Summary

Safety Investigation Report

Collision between a train and a road vehicle on a level crossing in Morlanwelz - 27 November 2017
Any use of this restricted report with a different aim than of accident prevention - for example in order to attribute liability - individual or collective blame in particular - would be a complete distortion of the aims of this report, the methods used to assemble it, the selection of facts collected, the nature of questions posed and the ideas organising it, to which the notion of liability is unknown. The conclusions which could be deduced from this would therefore be abusive in the literal sense of the term. In case of contradiction between certain words and terms, it is necessary to refer to the French version.
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SUMMARY

1 THE ACCIDENT

On the 27/11/2017, a driver drove his vehicle over the level crossing and, as he was doing so, the car stayed stuck on the level crossing. The driver was then unable to remove the vehicle and evacuate the area before the arrival of the train. He therefore left the vehicle, which was then hit by the train.

Given the very short time between the immobilisation of the vehicle and the arrival of the train, he was unable to warn the emergency services of the fact that a vehicle was stuck on the tracks to initiate the process of halting the train.

There is delay of approximately 35 seconds between the moment the bells of the level crossing start ringing and the arrival of the train.

When the train driver saw the car immobilised on the level crossing, he initiated an emergency brake procedure, but was unable to stop the train in time. The train was travelling at a speed of approximately 120 km/h; it hit the vehicle and dragged the car over several hundreds of meters before coming to a stop.

Why?

The main advantage of rail transport resides in the minimal amount of friction between the rails and the wheels (steel-steel contact). Little power is required to ensure the train's motion, but the consequence of this reduced friction is that braking distances are significant.

For example, at 120 km/h the minimum braking distance is of 441 metres for a passenger train to come to a complete halt (according to tests conducted with an AM96 railcar), and approximately double that distance for a freight train.

In 2016, a seminar entitled Lessons learned was held following the investigation into the accident of the Pittem level crossing\(^1\). The braking curves of a train compared with that of a car were shown.


Seminar Lessons Learned: [https://mobilit.belgium.be/fr/pittem_lessons_learned_presentation](https://mobilit.belgium.be/fr/pittem_lessons_learned_presentation)
**Consequences of the collision with the road vehicle**

As a consequence of the impact, a fire started in the road vehicle and spread to the railcar. The consequences of the collision with the vehicle on the passengers and staff on board the train were limited thanks to the design of the rolling stock and an efficient management of the situation by various services.

The accident did not claim any victims, but caused significant damage to the vehicle, the railcar and the infrastructure.

This accident is considered as a precursor. Indeed, after the collision with the vehicle, the rolling stock had to be “re-railed”, which caused another accident with dramatic consequences.

This accident is described in another investigation report.

**Crossing a level crossing**

Traffic regulations prohibit crossing a level crossing: when the barriers are moving or closed, when the flashing red lights are on, or when the warning bells are ringing. Furthermore, the driver cannot cross the level crossing when the traffic situation is such that it is likely to cause the immobilisation of the vehicle on the level crossing.

Crossing a level crossing requires the user to manage and process a significant amount of information. During this process, errors can occur. These information handling errors can lead to a mental representation of the level crossing situation that is very different from the real situation. If the situation is subject to an inadequate mental representation and/or personal factors (influence (drugs, alcohol), visibility, tiredness, etc.), the user of the level crossing can find him/herself in a complicated situation, leading him or her to abort the crossing or, in some cases, to stay immobilised on the level crossing as the barriers are closing due to an approaching train.

For the user, crossing a level crossing therefore includes several steps:

1. **the perception of information relating to the level crossing:** its visibility (road signs, traffic conditions, etc.) and its readability with respect to its environment. This perception can be flawed if the driver is distracted when he/she approaches a level crossing, which affects his/her ability to process information;

2. **the representation of the situation and decision making:** the user processes information relating to the crossing of the level crossing and establishes a mental representation of the situation. Based on this representation, the user will decide whether to proceed with the crossing or not. This decision is influenced by several factors; habits, (poor) knowledge of the regulations, behaviour, experience (or lack thereof), (poor) perception of the information.

3. **implementation of the decisions:** the user will finally implement the decision he/she made relating to crossing the level crossing.
LC1 of line 112 at Morlanwelz
The LC1 of Morlanwelz is an active level crossing, which means:

- the level crossing features adequate road signs providing users with the information they need relating to the level crossing: the road signs inform drivers of the presence of the level crossing ahead through signposts, and of its state through traffic lights;
- the level crossing features an automatic warning system to inform a driver when a train is approaching the level crossing: the automatic warning system notifying of an oncoming train at the level crossing warns users of the level crossing at the opportune moment;

The LC1 of Morlanwelz is equipped with light signals placed on the right and left side of the road, and on either side of the level crossing; it also features bells and semi-barriers. On the 27/11, the level crossing was operating correctly, i.e. the red lights went on, the bells were ringing and the barriers came down.

Furthermore, the LC1 is visible regardless of the direction of approach. This level crossing is not prone to accidents; the database reveals 1 accident (slalom) and 3 acts of vandalism (broken barriers, etc.).
2 WHY DID THE DRIVER STOP IN THE MIDDLE OF THE LEVEL CROSSING?

In conducting its analysis, the Investigation Body came to the site of the accident to understand the reasons of the immobilisation of the vehicle (in circumstances similar to those of the day of the accident). This allowed them to understand the influence of the road infrastructure and of traffic conditions on the accident. The Investigation Body determined that the configuration of the area surrounding the level crossing can lead, in certain conditions, to traffic jams and the immobilisation of vehicles as they are driving over the level crossing.

Source: Geoportail Wallonie.

In this situation, a vehicle (orange) tries to turn left onto the street in advance of the level crossing. Given that the vehicle does not have priority and there is a lot of oncoming traffic, the car is forced to stop. Vehicles that follow the orange vehicle onto the level crossing are also forced to stop and are unable to clear the area. There is therefore a traffic jam effect that extends all the way to the level crossing.
3 IS THIS A UNIQUE CASE? NO

The railway network features a significant amount of level crossings: as of the 1st of January, 2018, there were 1737 level crossings (excluding tourist lines and disused lines). Every year, numerous accidents occur at level crossings, claiming a significant amount of victims (injuries and fatalities). In 2017, the number of accidents that occurred on public level crossings on passenger and/or freight lines (excluding port areas and private level crossings) was of 31, causing 9 deaths, 3 severe injuries and 6 light injuries.

Studies conducted by the infrastructure manager reveal that the main causes of accidents at level crossing (excluding port areas) are negligence (slalom, etc.) in 48% of the cases, and lack of caution (driver blocked on a level crossing) in 36% of the cases (see point 3.6.).

Our analysis delved deeper and revealed that in various cases, the configuration of the area surrounding the level crossing can create a traffic jam effect, i.e. the traffic conditions are such that a jam is created in advance of the level crossing and extends to the level crossing, causing the vehicles to stop. We have observed several similar situations in various sites across the country. These level crossings were not selected randomly, but on the basis of their similarities with the configuration of the level crossing of Morlanwelz, or because they result in a high number of accidents, collisions with the barriers or fatalities. In each case, it was not the functioning of the level crossing that was questioned, but the behaviour of the drivers, namely their lack of vigilance.

Example: Gent LC14 L58 – Loss of priority after the level crossing (traffic lights - crossroads)
Level crossing 14 of line 58 is located on a roadway subject to intense vehicular traffic. The level crossing intersects with several lines and is relatively long (approximately 50 meters). In advance of the level crossing, there is a crossroads with traffic lights (loss of priority). The distance between the beginning and the end of the crossing is significant and causes difficulties in visualising the space available in advance of the level crossing. Furthermore, the level crossing is used by numerous lorries.
The driver drives onto the level crossing without realising that he might be immobilised on the level crossing and is at risk of being hit by a train.
4 WHAT MANAGEMENT MEASURES CAN BE TAKEN TO PREVENT THESE ACCIDENTS?

• **Road users know and apply the rules governing the use of level crossings**

  Road users know the rules preventing them from driving onto a level crossing when the road signs indicate that crossing is prohibited, or when the traffic conditions make such a crossing unsafe. They take these prohibitions into account in the thought process leading up to the decision to cross the level crossing or not to.

  Similarly, road users take into account outside conditions: the area surrounding the level crossing, the traffic conditions, the state of the road, the weather conditions, etc.

  Safety is everyone’s concern, and level crossing users contribute to this safety by remaining aware of the rules and not taking inconsiderate risks that can endanger their lives and that of others.

  Lack of caution and negligence on the part of the users are the two main causes of accidents at level crossings in Belgium, and awareness-raising campaigns are conducted by the infrastructure manager to remind users of the risks inherent to crossing.

• **State of the road infrastructure and raising awareness as to the risks of traffic jams around level crossings**

  In specific traffic situations or conditions, traffic jams extending all the way to a level crossing can occur and represent a potential source of immobilisation of vehicles driving onto a level crossing.

  In Belgium, several multidisciplinary LC task forces have been created at the request of the infrastructure manager, involving numerous stakeholders. Their purpose is to study the various planning possibilities relating to level crossings to draw the attention of road users to the risks.
In conducting our analyses, we were able to determine that the traffic jam phenomenon exists also in other countries (Holland, France...) and that various projects are being examined and tested. In France, for instance, several studies have been conducted relating to the proximity between level crossings and specific road configurations (roundabouts, crossroads, etc.) by the CEREMA\textsuperscript{2}. Several systems to enhance the road signage are, in particular, described, their purpose being to warn of the risk of the creation of traffic jams on certain level crossings. These are static signalling (signposts and markings) or dynamic signalling (signposts or traffic lights with systems to detect the creation of traffic jams). These systems therefore relate to road signs. There are also road clearance systems (additional lane to clear the level crossing in the event of a traffic jam) that are also under study.

5 CONCLUSION

Despite the safety measures implemented, numerous accidents (collisions of road vehicles, collisions with persons, etc.) and incidents (broken barriers, etc.) occur every year around level crossings, causing train delays and human fatalities. Each year, it has been noted that an increasing number of users illegally cross closed level crossings (to gain a few minutes, to catch a train). Not only are they endangering their own lives, but also the lives of others.

The braking distance of a moving train can be of several hundred meters. Therefore, when a train driver sees a vehicle immobilised on a level crossing, it is often too late to avoid a collision. Crossing a level crossing is therefore an act that requires special attention on the part of road users. It involves good knowledge and the application of the traffic regulations as well as increased prudence and vigilance, allowing to better analyse the situation and to cross in the best possible safety conditions. With regard to traffic jams, it is important to analyse the road infrastructure around the level crossings.

The infrastructure manager has an action plan to draw the attention of road users to the risks and to remove level crossings. Numerous studies are being conducted to provide solutions and to improve safety, and these require the participation of everyone, of the authorities, the regions, the municipalities, etc. It also involves the citizens: in the case of the removal of a level crossing, habits need to be changed.

The foreseen increase of railway traffic will involve a higher frequency of trains and therefore a greater number of barrier closings at level crossings, and therefore of traffic interruptions. The risks of traffic jams will therefore also increase. Let us be proactive, accept the change and prepare a safer future.

\textsuperscript{2} CEREMA: centre of studies and expertise on risks, the environment, mobility and planning (formerly SETRA: service of studies relating to transport, roads and road planning)

SETRA Information note: Improved safety at level crossings - adapting the roads and the signposting;

CEREMA Information note: Safety at level crossings on communal and inter-communal roadways.
Investigation Body for Railway Accidents and Incidents
http://www.mobilit.belgium.be