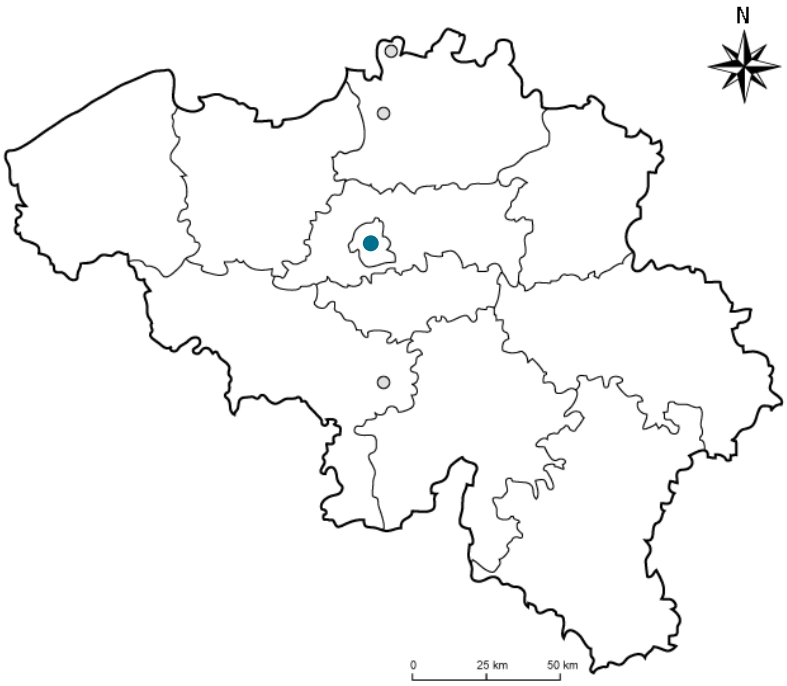


Illustration: schematic signalling plan showing the foreseen journeys for trains E3340 and E4519

Investigation



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. The summary only includes the "technical" TBL1+ and ETCS part.

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.

We recommend that a system is put in place to encourage the staff of the railway undertaking and infrastructure manager to report safe and unsafe behaviour within their company.

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[1].
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.

1 *With the exception of the TRAXX locomotives*

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[2].
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[3]).

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;
- …

We recommend that the safety authority ensures that:

- **the exchanges between the infrastructure manager and the railway undertakings enable a better coordination of the installation of ETCS;**
- **the exchanges are based on the safety analyses and/or risk studies and also on the measures proposed to reduce the risks that arise;**
- **in the absence of certain investigations, these investigations are carried out.**

2 *Infrabel uses the European standards respecting the requirements imposed by these.*
3 *In 2025, TBL1+ and Memor should no longer be present as only ETCS-equipped rolling stock should be in circulation*

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.

We recommend that the safety authority imposes a safety management system for railway undertakings to continuously manage safety risks linked to fatigue of train drivers and particularly through multi-dimensional timetable management.

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