

TRAIN COLLISION MAASVLAKTE (13 APRIL 2012)

In the Netherlands, efforts are undertaken to limit the risk of accidents and incidents as much as possible. However, when incidents or near incidents do occur, repetition can be avoided by carrying out a proper investigation into the cause, without seeking to apportion blame¹. It is essential that the investigation takes place independently of the parties involved. The Dutch Safety Board itself decides when to conduct an investigation, and during these investigations takes into account citizens' dependence on authorities and businesses. In a number of cases, the Safety Board is legally obliged to carry out an investigation.²

SUMMARY

Relevant facts

On 13 April 2012, two goods trains collided head on in the Rotterdam port area. Both trains were loaded with containers, some of which contained hazardous substances. One (of the three) train drivers sustained mild injuries as a result of the collision, which also caused severe damage to both locomotives and derailed some of the wagons and one of the locomotives. Some of the wagons and the containers they were carrying were also damaged, as was part of the railway infrastructure. No hazardous substances were released.

Causes

The two trains were heading towards each other on the same railway track because the train traffic controller had given both train drivers permission to drive to the relevant route section (from opposite directions). The train traffic controller, who could not see the relevant route section on his monitors, issued permission by phone; by the time he issued the second route section permission, he had forgotten issuing the first some fifteen minutes earlier. The train traffic controller was not equipped with any tools to help him keep track of all previously issued route section permissions. It is also important to point out that the relevant route section is not monitored by means of any technical systems, and clearance is issued for one train journey at a time. Furthermore, the train drivers did not have a clear view of the other oncoming train until the very last minute (the railway track on this route section is curved and runs under a viaduct).

Safety issues

As a result of these combined factors, there was an increased risk of collision on the relevant railway tracks. Nevertheless, the two connecting tracks were ordinarily used in both directions, and the train traffic controller was not required to use any instruments to monitor previously issued route section permissions. No explicit analysis had been conducted with regard to the increased risk of collision. ProRail is currently conducting such an analysis in response to the accident, and potential control measures are being assessed. In addition to the relevant railway tracks, ProRail will also be analysing all other comparable locations as a part of this effort.

¹ The Safety Board's investigations explicitly do not seek to apportion blame or liability. Statements made in the context of a Safety Board investigation, information gathered by the Safety Board, results of technical examinations and analyses, and documents produced (including the published report) cannot be used as evidence in criminal, disciplinary or civil proceedings.

² As regards rail accidents, the statutory investigation duty extends to collisions/derailments on the main railway network during which at least one person is killed or five or more people are seriously injured, or incidents after which it is immediately clear that the direct damage to rolling stock and railway infrastructure will exceed two million euro's.

INTRODUCTION

Reason for the investigation

The accident took place on the main railway network, and the direct damage to the rolling stock and railway infrastructure exceeded two million euro's. The accident is thus formally subject to the statutory investigation duty for serious rail accidents by virtue of the Dutch Safety Board Act. This type of accident also involves the danger of serious injuries on the train drivers' side and the release of hazardous substances.

Limited investigation and abridged report

The Board launched an investigation immediately after the accident. In line with standard procedure, this initially consisted of an exploratory investigation to determine the relevant facts/causes of the accident and identify the measures taken by the parties involved. The accident was also the subject of a parallel investigation by the Environmental and Transport Inspectorate (ILT). The Dutch Safety Board incorporated the outcomes of the ILT investigation in its exploratory investigation. Based on the outcome of its exploratory investigation, the Board concluded that the insights yielded by a more detailed investigation would not differ significantly from those described in the ILT report (RV12-0337). The Board thus decided against launching a further investigation and – partly in view of the measures that have been and will be taken by the companies involved – formulating any recommendations. For the same reasons, this report is limited to a summary.

ACCIDENT

Relevant facts

At around 10:30 am on 13 April 2012, two goods trains collided head on in the Rotterdam port area. The two goods trains were both made up of a diesel locomotive and multiple container wagons (loaded with containers, of which some contained hazardous substances).

Consequences

Two of the three train drivers sustained mild injuries as a result of the collision. Both locomotives and some of the wagons/containers also sustained damage, some of which was serious. One of the locomotives and twelve (of the 48) wagons were derailed. The railway infrastructure was also damaged over a stretch of some six hundred metres. According to a global estimate, the direct damage to the rolling stock and railway infrastructure totalled between five and ten million euro's. No hazardous substances were released.



Figure 1: These two photos show some of the derailed wagons.

COLLECTED INFORMATION

Situation and circumstances

The collision took place on the route section between the Maasvlakte West railway yard and ECT Delta terminal. This route section consists of two tracks (891 and 892), the collision took place on track 891. At the site of the location of the accident, these tracks bend and pass under a viaduct (N15). As a result, local visibility was limited to less than one hundred metres. The maximum line speed is 30 km/hour. At the time of the accident, there was still daylight and it was not raining;

there was no mist or any other weather conditions that would have been detrimental to the visibility.



Figure 2: This photo shows the course of the railway tracks and the final positions of both trains.



Figure 3: These photos show the visibility limitations near the bend and viaduct (from both directions).

Railway operators and rolling stock

- The relevant railway tracks are part of the main railway network and are located on the Betuweroute. Their management is thus covered by the management concession issued to ProRail by the Dutch government, within which Keyrail is responsible for maintenance, capacity management and traffic control. ProRail owns a 50% share in Keyrail, and has seconded staff to Keyrail in order to man the Kijfhoek train traffic control centre (from where all traffic over these tracks is controlled).
- The first train (41761), en route from the ECT Delta terminal to the Maasvlakte-West railway yard, was being pulled by a Rotterdam RailFeeding BV (RRF) locomotive. This train consisted of one locomotive and 25 loaded container wagons. The locomotive was manned by a student train driver and a train driver instructor. RRF served as official transport operator for the train.
- The other train (50998), en route from the Maasvlakte West railway yard to the ECT Delta terminal, was being pulled by a Häfen und Güterverkehr Köln GmbH (HGK) locomotive. This train consisted of one locomotive and 23 loaded container wagons. The locomotive was manned by one train driver only. HGK served as official transport operator for the train.

Traffic control and safety measures

The following information is available with regard to traffic control and safety measures for the relevant route section:

- The connecting tracks (891 and 892) between the Maasvlakte West railway yard and the ECT Delta terminal are not equipped with active train protection systems (in the form of automatic train detection systems³ in combination with signals or cabin signals); the tracks are located in what is referred to as a Non-Centrally-Controlled-Zone (NCBG). The train traffic controller issued route section permissions to the train drivers via mobile telephony (GSM-R). The train drivers were required to drive 'with caution'.⁴ The tracks were also subject to a 'One-Train-Per-Route-Section' (ETO) regime.⁵
- The train traffic controller had two instruments at his disposal in order to monitor previously issued route section permissions: written notes (by hand), and the Rail Management System (RMS) on one of his monitors (previous permissions could be marked by activating a yellow highlight over the relevant track number). The train traffic controller was not using either of these instruments, which were not mandatory.
- The train traffic controller had more than ten years of experience. At the time of the accident, he had already been working for about four hours. According to the subsequent interview, the

³ Automatic train detection systems automatically track a train's position on the railway track.

⁴ The term 'driving with caution' implies that the train driver must maintain a speed at which he can still stop the train within the distance he can actually oversee (and over which the tracks are free).

⁵ Under the ETO regime, a maximum of one train may be located in each route section at any one time. This implies that the train traffic controller may not issue route section permission to a train driver until 'the previous train' has left the relevant route section.

controller was⁶ 'busy, but not extremely busy' during this time period; he felt fit and – as far as the investigation was able to establish – had not been faced with any irregularities.

Route section permissions and routes

As regards route section permissions and routes, the investigation established the following:

- At around 10:21 am, the train traffic controller responded to a request by the learner train driver on the RRF train (then located on track C of the ECT Delta terminal) and issued permission (by GSM-R) to drive to the Maasvlakte West railway yard via track 891. The RRF train departed from the ECT Delta terminal at around 10:36 am and entered track 891.
- At around 10:34 am, the train traffic controller responded to a request by the train driver on the HGK train (then located on track 808 of the Maasvlakte West railway yard) and issued permission (by GSM-R) to drive to the ECT Delta terminal via track 891. At around 10:37 am, the signal (1246) at the start of track 808 turned yellow, after which the HGK train drove to track 891. The HGK train subsequently passed one other signal (1314); this signal was located at the start of track 891 and was blinking yellow.⁷
- The two trains collided head on at track 891 at around 10:40 am.

Approach speed

According to registrations by the two locomotives' Train Event Recorder systems (ARR), the RRF train approached the accident site at a speed of approximately 15 km/hour, while the HGK train had an approach speed of between 20 to 25 km/hour.

Implemented measures

The following measures have been or will be implemented in response to the accident:

- a) ProRail has determined that route section permissions for these connecting tracks (891 and 892) must be limited to trains driving on the 'right side', with the exception of specific cases⁸. ProRail has also determined that the train traffic controller responsible for the Maasvlakte (which is charged with controlling the connecting tracks) must monitor all route section permissions for the Non-Centrally-Controlled-Zone in the Rail Management System. This means the train traffic controller must mark all previously issued route section permissions on one of his monitors by activating a yellow highlight over the relevant track number; the train traffic controller may not remove this highlight until he has received a report that the train has left the track. These two procedural measures were implemented briefly after the accident.
- b) ProRail is also preparing a risk inventory and evaluation (RI&E) to determine the risk of collision on these connecting tracks. In follow-up to these measures, ProRail is also considering further (technical) measures to control the risk of collision more effectively. This includes the option of incorporating these tracks in the 'safety control system'. ProRail has indicated that this analysis and further decision-making on the potential measures will be completed in the first quarter of 2013.
- c) ProRail is currently assessing to which extent comparable situations (connecting tracks in Non-Centrally-Controlled-Zones) exist in other parts of the main railway network. The actions listed under points a and b will also be implemented at these locations⁹. ProRail has stated that it will complete its stock taking efforts and implementation of the actions listed under point a (driving on the right side only and mandatory use of a RMS for the monitoring of route section permissions) in the first quarter of 2013; the actions listed under point b (RI&E and decision-making on measures to be performed) will be completed in the second quarter of 2013.

⁶ As a part of the review procedure, ProRail informed us that the train traffic controller was subject to a high workload during the relevant period despite his statements to the contrary, and stated that a workload investigation had been launched.

⁷ A blinking yellow signal means: drive with caution, take into account that the track may be in use.

⁸ These exceptions concern calamities/obstructions lasting longer than 4 hours and exceptional situations in which the Traffic Control team leader issues explicit permission to the train traffic controller to allow trains to drive on the left.

⁹ ProRail has indicated that its efforts to take stock of/assess the relevant risks will include an assessment of the transportation of hazardous substances, the number of tracks and the presence of tight curves and structures (such as viaducts).

ANALYSIS

Immediate causes

The two trains were heading towards each other on the same railway track because the train traffic controller had given both train drivers permission to drive to the relevant section of track. First, he issued permission by phone to the student train driver in the RRF train; when the train driver in the HGK train requested a route by phone thirteen minutes later, the train traffic controller cleared a route to the same track by means of the relevant signals/railroad switches. He had forgotten that he had already issued the RRF permission to use the same track.

Underlying factors

The train traffic controller was able to issue this 'double' route section permission because the relevant track had not been fitted with an active train protection system (which automatically prevents any double route section permissions).

The train traffic controller had extensive experience, felt fit and was - according to his own statement - not over or underworked at the time of the accident¹⁰. His monitors did not offer a view of the relevant route section. He was not using any (manual or automated) tools to monitor previously issued route section permissions. Although such tools were available, their use was not mandatory.

The following additional factors also played a role in causing the accident:

- The train drivers could not see the other approaching train until the very last minute because the track at the site of the accident is sharply curved and passes under a viaduct.
- Despite the lack of an active train protection system and limited visibility at the viaduct, the two connecting tracks were ordinarily used in both directions. The use of two-way traffic (instead of 'driving on the right side only') was attributable to the fact that part of the ECT Delta terminal is more easily accessible if trains use the 'left' connecting track.

Risk analysis and management

The relevant tracks were also subject to a combination of the following risk factors:

- The tracks were located in a Non-Centrally-Controlled-Zone, which implies the absence of block protection and automatic train detection systems.
- Unlike the common procedure for Centrally-Controlled-Zones (*Centraal Bediend Gebied*), the train traffic controller issued route section permissions to train drivers by phone rather than by using the signals. The ECT Delta terminal railroad switch that offers access to the left/right connecting track was controlled by the train drivers rather than being remotely controlled by the train traffic controller. A further two railroad switches along the connecting tracks (115 and 117) are also controlled by the train driver rather than the train traffic controller. All three aspects represent an additional potential source of errors.
- As a result of the sharp curve at the viaduct, the train drivers had highly limited visibility at the site of the accident.
- The two connecting tracks were ordinarily used in both directions.
- The train traffic controller was not officially required to use any tools in order to monitor previously issued route section permissions.

According to the ILT report on the accident, both ProRail and Keyrail (responsible for railway security and train traffic control) and the involved transport operators (RRF and HGK) had not conducted an RI&E to assess the aforementioned risks.

¹⁰ A workload investigation is currently still ongoing, also see footnote 6.

CONCLUSIONS

The two trains were heading towards each other on the same track due to the fact that the train traffic controller had issued a 'double route section permission'. This error could occur due to the lack of a technical safety system on the track (which automatically prevents double route section permissions).

The tracks were under increased risk of collision, attributable to a combination of factors including: the lack of a technical safety system, the fact that train drivers were issued instructions by phone and a limited visibility distance. Despite all these factors, both tracks were ordinarily used in both directions, and the train traffic controller was not required to use any tools to monitor previously issued route section permissions.

No explicit RI&E had been conducted to analyse these combined risk factors. ProRail is currently conducting such an RI&E in response to the accident. This will include an analysis of potential control measures, including the option of incorporating the relevant tracks in the Centrally-Controlled-Zone. ProRail will consider whether to implement this measure at both the location in question and all other comparable sites.

EXPLANATION OF THE INVESTIGATION

Dutch Safety Board investigation

The Dutch Safety Board is charged with establishing the causes of accidents and near accidents, with a view to reducing the risk of similar events recurring or at least limiting the ensuing consequences. The Dutch Safety Board expressly does not seek to apportion blame as is the case in criminal investigations.

Review procedure

In accordance with the Dutch Safety Board Act, a draft version of this report was submitted to the companies and individuals involved, along with the request to check the report for factual inaccuracies.

The report was submitted to:

- ProRail BV → formally responsible for managing the railway infrastructure and manning the traffic control centre;
- Keyrail BV → responsible for maintaining the railway infrastructure, capacity management and traffic control;
- Rotterdam Rail Feeding BV → transport operator responsible for RRF train;
- Häfen und Güterverkehr Köln GmbH → transport operator responsible for HGK train;
- the (three) train drivers involved and the train traffic controller.

With the exception of the two train drivers in the RRF train, all these businesses and individuals submitted a response. With one exception, all the resulting comments - insofar as they related to factual events - led to subsequent adjustment of the report. The response that did *not* result in adjustment of the report text was issued by Rotterdam Rail Feeding BV (RRF). This response concerned the final paragraph of the Analysis section (lower section of page 6) and basically states that the RI&E conducted by RRF did contain two items on the potential risks of arriving at and departing from the terminals in relation to transfers between traffic control and the train traffic controller. However, this comment does not address the fact that the specific safety risks occurring on connecting tracks (as described in this report) are not explicitly mentioned in RRF's RI&E. Accordingly, no adjustments were made to the relevant text.