Federal Authority for
Railway Accident Investigation

Translation of an excerpt of the investigation report

“Train derailment, 30/08/2020, Niederlahnstein”

status as of 29/08/2022, version 1.0.

Note:

In accordance with Article 3 of Implementing Regulation (EU) 2020/572, points 1, 5 and 6 of Annex I of an investigation report shall be written in a second official European language. This translation should be available no later than three months after the delivery of the report.

The following English translation is a corresponding excerpt of the investigation report. The German language version is authoritative.

Excerpt translation:

1 Summary

The first section contains a brief description of the event, as well as information on the consequences, primary causes and safety recommendations provided in the individual case.

1.1 Brief description of the event

On 30/08/2020 at around 6:35 pm, the tank wagon train DGS 49077, which was loaded with diesel, derailed on the journey from Rotterdam to Basel at Niederlahnstein station in the single crossover W 35 – W 18.

1.2 Consequences

One person suffered minor injuries. The traction unit (TU) and eight oil tank wagons derailed. Six of the derailed tank wagons overturned. Several tank wagons were damaged. On two of the tank wagons, the tank wall was perforated due to the impact of the buffers, meaning that large amounts of diesel escaped and contaminated the soil. In addition, there was large-scale destruction of the infrastructure.

1.3 Causes

The derailment of the DSG 49077 was attributed to overriding of the buffers between the TU and the first tank wagon. The overriding of the buffers was caused by track geometry in the area of the derailment that is not permitted according to DB [Deutsche Bahn, the German national railway company] regulations, in combination with exceeding of the signalled speed. The situation was further facilitated due to longitudinal compressive forces caused by braking in the trainset, as well as the superstructure condition of the single crossover, which had been unfavourably altered due to operating influences.

1.4 Safety recommendations

The following safety recommendations are issued in accordance with section 6 of the Eisenbahn-Unfalluntersuchungsverordnung (EUV, German railway accident investigation regulation) and Article 26(2) of Directive (EU) 2016/798. It is recommended that

- speed guidelines should be strictly adhered to and there should be greater focus on the correct operation of safety devices by the driver during corporate and official monitoring.
- in order to manage risks in relation to maintenance according to the requirements of Delegated Regulation (EU) 2018/762 Annex II point 5.2.4, the procedure for inspecting the superstructure in “other main tracks” should be examined and improved if necessary.
- consideration should be given to introducing a standardised and individually assigned driver number in order to improve/allow for the monitoring of staff by the railway undertakings and supervisory authorities.
- consideration should be given to equipping oil tank wagons with additional safety features in order to limit consequential losses.

5 Conclusions

The following section contains a summary of the identified causal, contributory and systemic factors. In addition, two further subsections are provided containing information about measures already taken, and additional comments.

5.1 Summary and conclusion

The event was attributed to overriding of buffers between the TU and the first tank wagon of the DSG 49077 while travelling on a track and single crossover connection at Niederlahnstein station. The overriding of the buffers was caused by track geometry in the area of the derailment that is not permitted according to DB regulations, in combination with exceeding of the signalled speed of 40 km/h by up to 22 km/h.

With the aid of simulation it has been determined that travelling over the single crossover points 35 – points 18 at 62 km/h with the track in the ideal intended condition would have resulted in slight lifting of the respective rear inner-curve wheels of the bogie of the simulated tank wagon. However, as the track actually displayed flaws in the form of track geometry defects and a reduced radius, it can be assumed that the respective wheel lifted up even further. Due to the particular line routing and the additional direction deviation (cant error) at the transition from the straight track to the curve with r=150 m, maximum opposing displacement of the buffers occurred between the TU and the first wagon as a result of the dynamic vehicle reactions. Facilitated by the simultaneous impact of longitudinal tractive forces as a result of the braking initiated by the driver, the identified sliding of the buffer of the first tank wagon to the left occurred on the heavily strained buffers on the inside of the curve due to the temporarily disrupted route. In combination with the lifting of the wheels, the resulting overriding of the buffers caused the derailment according to the identified derailment marks to the left of the inside of the curve.

As a result of the incorrectly entered train data in the PZB (intermittent cab signalling system) vehicle equipment, the PZB monitoring system was not able to use an automatic train stop to correct the excess speed in Niederlahnstein after the 1000 Hz impact at entry signal G1 before intermediate signal S105. There was also a detrimental effect due to the fact that the safety buffers that would otherwise be present in the railway system were considerably reduced as a result of the track geometry, which did not comply with DB regulations, and other unfavourable changes in the track condition due to regular operational strains. The altered condition of the equipment was neither noticed nor corrected in good time by the infrastructure operator due to inadequate inspection procedures and maintenance guidelines that had not been adjusted.

5.1.1 Railway infrastructure company

The original alteration plans from 1996 for points 18 provided for a subsequent track curve with r=190 m. Contrary to this planning guideline, at an unknown time a track curve with r=150 m was installed. According to the regulations from DB Netz AG, the installation of a track curve with a radius of r=150 m in train routes with a speed of 40 km/h was not permitted. Nonetheless if their use is unavoidable for topographical reasons, an internal approval procedure would be needed to verify that there was at least the same level of safety. A corresponding procedure was not conducted by DB Netz AG either at the time or at a later date. In addition there was no topographical necessity, as shown by the original plans. The inclusion of the encountered routing in a train route with v=40 km/h therefore did not comply with DB regulations. Planning specifications were also not implemented in relation to the permitted speeds for this single crossover during the alteration process to replace points 35 in the years 2008 to 2010.

The theoretical application of the extraordinary limit value according to the currently valid DIN EN 13803 carried out after the accident event showed that 40 km/h was admissible from a mathematical perspective. This application during the routing, however, means that the limits of what is technically feasible have been reached. The available safety buffers, which must ensure firstly that there is sufficient safety and secondly that there is a sufficient wear margin, shrink accordingly. It is therefore essential, and also required by DIN EN 13803, that any risks resulting from the application are defined and limited using suitable protective measures. This requirement also results from Annex II, point 5.2.4 of Regulation (EU) 2018/762, according to which in order to control the relevant risks it is necessary to determine the need for maintenance of infrastructure, including on the basis of its design characteristics, in order to keep it in a safe operational state.

The general inspection procedure to be used for the single crossover between points 35 and 18 according to guideline Ril 821 was based exclusively on a visual status assessment (inspection type I 70) and was not adjusted to the special features of the routing of this single crossover. The deviations in the track geometry resulting from operational strain could not be systematically and reliably detected by the purely visual inspection procedure stipulated in the regulations. In addition, formally according to the regulations there was no inadmissible exceeding of maintenance parameters in the single crossover. Although extraordinary limit values were used during the routing, the maintenance strategy was not adjusted accordingly.

This ultimately made it possible for the permitted minimum radius to not be met due to successive operational demands. Against the background of improved and developed digital measurement methods, it is necessary to check whether other main tracks should be included in inspection procedures that go beyond visual assessment in order to meet the requirements for ensuring safe railway operations in future.

The simulation results firstly show that, in the event of track routing in line with the regulations with radius r=190 m, even at unauthorised excess speed (62 km/h) there should have been sufficient safety buffers to mean that in all probability the derailment would not have occurred. Secondly, they indicate that if the train had complied with the signalled speed (40 km/h), even with routing with r=150 m, in all probability the train would also not have derailed.

5.1.2 Signaller

Even if it is no longer possible to comprehend why the signaller deviated from the guidelines of the timetable for train announcing points for the journey of train DGS 49077, which was involved in the accident, he did choose an operationally permitted route. From the perspective of the signaller, there were no operational restrictions for the selected route.

The training supervisor on train 48931 reported circumstances that he believed were conspicuous in relation to the track situation to the signaller when travelling over the single crossover three days before on 27/08/2020. It was not possible for the training supervisor to further assess the situation from the moving train. This reported irregularity on the route did not cause the signaller responsible at the time to initiate further measures. The qualifications of a signaller do not include the expertise needed to assess defects in the track. The regulation of Ril 408.0641 section 2 therefore provides a clear instruction for signallers in these circumstances, stating that a specialist must inspect the place in the track and declare that it is fit for use before further train journeys can take place. No report was made to any such specialist.

DB Netz AG justified the signaller’s conduct by saying that the signaller on duty did not see any need for further measures because the training supervisor did not report any explicit defect in the superstructure. This justification does not comply with its own regulations, because according to the account from the training supervisor on train 48931 if the report had been handled correctly it should have been considered that there might be a defect in the superstructure.

5.1.3 Railway undertaking

Before issuing the additional certification for the driver, i.e. the licence to drive TUs for the own railway undertaking, the railway undertaking only carried out a paper examination of the driver’s documents. As a result, contrary to section 54(2) EBO [Railway Construction and Operating Regulations], the railway undertaking could not get a suitable picture of its own about the driver’s qualification and suitability. In addition, the monitoring of the driver’s performance to be conducted by the railway undertaking was outsourced to a service provider without installing processes in its own safety management system that were suitable to define the service provider’s tasks more precisely and monitor the results provided. The railway undertaking had not carried out its own monitoring of the driver before the accident event. Corresponding processes were also only included in the safety management system to an inadequate extent. Contrary to criterion 4.6 of Regulation (EU) 2018/762 Annex I, the railway undertaking was unable to prove that it pursued a systematic approach to managing risks when using external employees within its safety management system. The railway undertaking largely relied on the work of the contractually commissioned personnel service provider without carrying out any inspections, and therefore did not fully meet its obligation for systematic, safe operational management according to section 4(3) AEG [General Railway Act].

Whether or not the railway undertaking responsible had information on the driver's previous problems remains unclear.

5.1.4 Driver

The operational regulations on the permitted maximum speeds and the data that needed to be entered in the PZB vehicle device were clear and were not implemented correctly by the driver.

Complying with the prescribed speeds is of particular relevance in rail operations due to the high masses that are moving, the long system-related braking distances and the resulting potential hazards. In addition, not all speed variants can be technically influenced and monitored without the driver's involvement. As a result, the driver has a particular responsibility to observe and comply with speed specifications. Accordingly, great importance must be given to monitoring driver personnel in terms of correct compliance with speed specifications.

Due to the probability of human error, technical monitoring systems are very important in terms of safety. The PZB can support the driver's actions via messages and correct errors in the driver's behaviour via an automatic train stop. This function requires this equipment to be set up and operated properly. Accordingly, it is essential to give increased focus to the correct set up and operation of the PZB vehicle equipment when monitoring driver personnel.

5.1.5 Tank wagon equipment

As a result of the derailment, two tanks were severely damaged due to the impact of the buffers, as a result of which large amounts of the load were able to escape in an uncontrolled manner and contaminate the soil. There were considerable adverse effects for the environment. As a result of the relatively high flash point of diesel, there was no combustion.

It has been possible to confirm the effectiveness of additional safety elements during previous events. The probability of a perforation of the tank wall would have been considerably reduced in line with the protective purpose of this equipment. It must be assumed that the consequences of the accident would have been at least considerably minimised if safety equipment of this kind had been used on the tank wagons involved in the accident. If this were the case, the event would have had less impact on the environment. It is not possible to say with certainty whether this could have actually prevented the initial overriding of buffers and therefore the event itself.

Other wagon owners have transitioned to equipping tank wagons for other hazardous goods groups with additional safety elements in excess of the statutory requirements.

5.2 Measures taken since the event

The driver is no longer used by the railway undertaking. The TFS [train driver licensing entity] has imposed measures against the driver to ban him from driving traction units as per section 19(5) TfV [train driver licensing regulation], which have been confirmed in court.

Following an audit of the railway undertaking, the EBA [German Federal Railway Authority] demanded numerous corrective measures for the company's safety management system. The validity of the safety certification has expired in the meantime, and the requirement for participation in railway operations on the higher-level network is no longer present.

The routing of the single crossover between points 35 and points 18 was adjusted to the specifications of the DB Netz AG regulations after the event. The radius is now r=190 m again as originally planned.

5.3 Additional observations

During the accident investigation, factors were identified that could have affected the safety level of the railway system and therefore required more detailed consideration and evaluation.

5.3.1 Driver problems

The TFS became aware of the driver missing a signal at a railway undertaking in relation to considerable speeding and imposed refresher training measures on the basis of the TfV. Evidence was provided that refresher training had been conducted. The driver was then used again. In accordance with the TfV, the findings remained restricted to the group of companies involved and the authorities. Other railway undertakings which also used the driver were therefore not formally informed of these irregularities.

If a driver significantly jeopardises the safety of rail traffic or no longer meets the eligibility requirements for the issuing of a train driver licence, on the basis of the TfV the TFS may ban the driver from driving a traction unit and suspend or withdraw the train driver licence. For mistakes at work below the stated intervention threshold, the TfV currently does not contain any special regulations for the TFS.

In the safety management system necessary for participation in railway operations on the higher-level network, railways must in particular manage all risks resulting from their activity. To this end, railway undertakings must meet the requirements as per Annex I, point 3.1 "Actions to address risks" of Delegated Regulation (EU) 2018/762. This means that even possible risks resulting from train driver activity must be identified and assessed, and safety measures must be taken and monitored. In addition, employees and external parties must be informed about risks and railway undertakings must cooperate with other parties in relation to shared risks.

The company's own safety management system must be able to deal with expected or potential driver errors.

The question about whether, and if so how, information about mistakes at work can in principle be shared between railway undertakings in consideration of the driver's personal rights and what, if necessary, the role of the TFS could be in this arrangement, remains open and has not yet been resolved.

5.3.2 Driver number

In accordance with Regulation (EU) 2019/773 (TSI OPE) point 4.2.3.5, the driver number is a required part of the data records of the railway undertaking and is used to show the driver's identity in encrypted format. The driver is usually given this driver number by their railway undertaking. There are no legal regulations about how this is generated and assigned. By entering the six-figure driver number into the PZB vehicle device, it is intended that events and actions during a train journey or shunting movement can be attributed to a responsible person during subsequent evaluations.

By its own admission, the railway undertaking responsible for the train journey did not assign its own driver numbers for external drivers. As a substitute, the drivers were supposed to use their date of birth. The number used by the driver responsible was neither his date of birth, nor the last digits of his driving licence. The railway undertaking was not able to discern where this number came from. The origin of the driver number of the driver who arrived in Cologne, and who was working for the same railway undertaking, could not be clarified either.

The driver numbers for entry in the PZB vehicle device are generally assigned by the respective railway undertaking independently. If working for various railway undertakings, one driver may therefore have several numbers. Changing the number when changing the responsible railway undertaking would have been possible or even intended. The assessment of electronic trip registration data must be carried out by the responsible railway undertaking and may also be requested by the responsible supervisory authority for supervisory purposes. The assignment of journey data to one driver in the case of random samples may be complicated if there are several possible driver numbers. The obligatory use of an individually assigned driver number that is valid nationwide for entry into the PZB vehicle device could improve the possibilities for the railway undertakings or supervisory authorities to check on drivers across various railway undertakings that use the driver. In the letter dated 19/04/2021 ref. 3340-333üb/002-3400#006 the EBA has already made a foray in this area in relation to stakeholders in the railway system.

6 Safety recommendations

The following safety recommendations are made in accordance with section 6 of the EUV and Article 26(2) of Directive (EU) 2016/798.

No.	Addressee and safety recommendation	Relates to company
05/2022	Safety authority: It is recommended that speed guidelines should be strictly adhered to and there should be greater focus on the correct operation of safety devices by the driver during corporate and official monitoring.	Railway undertaking
06/2022	Safety authority: It is recommended that in order to manage risks in relation to maintenance according to the requirements of Delegated Regulation (EU) 2018/762 Annex II point 5.2.4, the procedure for inspecting the superstructure in “other main tracks” should be examined and improved if necessary.	DB Netz AG
07/2022	Safety authority: It is recommended that consideration should be given to introducing a standardised and individually	Railway undertaking

	assigned driver number in order to improve/allow for the monitoring of staff by the railway undertakings and supervisory authorities.	
08/2022	Safety authority: It is recommended that consideration should be given to equipping oil tank wagons with additional safety features in order to limit consequential losses.	Wagon owner