Translation of an excerpt of the investigation report

“Train collision Mannheim marshalling yard on 07/03/2024”

Status as of 01/12/2024, 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 07/03/2024 at around 09:21 am, when pulling into Mannheim station marshalling yard the DGS 43373 passed light shunting signal 602II, which was indicating stop, without authorisation in arrival sidings K. On marshalling hump A, the train movement then collided with the stationary shunting locomotive A_2.

1.2 Consequences

The two train drivers both sustained minor injuries in the event. Property damage was caused to the railway vehicles and the infrastructure.

1.3 Causes

During the investigation of the event, the following actions, failures, incidents or circumstances were identified as safety-critical factors. These are differentiated into causal or contributing and systemic factors according to Implementing Regulation 2020/572.

A detailed assessment of the event with classification as safety-critical factors is provided in the sections below.

What happened: Date/time, and action/failure/circumstance/incident	Causal factor	Contributing factor	Systemic factor
07/03/2024, 09:21 AM Action: Driver of DGS 43373 passed light shunting signal 602II, which was indicating stop	Lack of operational reliability [F1]		
07/03/2024, 09:21 AM Circumstance: Track not equipped with infrastructure-based train control systems	Target signal not equipped with 2,000 Hz track magnet [F2]		No planning requirement for target signals in marshalling yards to be equipped with PZB [S2]

Table 1: Summary of the influencing factors

1.4 Safety recommendations

The following safety recommendation no. 16/2025 is made in accordance with Section 6 EUV [German railway accident investigation regulation] and Article 26(2) of Directive (EU) 2016/798:

It is recommended that shunting signals, which can regularly be used as target signals for train movements, must undergo a risk assessment as per Regulation (EU) 2018/762 Annex II point 3.1.1.1. in relation to equipping them with 2,000 Hz track magnets.

5 Conclusions

The following section contains a summary of the identified causal, contributing 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 train collision could be attributed to a mistake by the driver of the DGS 43373. Without authorisation, he drove past light shunting signal 602II, which was indicating stop, [F1] and after seeing the vehicle on his track was no longer able to prevent a train collision with the stationary shunting locomotive A_2. The lack of a 2,000 Hz control system when passing light shunting signal 602II without authorisation, due to there not being equipment present, must also be seen as another causal factor [F2]. In all likelihood, excluding both causal factors would have prevented the event.

In relation to the causal factor "Lack of operational reliability" [F1]

When pulling into Mannheim station marshalling yard, the driver of the DGS 43373 incorrectly assumed that he would pass signal box 16 on the left and drive into another part of the station. As the DGS 43373 pulled in further, the driver saw light shunting signal 602II and, due to the fact that night mode was still activated at this time, assumed that it was off. He did not recognized the white-red-white mast sign on light shunting signal 602II. He also assumed that, if there were other train movements in sidings K of Mannheim station marshalling yard, he would have received a 1,000 Hz ATP warning at the distant signal when driving towards a signal indicating stop. He thought that this lack of warning confirmed his assumption that light shunting signal 602II was off and not indicating stop.

The driver of the DGS 43373 passing light shunting signal 602II, which was indicating stop, without authorisation caused the event. The mistake of failing to observe light shunting signal 602II, which was indicating stop, and in particular the white-red-white mast sign resulted in the train collision with the shunting locomotive A_2. This shows a lack of operational reliability on the part of the driver. In this context consideration must be given to the driver's previously missed work break and his assumed increased tiredness.

According to Regulation (EU) 2018/762 Annex I point 4.2.1, the railway undertaking's competence management system should have ensured that the driver was fit to perform his safety-

related task. In addition to identifying the skills necessary for the safety-related task, this also included appropriate education, ongoing training and regular assessment of the skills to ensure that the driver's qualifications and proficiencies were permanently maintained.

In relation to the causal factor "Target signal not equipped with 2,000 Hz track magnet" [F2]

From an infrastructure perspective, Mannheim station marshalling yard was not fully equipped with PZB (intermittent train control system) track magnets. The lack of track magnets at the target signal for the train movement ultimately meant that monitoring of the driver's conduct was not technically possible. In particular, an effective 2,000 Hz track magnet at light shunting signal 602II would have resulted in an automatic train stop of the DGS 43373 when the driver passed the signal without authorisation and, in all likelihood, would have prevented the collision with the shunting locomotive A_2. Even before the event, the infrastructure manager had identified and arranged for certain equipment gaps to be dealt with, see below on [S2].

In relation to the systemic factor "No planning requirement for target signals in marshalling yards to be equipped with PZB" [S2]

The lack of PZB equipment according to causal factor [F2] could be attributed to planning principles from the time of the Deutsche Bundesbahn [West German state railway until 1993]. Following the reorganisation into Deutsche Bahn AG, these rules were adopted into new regulations and the lack of infrastructure-based equipment has been preserved as the status quo ever since. However, as part of the dynamic responsibility of an operator as per Section 2(1) EBO [German Ordinance on the Construction and Operation of Railways] and Regulation (EU) 2018/762 Annex II point 5.2, the infrastructure manager must also examine existing regulations because railways, and therefore railway operation, are subject to constant change. In particular, as part of its safety management system, the infrastructure manager must react and act accordingly if there are increased faults and/or accidents with the same cause. In this context, even before the event the infrastructure manager issued the instruction 819.0203-W-102 "Distant signalling for exit and intermediate signals – Adjustment of guideline 819.0203 and compensation measures for existing systems". This instruction was justified by the fact that there had been increasing incidents of unauthorised passing of signals indicating stop due to a lack of distant signalling. The infrastructure manager had therefore already recognised the problem of the lack of distant signalling of a target signal indicating stop. In the

opinion of the Federal Authority for Railway Accident Investigation, contrary to the infrastructure manager's own interpretations, the strengthened equipment requirements should also have applied to Mannheim station marshalling yard. This is justified by point 5.3.3.1 no. 1 of instruction 819.0203-W-102 "Distant signalling for exit and intermediate signals – Adjustment of guideline 819.0203 and compensation measures for existing systems", according to which the instruction text relates to target signals indicating Hp0 [main signal stop]/Sh0 [protective signal stop]. According to guideline 819.0302 section 2(2), a shunting signal designed as a light signal can be used, among other things, as a target signal for the arrival of freight and passenger trains. According to guideline 819.0302 section 2(5), the light signal must be executed as a high design with an individual mast if it is used as a target signal for train movements. Light shunting signal 602II in Mannheim station marshalling yard meets these structural requirements of guideline 819 and is used as a target signal for arriving freight trains. The exception as per point 5.3.3.2 no. 3 of the stated instruction also cannot apply in Mannheim station marshalling yard, because the arrival speed for train movements in the station is signalled as 40 km/h. The implementation period had not yet expired at the time of the event. As a result, no safety recommendation is issued in relation to the addition of distant signalling.

In accordance with Regulation (EU) 2018/762 Annex II point 3.1.1.1., an infrastructure manager must identify and analyse all relevant operational, organisational and technical risks and evaluate them using appropriate risk assessment methods. Based on the evaluation, the infrastructure manager must develop safety measures and then monitor the effectiveness of the safety measures. In the opinion of the Federal Authority for Railway Accident Investigation, a comparable retrofitting of high-standing stop aspect signals as the target signal for a train movement in a marshalling yard with 2,000 Hz track magnets would contribute to increasing railway safety. For this reason, a corresponding safety recommendation is issued in relation to this.

5.2 Measures taken since the event

The railway undertaking has revoked the supplementary certificate for the driver of the DGS 43373. He has no longer been deployed in the railway undertaking since the event.

The railway undertaking has also taken the following measures:

- Employees at the management level as well as in traffic management, the control centre and planning have been made aware that duty shifts and transport services must

be scheduled according to the requirements of the safety management system and requirements of working hours legislation must be complied with.

- Assignments for drivers are presented in greater detail and contain the location and time of work safety breaks.
- Incoming timetables and the timetable instruction are examined in greater detail.
- During further training, drivers are made aware of the correct conduct in relation to signals indicating stop.
- The process for compliance with work safety breaks for drivers has been changed. The drivers must electronically report all work safety breaks taken. These are examined by control centre employees at specified times.

5.3 Additional observations

Not applicable.

6 Safety recommendations

The following safety recommendation is 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
16/2025	Safety authority: It is recommended that shunting signals, which can regularly be used as target signals for train movements, must undergo a risk assessment as per Regulation (EU) 2018/762 Annex II point 3.1.1.1. in relation to equipping them with 2,000 Hz track magnets.	Infrastructure manager