STATE COMMISSION ON RAILWAY ACCIDENT INVESTIGATION
Ministry of Interior and Administration

REPORT No. PKBWK 7/2025

on the investigation of a serious railway accident
that occurred on 26 November 2024 at 12:30 hrs
on the Sochaczew - Bednary route,
track no. 1, km 61.941 of railway line no. 3 Warszawa Zachodnia - Kunowice,
a Category B level crossing
the area of the infrastructure operator PKP PLK S.A., Railway Line Plant in Warsaw

WARSAW, 19 November 2025

https://www.gov.pl/web/mswia/panstwowa-komisja-badania-wypadkow-kolejowych

Pursuant to Article 28f(3) of the Act of 28 March 2003 on rail transport, the Commission's investigation determines neither guilt nor liability.

This Report has been prepared under the provisions of *Commission Implementing Regulation (EU) 2020/572 of 24 April 2020 on the reporting structure to be followed for railway accident and incident investigation reports (OJEU L 132 of 27 April 2020)*

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I. ABSTRACT

Type of occurrence: Serious accident.

Description: An occurrence at a Category B level crossing (also referred to as a railway crossing or a crossing) in which a MAN lorry stopped in the axis of track no. 1 before a closed exit barrier while train EIJ 5220 was approaching on that track, which led to the train running into the stationary lorry.

Date of the occurrence: 26 November 2024, 12:30 hrs.

Location of the occurrence: The Category B level crossing located at kilometre 61.941 of railway line no. 3 Warszawa Zachodnia - Kunowice, Sochaczew - Bednary route, track no. 1, crossing identification no. 003 061 941, geographical location 52º09'44,1"N 20º10'24.7"E.

Consequences of the occurrence: As a result of being hit by the train, the car was turned and thrown to the left side of track no. 1, as seen in the direction of the train's travel, destroying an N3 barrier drive, the crossing's traffic control equipment container and the power supply container. Electric Multiple Unit (EMU) ED161-004 of the carrier PKP Intercity S.A. sustained damage to its front section and subsequently derailed to the right with the first bogie in the travel direction. The train came to a halt at kilometre 61,830 after travelling 109 metres in a derailed state. The turning lorry hit the side of the train, destroying the side skin of the EMU and breaking the glass pane in the second window behind the train driver's cab in the passenger section of the carriage. Three passengers on the train were given medical aid following the occurrence. The driver of the road vehicle had got off the vehicle prior to the occurrence and did not sustain any injuries. The train drivers who were in the cab of the train did not sustain any injuries either.

Causal factor:

(means any action, omission, event or condition, or a combination thereof that, if corrected, eliminated, or avoided, would have prevented the occurrence, in all likelihood)

The entry of the road vehicle onto the level crossing while the half-barriers were being lowered a signal was being given by the road traffic lights prohibiting entry beyond the lights, and the road vehicle's discontinuation of traversing and leaving the crossing.

Contributing factors:

(means any action, omission, event or condition that affects an occurrence by increasing its likelihood, accelerating the effect in time or increasing the severity of the consequences, but the elimination of which would not have prevented the occurrence)

1) Stopping and leaving the road vehicle on the crossing in the gauge of track no. 1.
2) Failure of the driver of the road vehicle to take special care when traversing the level crossing.
3) The occurrence of a sudden stress reaction in the road vehicle driver as a result of an unexpected critical situation involving the closure of the lorry in the crossing zone between the closed barriers.
4) Failure to implement 100% of Recommendation No. 2 from the 2018 PKBWK Annual Report, which reads "*Infrastructure managers shall eliminate exit barriers in automatic level crossing systems at Category B level crossings where the four half-barrier solution is used, and, where justified by local conditions, shall notify the road manager of the need to put in place safeguards on the approach to a Category B level crossing to prevent road vehicles entering onto the level crossing on a lane that allows bypassing a closed barrier, in particular by means of separation strips or separators. (...)*".

Systemic factor:

(means any causal or contributing factor of an organisational, managerial, societal or regulatory nature that is likely to affect similar and related occurrences in the future, including, in particular the regulatory framework conditions, the design and application of the safety management system,

The system of crossing warning discs (TOP) in use, positioned at the trackside before level crossings, does not advise train drivers that the crossing zone (the length of the crossing) is occupied. Such a design of the system does not ensure compliance with safety requirements.

Recommendations and their addressees:

1) Infrastructure managers that have not implemented 100% of "*Recommendation No. 2 from the 2018 PKBWK Annual Report"* shall step up the implementation of the recommendation and submit to the President of the Office of Rail Transport a schedule of actions aimed at eliminating exit half-barriers at Cat. B level crossings.

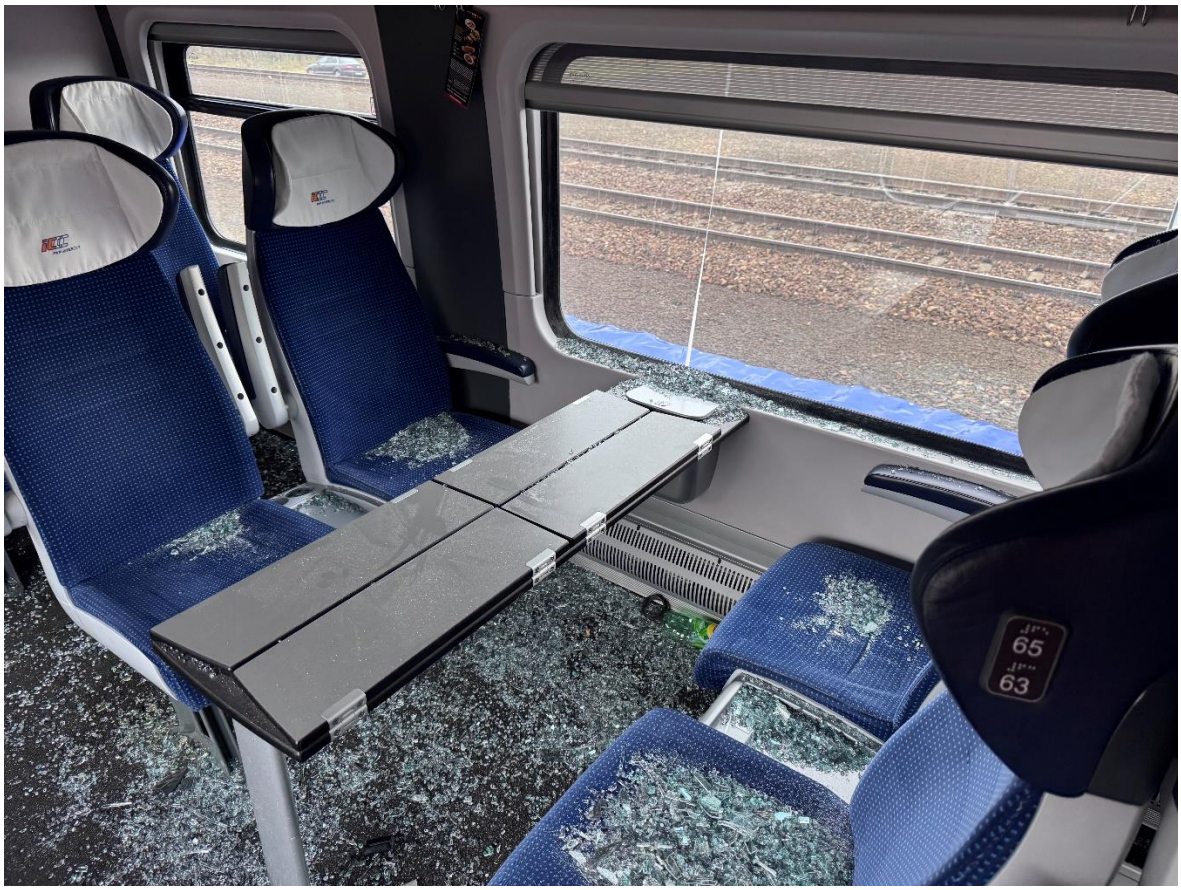
2) Railway carriers operating powered railway vehicles shall conduct safety inspections of train driver cabs, focusing in particular on whether the driver emergency evacuation is hindered where there are two seats in the cab. If any difficulties are identified, they shall take appropriate actions to eliminate them.

3) Infrastructure managers shall take actions to retrofit level crossings with a system for detecting obstacles in the crossing zone.

Photograph 1 – The consequences of the occurrence in the area of the crossing – damage to the infrastructure and equipment prohibiting entry to the crossing (photo by the railway commission)

Photograph 2 – The consequences of the occurrence to the railway vehicle – damage to the cab and head of ED161- 004a (photo by the railway commission)

Photograph 3 – The consequences of the occurrence to the railway vehicle (photo by PKBWK)



Photograph 4 – The consequences of the occurrence to the railway vehicle (photo by PKBWK)

II. THE INVESTIGATION AND ITS CONTEXT

1. Decision to establish an investigation

The Chairman of the State Commission on Railway Accident Investigation (hereinafter referred to as "PKBWK" or "the Commission") Tadeusz Ryś issued decision No. PKBWK.590.6.2024 of 2 December 2024 to investigate the railway occurrence at the Cat. B level crossing on railway line no. 3 Warszawa Zachodnia - Kunowice at km 61.941, track no. 1 of the Sochaczew - Bednary route.
In view of this fact and considering the provisions of Article 28e(4) of the Act of 28 March 2003 on rail transport (consolidated text: Journal of Laws 2024, item 697, as amended), hereinafter referred to as "the Rail Transport Act", the occurrence was reported to the European Union Railway Agency and registered in its database under the number PL-10633.

2. Motivation for the decision to establish an investigation

Pursuant to Article 28e(3)(2) and (3) of the Rail Transport Act: *"The decision to undertake the investigation of the accident or incident referred to in Paragraphs 2 and 2a shall be made by the Chairman of the Commission, taking into account:*
1) (...)
2) whether the accident or incident forms a series of accidents or incidents relating to the system as a whole;
3) the impact of the accident or incident on railway safety;
4) (...).
In the course of the investigation, the occurrence was reclassified from an accident to a serious accident. The Investigation Team considered that the losses resulting from the occurrence had exceeded €2 million and that the occurrence had had an impact on safety management and safety regulations.

3. The scope and limits of the investigation including a justification thereof, as well as an explanation of any delay that is considered a risk or other impact to the conduct of the investigation or its conclusions

There were no limits during the investigation that would have a negative impact on its course.
The investigation was conducted under Article 28h(1) of the Rail Transport Act and, in accordance with the provisions of Article 28f(3), does not determine guilt or liability.

4. An aggregated description of the technical capabilities of the functions of the persons represented in the team of investigators

The Chairman of the Commission appointed the Investigation Team from among the standing members of the Commission with qualifications and competencies regarding the investigation concerned.

5. A description of the communication and consultation process established with persons or entities involved in the occurrence during the investigation and in relation to the information provided

Under Article 28h(2)(5) of the Rail Transport Act, the Chairman of PKBWK obliged specific persons from the railway commission to cooperate with the Investigation Team (letter no. PKBWK.590.6.1.2024 of 2 December 2024).

In accordance with letter no. PKBWK.590.6.2.2024 of 16 December 2024, the chairman of the railway commission transferred formally the accumulated documentation to the Investigation Team on 18 December 2024.

6. A description of the level of cooperation offered by the entities involved

In the course of the investigation, cooperation with representatives of entities linked to the circumstances of the occurrence did not raise any concerns with the Investigation Team.

7. A description of the investigation methods and techniques as well as analysis methods applied to establish the facts and findings referred to in the report

Throughout the process aimed at investigating the circumstances of the occurrence, the Investigation Team considered the provisions of national rules, internal rules of the infrastructure manager and railway carrier, and the technical documentation. Furthermore, the Investigation Team relied on their own knowledge and experience, as well as on the documentation prepared by the Investigation Team and the railway commission. Within the investigation, the Investigation Team carried out inter alia the following activities:

- an inspection of the site and consequences of the occurrence, an inspection of the level crossing, the approach roads and the railway line,
- interviews with the people involved in the occurrence,
- production of photographic and video following the occurrence and at later dates during the cleanup,
- analysis of documentation provided by the railway carrier and the infrastructure manager, and the documentation made available by the prosecutor's office,
- analysis of the data from the railway vehicle's event data recorder,
- analysis of the data contained in the video recorders on the railway vehicle and at the level crossing,
- analysis of the internal provisions of the infrastructure manager and the railway carrier applicable to the occurrence concerned,
- analyses of the Safety Management System (SMS) operated by the infrastructure manager and the carrier.

Below is a list of selected legal acts, rules and internal instructions used during the investigation:

European Union Regulations and Directives:

1) Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety (OJ EU L 138 of 26 May 2016, p. 102, as amended).
2) Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation (OJ EU L 119 of 4 May 2016, p. 1, as amended).
3) Commission Implementing Regulation (EU) 2020/572 of 24 April 2020 on the reporting structure to be followed for railway accident and incident investigation reports (OJ EU L 132 of 27 April 2020).

National rules:

1) Act of 28 March 2003 on rail transport (consolidated text: Journal of Laws 2024, item 697, as amended).
2) Act of 7 July 1994 on the Construction Law (consolidated text: Journal of Laws 2024, item 725, as amended).
3) Act of 20 June 1997 on the Road Traffic Law (consolidated text: Journal of Laws 2024, item 1251, as amended).
4) Act of 10 May 2018 on the protection of personal data (consolidated text: Journal of Laws 2019, item 1781).

5) Act of 21 March 1985 on public roads (consolidated text: Journal of Laws 2024, item 320, as amended).
6) Regulation of the Minister of Infrastructure and Development of 20 October 2015 on the technical conditions to be met by crossings of railway lines and sidings with roads, and on their positioning (Journal of Laws, item 1744, as amended).
7) Regulation of the Minister of Infrastructure of 11 January 2021 on personnel employed on positions related directly to the operation and safety of rail traffic and to driving of specific types of rail vehicles (Journal of Laws 2024, item 780, as amended).
8) Regulation of the Ministers of Infrastructure and of the Interior and Administration of 31 July 2002 on road signs and signals (consolidated text: Journal of Laws 2019, item 2310, as amended).
9) Regulation of the Minister of Infrastructure of 24 June 2022 on the technical and construction rules applicable to public roads (Journal of Laws, item 1518).
10) Regulation of the Minister of Transport and Maritime Economy of 10 September 1998 on the technical conditions to be met by railway structures and on their positioning (Journal of Laws No. 151, item 987, as amended).

Internal instructions of the railway carrier PKP Intercity S.A.

1) Instruction for a driver of a traction vehicle - Bt-1,
2) Instruction for conductor teams regarding operation of passenger trains in service with PKP Intercity S.A. - Br-21

Internal instructions of the infrastructure manager PKP PLK S.A.

1) Ie-1 (E-1) Instruction on signalling operations,
2) Ir-1 Instruction on operating railway traffic,
3) Ir-8 Instruction on the handling of serious accidents, accidents and incidents in railway transport,
4) Id-1 (D-1) Technical conditions for the maintenance of the surface of railway lines,
5) Ik-2 Instruction on inspections concerning railway traffic safety,
6) Id-7 Instruction on surveillance of railway lines.

8. A description of the difficulties and specific challenges encountered during the investigation

Members of the Investigation Team did not encounter any difficulties or problems that could have impact on the course, timeliness or conclusions of the investigation.

9. Any interaction with the judicial authorities

The Investigation Team cooperated with the prosecutor of the Sochaczew District Public Prosecutor's Office investigating the case under the Agreement of 27 June 2014 between the Prosecutor General and the Chairman on Railway Accident Investigation. The Investigation Team was allowed to examine the documents gathered by the Public Prosecutor’s Office. No difficulties were encountered during the cooperation.

10. Other information relevant in the context of the investigation

The Investigation Team did not identify any other information relevant in the context of the investigation.

III. DESCRIPTION OF THE OCCURRENCE

1. The occurrence and background information

1.1. Description of the type of occurrence

The occurrence was classified as a serious accident at a Category B level crossing.
When train EIJ 5220 was approaching the crossing, a lorry (a MAN tipper) entered the level crossing while the traffic lights were giving the signal of two alternating flashing red lights and the half-barriers were being lowered. Next, the car came to a halt in the axis of track 1 before the exit barrier, which led to it being ran into by train EIJ 5220.
The Investigation Team concluded that the incident met the definition of a serious railway accident as set out in Article 4(46) of the Rail Transport Act, which provides that:
"*serious accident - any accident caused by a collision, derailment or any other occurrences with an obvious impact on safety regulation or safety management resulting in:*
a) the death of at least one person or serious injuries to five or more persons, or
b) extensive damage to a rail vehicle, railway infrastructure or the environment that can be immediately estimated by the accident investigation commission to be at least €2 million."
The Investigation Team identified systemic factors with an obvious impact on safety management and, as a result, reclassified the occurrence type from "accident" to "serious incident".

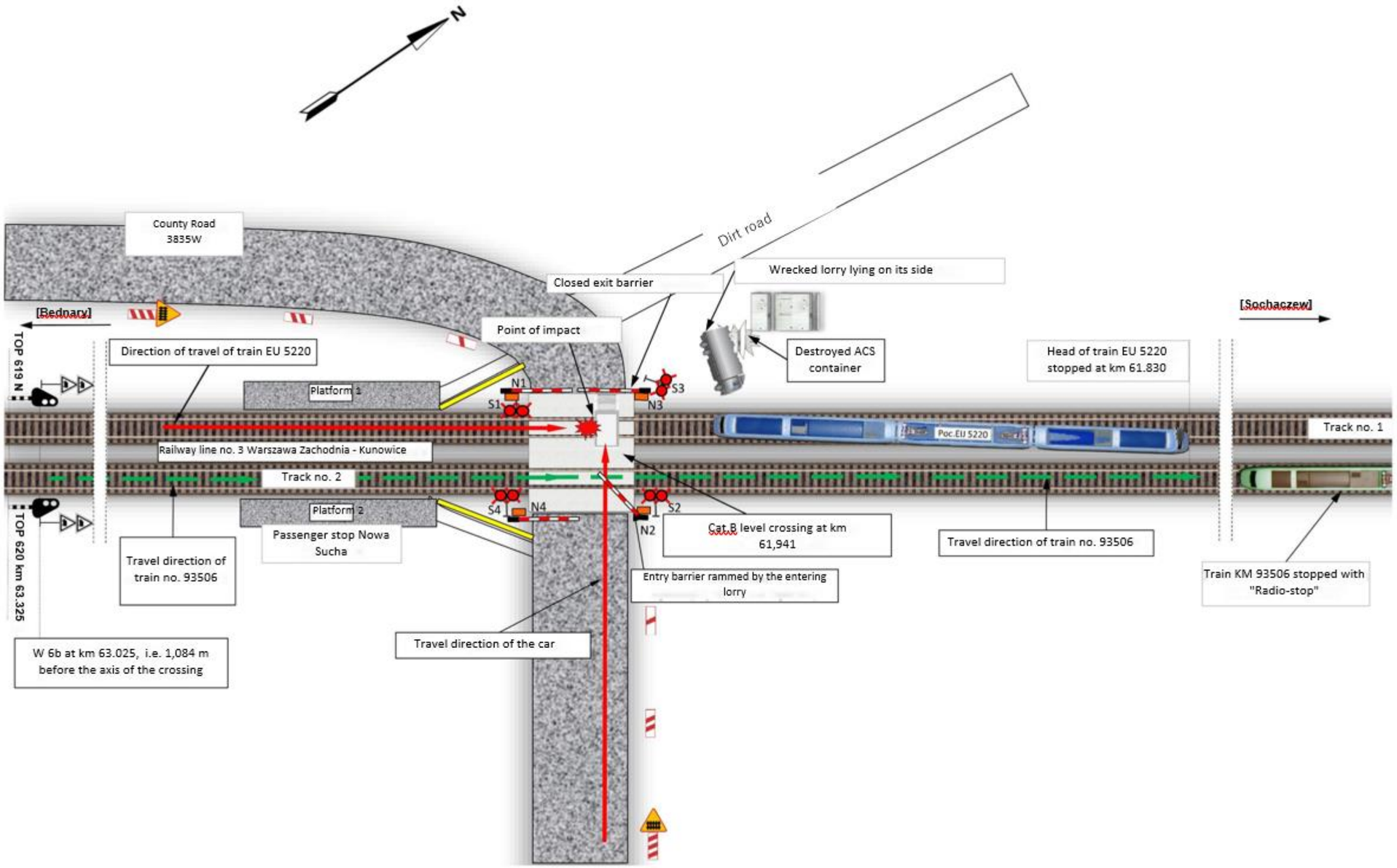
1.2 The date, exact time and location of the occurrence

The occurrence took place on 26 November 2024 at 12:30 hrs at the Category B level crossing located on the Sochaczew - Bednary route, track no. 1, km 61.941 of railway line no. 3 Warszawa Zachodnia - Kunowice. Geographical coordinates: 52º09’44,1”N 20º10’24.7”E.

1.3. The description of the occurrence site, including weather and geographical conditions at the moment of the occurrence and if any works were carried out at or in the vicinity of the site

The Cat. B level crossing where the occurrence took place is located in the town of Nowa Sucha on County Road No. 3835W. The car entered the crossing from the right side looking from the direction of the moving train. The surface of the road is mineral bitumen. The width of the roadway on the approach to the level crossing is: left side 6.5 m, right side 5.8 m. The inclination in advance of the crossing over 20 metres is: left side 1.8%, right side 1.77%. The permitted speed of road vehicles on the road in the area of the level crossing is 50 km/h. The road intersects with the railway track at a 73º angle. The area where the road intersects with the railway line is located in an urban area. The level crossing for road users has signage on both sides: warning signs A-9, indication posts on the right-hand side, G-1a, G-1b, G-1c and G-2 "Electrified overhead line" plates. Following the accident, the crossing was additionally marked with a B-20 "Stop" sign with the plate "Traffic lights out of order" due to the damage to the signalling equipment at the crossing. The lanes are separated by the double continuous line P-4, with the conditional stop line P-14 drawn on the roadway before the traffic lights. The geographical coordinates of the level crossing are as follows: 52º09’44,1”N 20º10’24.7”E. The occurrence took place in daylight with no precipitations or fog, in good visibility, ambient temperature of +6º C. No works were being carried out in the area of the crossing. The Cat. B level crossing was equipped with four traffic lights and four half-barriers (two entrance barriers and two exit barriers).

Figure 1 – A sketch of the serious accident (prepared by PKBWK)



1.4. Deaths, injuries and material damage

a) passengers, employees or contractors, level crossing users, trespassers, other persons at a platform, other persons not at a platform

As a result of the serious accident, three people travelling on the train were injured and were given medical aid by a Emergency Medical Team.

b) cargo, luggage and other property

The road vehicle was not carrying cargo and there was no damage to luggage or other property of the travellers.

c) rolling stock, infrastructure and the environment

Rolling stock
The train consisted of electric multiple unit ED161-004, whose front section A was destroyed. The EMU derailed with the first bogie (photographs 1 and 2).
A broken glass pane in the passenger section of the carriage on the left side of the train in the second window behind the driver's cab (photographs 3 and 4), and damaged carriage skin (photograph 3).

Infrastructure
The following damage was identified:
- a damaged apparatus and power supply cabinet for the Automatic Crossing System equipment,
- a damaged technical container (ruptured side wall),
- broken barrier rods, 2 pcs,
- damaged prestressed concrete sleepers, 186 pcs. with attachments,
- damaged "Mirosław Ujski" type crossing slabs, 2 pcs.

Environment
No environment pollution took place as a result of the occurrence.

1.5. The description of other consequences, including the impact of the occurrence in the regular operations of the actors involved

As a result of the occurrence, it was necessary to stop train traffic on railway line no. 3, on the Sochaczew - Bednary section on tracks no. 1 and 2 beginning on 12:41 hrs on 26 November 2024. Traffic on track no. 2 was resumed at 19:10 hrs on the same day, while traffic on track no. 1 was resumed at 16:29 hrs on 27 November 2024.
The railway carrier "Koleje Mazowieckie – KM" sp. z o.o. cancelled 23 trains on the Sochaczew - Łowicz Główny - Sochaczew , Sochaczew - Płock - Sochaczew section during the cleanup operation, offering replacement bus services instead. Due to the train traffic disruption on the Sochaczew - Bednary route, 32 trains of the railway carrier PKP Intercity S.A running on the Łowicz Główny - Warszawa Zachodnia section were diverted via Skierniewice.
As a result of the disruption, 183 passenger trains were delayed for 2,648 minutes, 12 freight trains were delayed for 906 minutes, and other 7 trains were delayed for 732 minutes.

1.6. The identification of the persons, their functions, and entities involved, including possible interfaces to contractors and/or other relevant parties

The following persons were directly involved in the occurrence:
- the drivers of train EIJ 5220 - employees of the railway carrier PKP Intercity S.A.
- the driver of the MAN road vehicle.

1.7. The description and identifiers of train(s) and their composition including the rolling stock involved and their registration numbers

Train EIJ 5220 travelling from Bydgoszcz Główny to Lublin Główny consisted of the ED161 - 004 series Electric Multiple Unit (EMU).

The EMU has a "*Rail vehicle type operation approval certificate no. PL 51 2018 0085"* and had a valid "*Release for use/Return to service certificate no. 248/PSZ/2023"* dated 25 August 2023. The certificate was valid for the mileage of up to 2,880,000 km. At the time of the occurrence, the recorded mileage of the EMU was 2,218,640 km.

The EMU consisted of eight units with the following EVNs:

- PL- PKPIC 94 51 2 150 237-7
- PL- PKPIC 94 51 2 150 238-5
- PL- PKPIC 94 51 2 150 239-3
- PL- PKPIC 94 51 2 150 240-1
- PL- PKPIC 94 51 2 150 241-9
- PL- PKPIC 94 51 2 150 242-7
- PL- PKPIC 94 51 2 150 243-5
- PL- PKPIC 94 51 2 150 244-3

Details of train EIJ 5220 – acquired from the brake test report form:

- train length…… 151 m
- total mass of the train…….278 tonnes
- required braked mass percentage…… 153 %
- required braked mass…… 426 tonnes
- actual braked mass…… 454 tonnes
- actual braked mass percentage..... 163%.

1.8. A description of the relevant parts of the infrastructure and signalling system – track type, switch, interlocking, signal, train protection systems

Railway line no. 3 Warszawa Zachodnia - Kunowice was modernised between 2015 and 2018.

Track:

rail type……..…..	– UIC60/60E1, year of installation: track no. 1 - 2021, track no. 2 - 2022,
sleepers…….	– prestressed concrete,
attachment type…….……	– flexible, track no. 1 type SB3, track no. 2 type SB3/SB4,
ballast type……	– crushed stone,
maximum permitted train speed en route……..…	– 160 km/h.

Signalling equipment:

The Local Control Centre (LCS) Łowicz is equipped with EBI LOCK 950 R4 type computerised signalling equipment. Among other things, the LCS Łowicz supervises and manages railway traffic on the Łowicz Główny - Sochaczew section (railway line no. 3). An EAC SHL12-type line block system is installed on this section.

The signalling and railway traffic control equipment at the level crossings are designed to operate traffic in both directions on each track.

Level crossing:

- Category B
- the intersection of railway line no. 3, Sochaczew - Bednary route, with county road no. 3835W Kozłów Szlachecki - Nowa Sucha - Guzów, the village of Nowa Sucha,
- individual journey identification number (yellow sticker): 003061941,
- crossing axis – km 61.941,
- angle of railway line-road intersection – 73°,

- the surface of the crossing is made of Mirosław Ujski slabs,
- mineral bitumen (MB) road surface on the approaches,
- approach road gradeline (according to the chainage of the railway line):
  - left side: +1.8% over a distance of 20 m,
  - right side (the direction of entry of the road vehicle to the level crossing): +1.77% over a distance of 20 m,
- traffic ratio on the level crossing – 157080; the latest measurement was taken on 7-8 September 2021,
- total length of the level crossing - 31.5 m,
- width of the road crown on the level crossing – 6.7 m,
- width of the roadway on the level crossing - 5.7 m,
- width of the roadway on the approaches, left side – 6.5 m,
- width of the roadway on the approaches, right side – 5.8 m,
- maximum speed of road vehicles on the level crossing – 50 km/h,
- illuminated crossing – two lighting columns, one on each side of the crossing.

Automatic Crossing System (ACS):
ACS equipment: SPA 41 type. EOC-type track circuits were used as detection equipment. On the day of the accident, the level crossing was equipped with four half barriers closing the entire width of the roadway, including the footpaths, and four traffic lights, 2 on each side. The remote control device (UZK) is installed at Bednary station (local UZK) and at LCS Łowicz (remote UZK). The level crossing is provided with four crossing warning discs (TOP) for each track in each direction. The level crossing is equipped with monitoring cameras and number plate identification cameras.

Level crossing signage.
The signage on the approach road leading to the crossing as at the day of the occurrence:
An A-9 warning sign with G-1a, G-1b and G-1c indicator posts were positioned on the approach to the level crossing from the direction of the oncoming road vehicle. Between the G-1a and G-1b indicator posts, there were a D-1 sign and a T-6a plate placed on a shared mast. Ahead of the crossing, at a distance of 5 m from the outermost rail of the track, a "G-2 Electrified Overhead Line" sign was placed on a pole.

Signage on the side of the track
W6b trackside signs:

- according to the ascending chainage of the line: at km 60.893, i.e. 1,048 m from the axis of the crossing,
- according to the decreasing chainage of the line: at km 63.025, i.e. 1,084 m from the axis of the crossing (train travel direction),
- crossing warning discs TOP, according to the ascending chainage of the line: at km 60.567, i.e. 1,374 m from the axis of the crossing,
- crossing warning discs TOP, according to the descending chainage of the line: at km 63.325, i.e. 1,384 m from the axis of the crossing.

1.9. Any other information relevant for the purpose of the description of the occurrence and background information

No other relevant information was identified in the context of the description of the occurrence.

2. The factual description of the events

2.1. The proximate chain of events leading up to the occurrence, including actions taken by persons involved, the functioning of rolling stock and technical installations, the functioning of the operating system.

On 26 November 2024, passenger train KM 93506 (the carrier "Koleje Mazowieckie - KM" sp. z o.o.) travelling from Łowicz Główny to Otwock left Łowicz Główny station as scheduled at 11:50 hrs. As a result

of a fault in the signalling equipment (srk) on track no. 2 on the Bednary - Łowicz Główny route, restrictions were imposed and the train was travelling with a speed limit of 20 km/h. The restrictions caused had caused it to be delayed (by approximately 20 minutes).

Because of the fault and the fact that track no. 2 of the Bednary - Łowicz Główny route was occupied by passenger train KM 93506 (the carrier "Koleje Mazowieckie - KM" sp. z o.o.), the signaller at Łowicz Główny station set the route for train EIJ 5220 (the carrier PKP Intercity S.A.) Bydgoszcz Główny - Lublin Główny from Łowicz Główny station on track no. 1 (the direction opposite to the main one). The setting was in accordance with applicable regulations, and it is allowed to operate train traffic in both directions on each track, as the signalling equipment is designed for this purpose. After all the procedures related to dispatching the train on the left track (opposite to the main track) had been completed and the signal permitting departure had been shown, train EIJ 5220 left Łowicz Główny station at 12:23 hrs.

At that time, the delayed passenger train KM 93506, approaching Nowa Sucha passenger stop on track no. 2, activated the Automatic Crossing System (ACS) at the level crossing at kilometre 61.941 - the half-barriers were lowered and the traffic lights gave a signal prohibiting entry beyond them (two alternating flashing red lights). There were cars waiting before the closed barriers on the approach to the crossing. The third in line of the cars waiting in front of the crossing was a MAN lorry (tipper).

After train KM 93506 departed from Nowa Sucha passenger stop in the direction of Sochaczew on track no. 2 and passed the crossing, the ACS equipment started the process of raising the semi-barriers. The traffic lights continued to give a no-entry signal, and they are only extinguished when all the half -barriers are in the vertical position and when no train is approaching the crossing. Even though the traffic signals were giving a signal prohibiting entry to the crossing and the half-barriers were in the process of being raised, two passenger cars entered the level crossing. The driver of the lorry followed the cars in front of him without paying attention to the signals given by the traffic lights or the position of the half-barriers. Because train EIJ 5220 was approaching on track no. 1, the ACS equipment stopped the process of raising the half-barriers (the traffic lights continued to give the signal prohibiting entry) and switched to the closing cycle to secure the passage of the train (in sequence, the entry half-barriers are closed first and the exit half-barriers are beginning to close after the former are lowered).

When the lorry was at the conditional stop line P-14, the entry half-barriers had been already closing to secure the passage of train EIJ 5220 and their angle of inclination relative to the horizontal was approximately 45^0 (photographs 5 and 6).

Photograph 5 – A view from the camera from the side of the N1 drive showing the crossing at the moment when the lorry is in front of the P-14 line (source: PKP PLK S.A.).

Photograph 6 – A view from the camera from the side of the N2 drive showing the crossing at the moment when the lorry is in front of the P-14 line (source: PKP PLK S.A.).

The driver of the lorry continues to drive and, as he enters the level crossing, bends the aluminium profile of the N2 half-barrier drive which is then lowered between the cab and the loading area (photographs 7 and 8).

Photograph 7 – A view from the camera from the side of the N1 drive showing the lorry entering the crossing and the barrier being bent (source: PKP PLK S.A.).

Photograph 8 – A view from the camera from the side of the N2 drive showing the lorry entering the crossing and the barrier being bent (source: PKP PLK S.A.).

The two passenger cars travelling in front of the lorry managed to leave the crossing before the exit barriers were lowered. The bent exit half-barrier of the N2 drive had reached the horizontal position and, in accordance with the closing sequence, the process of closing the exit barriers had started. At that time, the lorry traversed track no. 2 and stopped in the gauge of track no. 1 in front of the closing exit barrier of the N3 drive (photographs 9 and 10).

Photograph 9 – A camera view from the side of the N1 drive - the lorry stops in front of the closing exit barrier of the N3 drive (source: PKP PLK S.A.).

Photograph 10 – A camera view from the side of the N2 drive - the lorry stops in front of the closing exit barrier of the N3 drive (source: PKP PLK S.A.).

The driver of the lorry exited his vehicle and when he noticed train EIJ 5220 approaching the crossing he started gesturing with his hands towards it in order to stop the train.

The ACS equipment at the level crossing concerned includes crossing warning discs (TOP) which inform train drivers of the status of the signalling equipment at the crossing. Approaching the level crossing, train EIJ 5220 activated the ACS equipment (road traffic lights were giving the signal prohibiting entry to the crossing, and the half-barrier drives switched into the closing cycle). Because the ACS was in working order, until train EIJ 5220 passed crossing warning disc no. TOP 619N, installed at the trackside (1,384 m before the crossing) and referring to the crossing located at kilometre 61.941, the train drivers were receiving the Osp2 signal (*"Osp2 - Signalling devices on the level crossing to which the signal refers are serviceable; movement through the crossing at the maximum permitted speed").* Consequently, train EIJ 5220 continued to run at the scheduled speed applicable on this section of the line V_{max} = 160 km/h. The train's braking distance at this speed is 1,300 metres. Behind the TOP 619N disc in the path of EIJ 5220 train the track was laid in a curve. The straight section of the track starts 800 m before the crossing. After getting out of the curve, the train driver, although not required by regulations, gave the Rp1 "Attention" acoustic signal and, after noticing some traffic at the crossing and then identifying an obstacle at the crossing (after 3 seconds), implemented emergency braking. The second train driver, aware that a collision is unavoidable, activated the "Radio-stop" system to stop other trains that were travelling on line no. 3 (they are within radio range of the A 1r "Alarm" signal) and prevent these trains from entering the occurrence area. The reaction of the braking systems and the sudden discharge of air (emergency braking) occurs at a distance of 543 m from the axis of

the crossing. Over that distance, the train reduced its speed from 155.4 km/h to 70.7 km/h, and it is at the latter speed that the train collides with the load section of the lorry on the level crossing. Following the impact, train EIJ 5220 derailed with the first bogie to the right side and travelled 109 metres in a derailed state, then stopped at kilometre 61.830.

2.2. The chain of events from the occurrence until the end of the actions of the rescue services, including measures taken to protect and safeguard the site of the occurrence, the efforts of the rescue and emergency services.

The occurrence on the level crossing was reported to the 112 operator at 12:33 hrs by a resident of a house in the vicinity of the crossing. At the same time, the driver of EIJ 5220 train reported the accident to the signaller at Sochaczew station by radio.

At 12:40 hrs, the signaller at Sochaczew station also notified the 112 operator, following which, at 12:43 hrs, he notified the section dispatcher of the infrastructure manager about the suspension of traffic and closure of both tracks of the Sochaczew - Bednary route.

The following first responders arrived at the accident site:

- the Police at 12:45 hrs
- the Fire Service at 12:50 hrs
- the EMT at 12:50 hrs
- the prosecutor at 13:50 hrs
- a UNIMAN technical rescue vehicle from Warszawa Wschodnia station at 15:00 hrs.

For the duration of the rescue operation, the overhead line on tracks no. 1 and 2 was de-energised from 13:45 hrs to 19:06 hrs. At 15:05, the travellers were taken by a replacement bus service launched by the carrier. Train consist EIJ 5220 was re-railed at 18:30 hrs and shunted to track no. 3 at Bednary station at 22:55 hrs. Following replacement of the damaged track infrastructure components, traffic was resumed with a speed limit of 20 km/h at the crossing because the Automatic Crossing System equipment were out of order and undergoing reconstruction.

The cleanup was complete and regular traffic was restored on both tracks in both directions on the Sochaczew - Bednary route on 10 December 2024 at 12:30 hrs.

IV. ANALYSIS OF THE OCCURRENCE

1. Roles and duties

1.1. Railway undertaking(s) or infrastructure manager(s)

Infrastructure operator PKP PLK S.A. Railway Line Plant in Warsaw

The infrastructure manager is responsible for inter alia appropriate maintenance of the railway line, including level crossings. The responsibilities of the infrastructure manager are laid down in inter alia Article 62 of the Act of 7 July 1994 on the Construction Law. The said provision requires the infrastructure managers to conduct annual and five-year reviews of construction works (including level crossings and traffic protection devices installed thereon). §31 of Internal instruction Id-1 of the infrastructure manager imposes an obligation to conduct diagnostic examinations of level crossings (including as regards railway and road surface, visibility conditions, lighting). The timing of reviews of construction works set forth in the applicable instructions are compliant with Article 62 of the Act of 7 July 1994 on the Construction Law. PKP PLK S.A., Railway Line Plant in Warsaw, submitted reports on annual and five-year reviews (inspections) of level crossings. The Investigation Team analysed the five-year and annual inspection reports and reports on diagnostic checks concerning facility maintenance. The documents show that no irregularities were found and the technical condition was described as good. Therefore, it was not necessary to issue any recommendations and the construction work was cleared for further operation without any recommendations regarding required corrective actions.

In its "*2018 Annual Report on activities of PKBWK*", the State Commission on Railway Accident Investigation issued the following Recommendation: "*Infrastructure managers shall eliminate exit barriers in automatic level crossing systems at Category B level crossings where the four half-barrier solution is used, and, where justified by local conditions, shall notify the road manager of the need to put in place safeguards on the approach to a Category B level crossing to prevent road vehicles entering onto the level crossing on a lane that allows bypassing a closed barrier, in particular by means of separation strips or separators. Such a configuration is inconsistent with the provisions of Point 6.2 of Annex 4 to the Regulation of the Minister of Infrastructure of 3 July 2003 on the detailed technical conditions concerning road signs and signals and road traffic safety devices, and on the conditions of their installation on roads (consolidated text: Journal of Laws 2019, item 2311, as amended), which provides that: "barriers U-13a and U-13b which close the entire width of the roadway shall be used at Category A level crossings, whereas half-barriers U-13c shall be used at Category B level crossings. Half-barriers shall be positioned so that they close the right half of the road on each side (also where half-barriers are installed on one-way roadways)".*
The President of the Office of Rail Transport provided PKBWK with "*Information on the implementation of the recommendations made by PKBWK in 2019*". The information shows that the recommendation applied to 6 infrastructure managers, and that the average percentage of its implementation in 2019 was 81. As the most common identified risks, the information mentions also "*a car closed on the crossing*" and "*entry onto the crossing while the half-barriers were being raised or lowered, and disregard of the information from the road traffic lights at Category B crossings*". PKBWK repeated a similar recommendation in its "*2019 Annual Report on activities of PKBWK"* and, subsequently, in Report "*No. PKBWK 5/2023 on the investigation of a railway accident that occurred on 20 February 2023 at 18:11 hrs on the Chałupki – Krzyżanowice route, track no. 2, Cat. B level crossing at km 47.973 of railway line no. 151 Kędzierzyn-Koźle – Chałupki, the area of the infrastructure manager PKP PLK S.A., Railway Line Plant in Tarnowskie Góry*". In the latter occurrence, contributing factors included, in addition to the poor location of the pedestrian crossing (immediately at the exit barrier), the failure to remove the exit barrier. Had there been no exit barrier, the chances to avoid the occurrence would have been higher, the vehicle would have been able to leave to crossing zone. Following the issue of the recommendations in Report No. PKBWK 5/2023, the President of the Office of Rail Transport (UTK) reported that the average percentage of implementation of the recommendations was 91.
The Investigation Team also analysed occurrences that had been classified as Category C 66 incidents "*Failure of a road vehicle to stop ahead of a closed barrier (half-barrier), leading to damage to the barrier*

or road signals that displayed signal aspects warning of an oncoming train, without a collision with a rail vehicle". This category also includes occurrences in which road vehicles were closed at a level crossing and rammed the barrier rod in order to leave the danger zone of the crossing. There were 87 such cases in 2022, 82 in 2023, and the number fell significantly to 53 in 2024. The decrease in Category C66 occurrences between 2022 and 2023 was 5.7%, and between 2023 and 2024 it was 35.6%.
2022-2024 statistics on Category B level crossing occurrences classified as B19 accidents – *"A rail vehicle running into a road vehicle (other road/agricultural machinery) or vice versa at a level crossing equipped with an automatic crossing system with traffic lights and barriers (Cat. B)"* were as follows: 15 accidents were recorded in 2022, 11 accidents were recorded in 2023, and 7 accidents occurred in 2024. Here, too, there is a clear improvement, with a decrease by around 26.6% in 2023 and 36.6% in 2024.
As can be seen from the above analysis, the removal of exit half-barriers and the increased awareness and responsibility of drivers significantly contributes to the improvement of safety at level crossings, which is reflected in the statistics and the observed downward trends in the number of occurrences.

Crossing warning discs (TOP) have been installed for drivers of rail vehicles before many level crossings to inform the drivers whether the signalling equipment at the crossing is in working order and to show at what maximum speed the train should pass the crossing, depending on the serviceability of the equipment. The TOP disc gives two signals: Osp1 or Osp2. The Ie-1 (E-1) instruction on signalling operations provides that: *Signal Osp 1 "Signalling devices on the level crossing to which the signal refers are unserviceable; movement through the crossing at the speed of 20 km/h*", and *Signal Osp 2 "Signalling devices on the level crossing to which the signal refers are serviceable; movement through the crossing at the maximum permitted speed*". In the serious accident analysed in this Report, information was given to the train drivers from the ACS equipment via TOP the signal prohibiting entry to the crossing had been switched on, the equipment was operational and the train could proceed at the highest permitted speed (Osp2 displayed on TOP619N). From the moment train EIJ 5220 activated the ACS equipment until the TOP disc relating to that crossing was passed, the train drivers were informed for 18 seconds via the TOP disc that the signal prohibiting entry at the crossing was in working order and that the train should be driven at the highest permitted speed (i.e. up to 160 km/h). During these 18 seconds, the two drivers of road vehicles breached applicable traffic regulations (prohibition of driving beyond traffic lights showing two alternating flashing red lights) and caused a dangerous situation by staying in the zone secured by the barriers, but they managed to traverse the crossing. However, the third driver, also disregarding the signal prohibiting entry beyond the road traffic lights and the closing half-barriers, did not leave the crossing and stopped the vehicle in front of the closing exit barrier in the gauge of track no. 1. The automatic crossing systems currently in use, equipped with TOP discs for train drivers, are inadequate as they do not provide information to the train drivers about the real danger at the crossing (an obstacle in the path of the train). In the serious accident analysed, the estimated value of the losses was more than PLN 15 million and it was only thanks to a favourable coincidence that no one was killed or seriously injured. In the accidents cited in this Report that occurred in similar circumstances, the consequences included fatalities both among road users and train drivers operating rail vehicles. In the two cases cited in this Report, the entry of road vehicles to the crossing took place at a time when the ACS SSP equipment did not indicate an approaching train (they were on system standby), so the road user had the right to enter the crossing. When the automatic crossing system was activated by the train (through the train detection devices) and the system went into a warning state, the vehicles did not manage to leave the danger zone. The lack of information in the current automatic crossing systems with TOP about an obstacle in the train's path resulted in the train being driven at the maximum permitted speed. At high maximum train speeds, the driver's visual identification of an obstacle at the crossing and the implementation of emergency braking upon noticing it often ends in an accident with serious consequences due to the insufficient braking distance. Category B level crossings are crossings with a high volume of traffic (over 150,000), which indicates high traffic intensity and, therefore, an increased likelihood of a dangerous situation. When a laden lorry stops at a level crossing and a train hits it at high speed, the collision of such two masses causes serious consequences. An accident involving a train and a road vehicle where the load is a hazardous material can additionally result not only in great property damage and loss of life of the persons involved, but also in a threat to the life and health of the surrounding population and contamination of the environment. The currently used technical solution where TOP crossing warning discs, as part of the automatic crossing system, only inform the drivers of the working order of the crossing equipment and warn road users of an approaching train is not sufficient.

Since TOPs do not inform rail vehicle drivers about obstacles in the path of travel through the crossing zone, safety of train drivers, level crossing users and passengers is not ensured. The ACS devices installed at level crossings equipped with TOP discs should be retrofitted with systems identifying obstacles in the crossing zone and linked in such a way that only if there are no obstacles at the crossing, rail vehicles are allowed to travel at the highest permitted speed. Level crossings equipped with automatic crossing systems linked to or dependent on signalling equipment should also receive obstacle detection systems at the crossing.

Railway carrier PKP INTERCITY S.A.

The railway carrier operates under single safety certificate no. PL1020210197 issued by the President of the Office of Rail Transport for the period from 1 December 2021 to 1 December 2026. The rail vehicle designated to carry out a transport task by the railway undertaking held a Release for use/Return to service certificate. The designated train crew that operated train EIJ 5220 held all ratings and qualifications required by law. The train was run based on a timetable.

The responsibilities of railway carriers concerning safe operation of a rail vehicle are laid down in the infrastructure manager's "*Instruction on operating railway traffic Ir-1"*, "*Instruction on signalling operations Ie-1"* and the carrier's internal " *Instruction for a traction vehicle driver Bt-1"*. Based on an analysis of the collected evidence material, the Investigation Team did not identify any irregularities in the conduct of the train crew while they were driving the train.

1.2. The entities in charge of maintenance, the maintenance workshops, or any other maintenance suppliers

Not applicable.

1.3. Manufacturers of rolling stock or other suppliers of rail products

The Investigation Team did not identify any causal or contributing factors to the occurrence that would be linked to manufacturers of rolling stock or suppliers of rail product.

1.4. National safety authorities or the European Union Agency for Railways

The President of the Office of Rail Transport (UTK) supervises safety in railway traffic. Based on the evidence gathered in the case, the Investigation Team did not identify any factors indicating a connection between the national safety authorities and the occurrence.

1.5. Notified bodies, designated bodies or risk assessment bodies

Based on the evidence gathered in the case, the Investigation Team did not identify any factors related to notified bodies and risk assessment bodies that could have impact on the occurrence.

1.6. Certification bodies of entities in charge of maintenance mentioned under Point 1.2

The certification body for the railway carrier PKP Intercity S.A. as the entity responsible for maintenance as part of the Safety Management System (SMS) is the President of the Office of Rail Transport. Based on the evidence gathered in the case, the Investigation Team did not identify any factors on the side of the certification body of the railway carrier that would have impact on the occurrence.

1.7. Any other person or entity relevant to the occurrence, documented or not in one of the relevant safety management systems or referred to in a register or relevant legal framework

Not applicable.

2. Rolling stock and technical installations

Powered rail vehicle ED161-004 is equipped with the following safety automation systems, required and active when running:

- SIFA - a system designed to periodically check the train driver's vigilance. The train driver's inactivity automatically triggers emergency braking;
- Automatic Train Stop (SHP) - a point effect system. A railway vehicle element resonates with a trackside element installed in the track ahead of signals or requiring stop places, which will implement emergency braking to stop the rail vehicle before the signal or required stop place if the train driver fails to react,
- "Radio-stop" - a system which, when the A 1r "Alarm" radio signal is received by a rail vehicle in motion, results in the implementation of emergency braking, causing the train to stop.

In addition to the safety automation systems, rail vehicle ED161-004 was equipped with a Hasler TELOC 1500 event data recorder, type 5.2421.148/01, series 15055764, and a front-view image recording system. The event data of the rail vehicle running as train EIJ 5220 on 26 November 2024 were analysed. Below are screenshots from the analysis software and a description of the driving parameters. The table describes the designations used during the analysis.

Table 1 – A description of the designations used in the parameters analysed in the graphs.

Number in the charts	Description
1	Stop at Łowicz Główny station.
2	Rp1 signal "Attention" is given.
3	The train driver uses the vigilance button after the SHP system is activated.
4	Rp1 "Attention" is repeated.
5	Braking system response - air is discharged from the braking system when emergency braking is implemented with the use of a direct brake setter.
6	The "Radio-stop" system is activated and the A 1r "Alarm" signal is given.
7	Rp1 signal "Attention" is repeated.
8	The moment of impact.
9	The train stops.

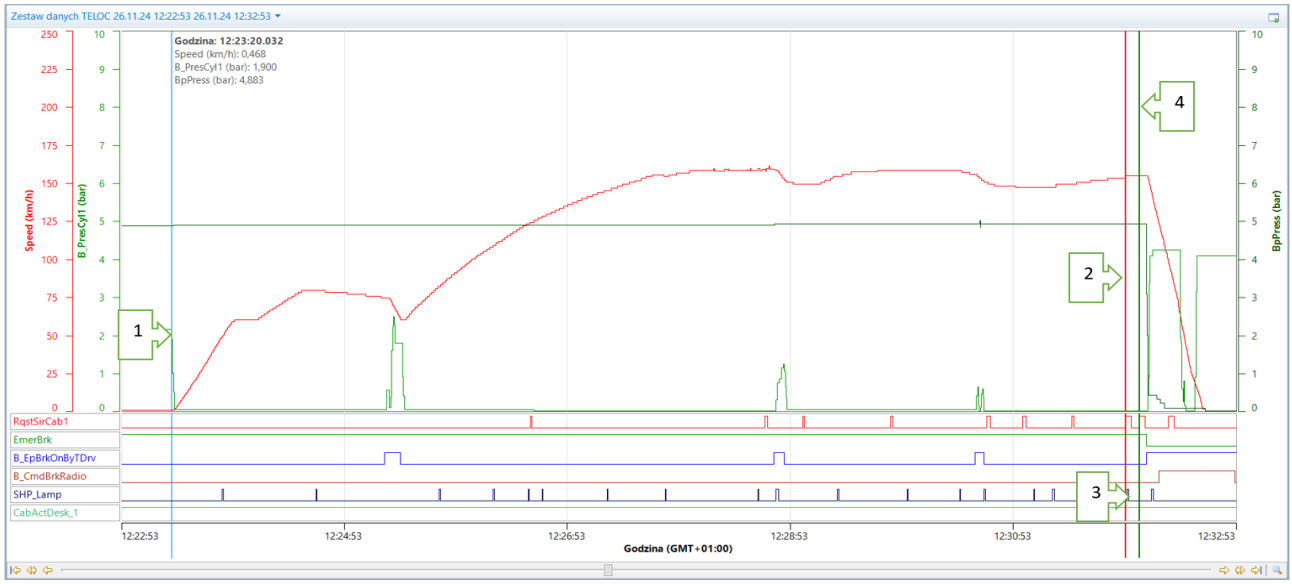


Figure 2 – A chart of the event data for EIJ 5220 train from Łowicz Główny station until the moment of the collision (prepared by PKBWK)

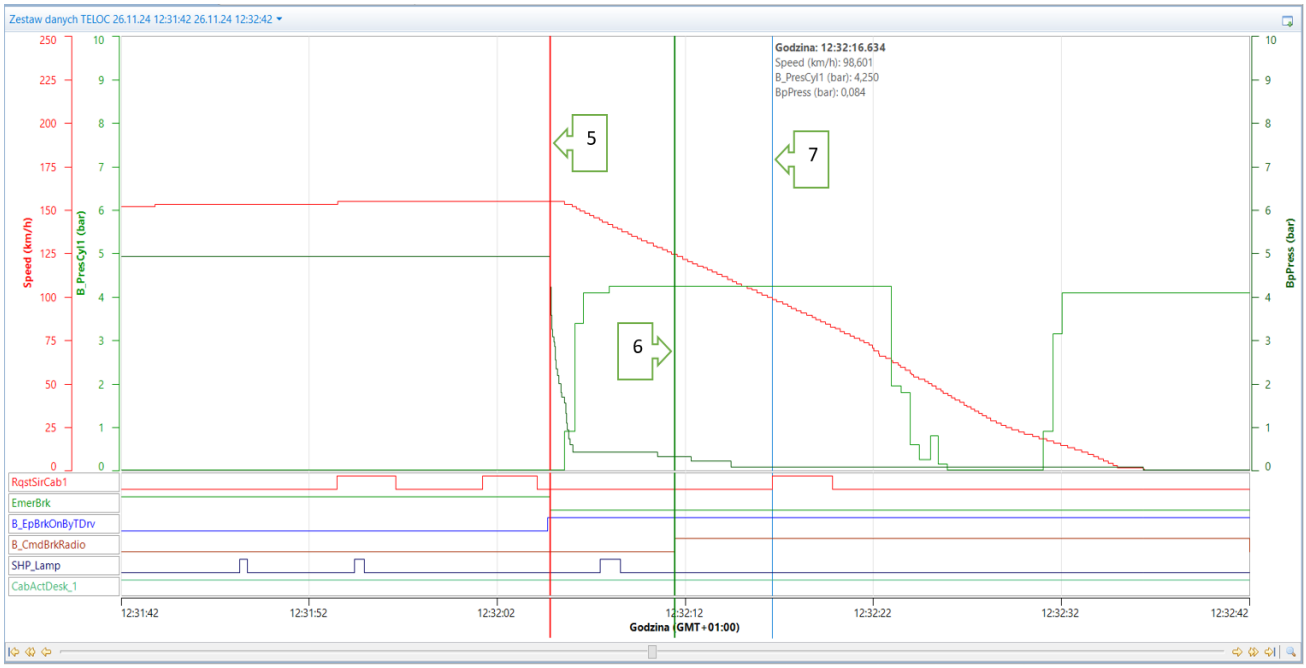


Figure 3 – A chart of the event data for train EIJ 5220 one minute before the impact (prepared by PKBWK)

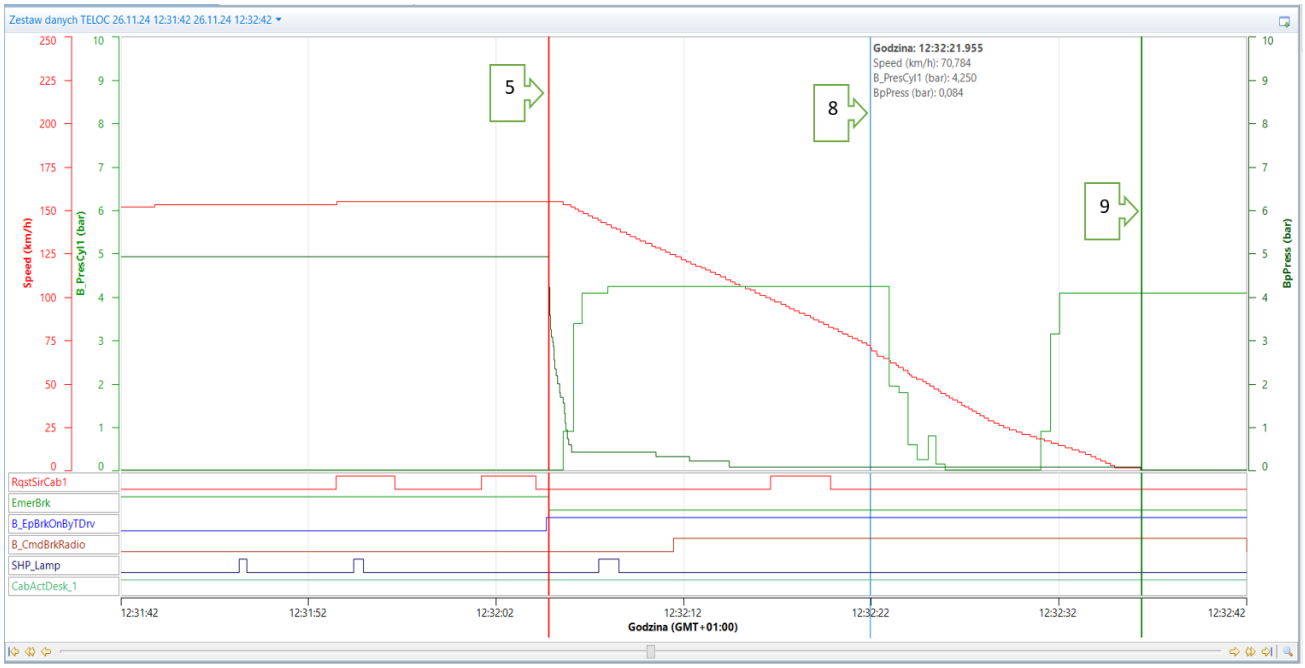


Figure 4 – A chart of the event data for train EIJ 5220 one minute before the impact, cont. (prepared by PKBWK)

Train EIJ 5220 departed from Łowicz Główny station according to the timetable at 12:23:20 hrs (Fig. 2, point 1). After covering 17.447 km at 12:31:53 hrs, travelling at 153.3 km/h, the train passes the W6b indicator located at kilometre 63.020. At the indicator, the train driver gives the Rp1 "Attention" signal for 3 seconds (Fig. 2, point 2). When giving the Rp1 "Attention" acoustic signal, the train driver acknowledges vigilance and deletes the activated SHP system (Fig.2, point 3). After travelling for 201 m, at 12:31:56 hrs, after getting out of the curve, despite not being required to give any acoustic signals, the train driver starts giving the Rp1 "Attention" acoustic signal for 3 seconds (Fig.2, point 4).

After travelling for 37 m from the point where the Rp1 "Attention" signal is terminated, at 12:32:04.8 hrs, there is air discharge from the braking system after the train driver implements emergency braking (Fig. 3 and 4, point 5). When emergency braking is implemented, the train is 543 m from the axis of the crossing and is travelling at 155.4 km/h. At 12:32:11 hrs, at the speed of 124.6 km/h, the train driver activates the "Radio-stop" system and gives the A 1r "Alarm" signal. This takes place 285 m from the axis of the crossing (Fig.3, point 6). Having

travelled 418 m since the emergency brake was implemented (125 m from the axis of the crossing), at 12:32:16 hrs, at the speed of 98.6 km/h, the train driver repeats the Rp1 "Attention" signal (Fig.3, point 7) which lasts for 3 seconds. At 12:32:22 hrs, the train hits the lorry at the speed of 70.7 km/h (Fig. 4, point 8). The head of the train stopped 112 m from the axis of the crossing at kilometre 61.830 at 12:32:36 hrs (Fig.4, point 9).
The time of the occurrence recorded by the recorder differs by 2 minutes from the time provided by the infrastructure manager in the notification.

3. Human factors

3.1. Human and individual characteristics

The evidence gathered by the Investigation Team shows that both the train drivers and the lorry driver were well rested and their mental and physical condition did not raise any concerns. The train drivers and the lorry driver were tested for alcohol after the occurrence, with a negative result in all cases. A significant factor that consequently led to the occurrence was the sudden stress reaction of the car driver as a result of the unexpected critical situation in which his lorry was closed in the crossing zone between the barriers. Despite sufficient time (38 seconds elapsed between the lorry coming to a halt on the crossing and the occurrence), the decisions taken did not lead to the vehicle being removed from the danger zone of the level crossing.

3.2. Job factors

There are two seats installed in the cab of ED161-004 (photograph 11). One is for the driver (pictured right), the other is for another person authorised to be in the in the cab. The installation of the seats in such a way, in the event of an emergency and the need to leave the cab immediately, makes evacuation from the cab virtually impossible; evacuation is significantly hindered where there is one person in the cab. Turning either seat blocks it against the other, thus blocking the escape route. Such positioning poses a threat to train drivers performing their duties on their work positions, especially as every second is of the utmost importance in the event of evacuation.
Analysis of the evidence gathered in the case confirmed the difficulties associated with evacuation from the driver's cab on ED161-004. After emergency braking was implemented and once it was clear that there was no way to avoid the accident, the train drivers decided to remain in the cab, as the time to evacuate the cab safely was too long due to the positioning of the seats. The Investigation Team considered this way of installation of the seats as another irregularity, unrelated to the incident.

Photograph 11 – A view of the seats installed in the cab of ED161 004 (photo by PKBWK)

3.3. Organisational factors and assignments

As it transpires from the evidence gathered by the Investigation Team, the employer provided the train drivers involved in the occurrence with the rest time required by law. The drivers of train no. EIJ 5220 had 12 hours of rest before starting their work. They had also received training required for operating ED161 series traction vehicles and had completed other training courses related to their job. The train drivers held all ratings and authorisations required by the applicable law and instructions for actions performed on the job concerned. The Investigation Team does not raise any objections concerning the carrier's organisational assignments. According to the recorded operation of the road vehicle, the driver had taken the required rest.

3.4. Environmental factors

The occurrence took place at a level crossing located after a passenger stop (looking in the train's direction of travel). After getting out of the curve 800 m ahead of the axis of the level crossing, the drivers of train EIJ 5220 had difficulty identifying the obstacle on the track, as the colour of the side of the lorry stationary on the level crossing was similar to the colour of the material from which the platform and platform edges were made. From this distance, the lorry merged with its surroundings, and the implementation of emergency

braking 543 metres before the crossing demonstrates correct monitoring of the track; however, at the speed of 155.4 km/h, the distance was too short to stop the train before the obstacle.

4. Feedback and control mechanisms, including risk and safety management as well as monitoring processes

4.1. The processes, the methods, the content and the results of risk assessment and monitoring activities, performed by any of the involved actors: railway undertakings, infrastructure managers, entities in charge of maintenance, maintenance workshops, other maintenance providers, manufacturers and any other actors, and the independent assessment reports referred in Article 6 of Implementing Regulation (EU) No 402/2013

The infrastructure manager PKP PLK S.A. keeps the so-called *Hazard Record* as part of its Safety Management System (SMS). The record is updated by the infrastructure manager on an on-going basis and contains the following elements: hazard name, hazard number, hazard source, outcomes, risk control measures, hazard source manager, and risk acceptance rules.
As part of the investigation, the Commission's Investigation Team analysed the contents of the *Hazard Record*, which is one of the most critical elements of the Safety Management System in place at the infrastructure manager PKP Polskie Linie Kolejowe S.A. The Investigation Team does not raise any comments concerning the Hazard Record.

Procedure SMS-PW-01 Maintenance of a railway line in technical and organisational serviceability.
The purpose of the procedure is to define the rules and processes of maintenance of railway lines in technical and organisational serviceability to ensure safe operation of railway traffic by PKP Polskie Linie Kolejowe S.A. Documents related to this procedure are, in particular: the Construction Law, the Rail Transport Act, national regulations, Book and procedures of the Safety Management System of PKP Polskie Linie Kolejowe S.A., Organisational Regulations of PKP Polskie Linie Kolejowe S.A., internal regulations of the Company concerning railway traffic ("Ir"), internal regulations of the Company concerning railways ("Id"). Maintenance of level crossings (of all categories) is described as a supporting process in procedure SMS-PW-01: "Maintenance of a railway line in technical and organisational serviceability" of the Safety Management System. According to §16 of SMS-PW-01, the sources for assessing the risk of a failure or accident shall be the parallel processes of level crossing diagnostics and surveillance, the results of level crossing inspections carried out in accordance with internal regulations, as well as information from outside. SMS-PW-01 includes a requirement to carry out diagnostic tests of the crossing at least once a year, including visibility condition checks, in accordance with the requirements of Instruction Id-1 and applicable Regulation of the Minister of Infrastructure and Development of 20 October 2015 on the technical conditions to be met by crossings of railway lines and sidings with roads, and on their positioning (Journal of Laws, item 1744, as amended). The diagnostic process is organised by the competent Director of the Railway Line Plant in cooperation with heads of diagnostic teams. Diagnostic team members analyse, evaluate and interpret the results of diagnostic tests, and formulate conclusions. The process of technical surveillance of level crossings, including their inspections (conducted by employees of the Operations Section and field commissions with the participation of a representative of the road manager) is organised separately by the Deputy Director of the Railway Line Plant for technical matters. Based on the information obtained from the infrastructure manager, 10 potentially dangerous situations were identified at the level crossing at km 61.941 of line no. 3 between 1 January 2022 and 30 June 2025. One involved a collision of road vehicles in the area of the crossing (with no train involved), and the others were classified as "*D73 - Damage to crossing equipment (identified when no rail vehicle was approaching the level crossing), or disruption to railway traffic - caused by inappropriate behaviour of a crossing user or hooliganism*". The effects of those occurrences included broken protections in the N1 half-barrier drive on four occasions, and broken protections in the N2 and N4 half-barrier drives on two occasions. In three other cases, the damaged or vandalised elements of the crossing protection system were not named. The Investigation Team does not raise any comments concerning execution of tasks under the procedure.

5. Previous occurrences of a similar character

As part of the investigation, the Investigation Team analysed selected accidents that occurred at level crossings under similar circumstances.

A brief description of the occurrences and their consequences.

1. An occurrence on 1 July 2024 at 09:19 hrs, at the Cat. B level crossing at km. 17.211 of railway line no. 3, Ożarów Mazowiecki - Błonie route: passenger train no. 91448 ran into a lorry with a semi-trailer stationary on the crossing. The lorry entered the crossing with the crossing barriers opened and automatic crossing signalling devices (ACS) switched off. As road vehicles ahead of the lorry stopped unexpectedly, a traffic jam was created and the vehicle was stopped on the level crossing. When the road vehicle was on the crossing, the oncoming train no. 91448 activated the automatic crossing system, causing the road traffic lights to switch on and the half-barriers to close. The road vehicle was unable to leave the crossing zone because of the cars on the road ahead of it. The lorry driver attempted to drive off the crossing, but due to a lack of space, the train travelling on track no. 2 hit the semi-trailer. As a result of the occurrence, the train driver died instantly. There were no other victims. The train driver's cab and the first section of rail vehicle ER75-001 were destroyed. The semi-trailer of the lorry was also destroyed, together with the cargo it was carrying (construction materials).

The Investigation Team considered the causal factor to be as follows:

- The lorry entering and remaining on the Cat. B level crossing on tracks 1 and 2 as the vehicles ahead of it stopped unexpectedly, which prevented the lorry from exiting the crossing and led to a passenger train travelling on track 2 colliding with the semi-trailer of the lorry.
- The lorry entering the crossing even though there was no room on the other side of the crossing to continue driving (Article 28(3)(2) of the Road Traffic Act).

The Investigation Team considered the contributing factors of the occurrence to be as follows:

- Failure to take special care when approaching and traversing the crossing.
- The road vehicles ahead of the lorry stopping and creating a traffic jam voivodeship road DW718, preventing the lorry from leaving the crossing zone at the time of the occurrence.
- Improper organisation of vehicle traffic in the area of the crossing causing road traffic jams at the crossing and in its vicinity, in particular too short a traffic lights cycle at the junction of voivodeship road no. DW718 and national road no. DK92 located approximately 330 m from the crossing.
- Ineffective checks at the crossing, failing to reveal recurring traffic jams at the crossing and the risks caused by the improper traffic organisation.
- Very high traffic volumes on voivodeship road DW718, which is a single level crossing, generated by the nearby exit from the A2 motorway.

The Investigation Team considered the systemic factors to be as follows:

- Despite the preventive measures taken by the railway infrastructure manager and the voivodeship road manager in connection with previous railway occurrences at the crossing concerned (accidents, incidents), the safety at the crossing was not ensured.
- Failure to implement the provisions of Agreement No. 25/MZDW/2018 signed on 22 May 2018 between the Municipality of Ożarów Mazowiecki, the Mazovian Voivodeship and PKP PLK S.A. on the construction of collision-free crossings, including a multi-level crossing, to replace the level crossing at km 17.211 of railway line no. 3.

2. An occurrence on 3 April 2019 at 15:44 hrs, on the Cat. B level crossing, with a properly operating signalling with four half-barriers (two entrance and two exit barriers) at km 152.183 on track no. 1 of railway line no. 271 Wrocław Główny – Poznań Główny, during which train IC 45101 operated by carrier PKP Intercity S.A. drove into an ambulance stationary between the closed barriers.

The driver of the ambulance passed a passenger car stationary before the closed entrance barrier and entered the level crossing while the exit barrier was closing. While the ambulance was driving through the level crossing, the exit barrier closed, preventing it from leaving the level crossing. The driver of the ambulance manoeuvred to keep the vehicle out of the track gauge but did not leave the crossing. The approaching train drove into the ambulance stationary on the crossing. As a result of the occurrence, two persons died instantly and the ambulance driver was taken to hospital. As a result of

the accident, the road vehicle was destroyed and the locomotive and wagons were damaged. The accident was investigated by a railway commission which considered the direct cause to be the ambulance's entry onto the crossing with the barriers down. The root cause of the accident was identified to be the car driver's failure to comply with the Road Traffic Act when approaching and traversing the level crossing.

3. On 20 February 2023 at 18:11 hrs on the Chałupki - Krzyżanowice route, track no. 2, the Category B level crossing at km 47.973 of railway line no. 151 Kędzierzyn-Koźle - Chałupki, freight train no. 441008 ran into a Scania road tractor with a semi-trailer.

After the passenger train had passed the crossing and the half-barriers were raised, the column of cars standing ahead of the crossing, including the Scania lorry, began to move. When the car column was traversing the crossing, the approaching train no. 441008 activated the automatic crossing system at the crossing. Due to pedestrian traffic at the foot path located in close proximity behind the exit barrier, the car column stopped to give way to the pedestrians. When the pedestrian traffic stopped, the lorry was closed on the crossing by the barriers. Oncoming train no. 441008 hit the semi-trailer of the lorry. No one was injured as a result of the occurrence; the semi-trailer and the right side of the locomotive were damaged.

The investigation was conducted by the State Commission on Railway Accident Investigation. In the course of the investigation, it was considered that the causal factor was the inability of the road tractor with the semi-trailer to drive off the Cat. B level crossing because of the proximity of the pedestrian crossing and the requirement for vehicles to stop in order to give way to the pedestrians when there is pedestrian traffic at the crossing. Contributing factors identified by the Investigation Team included, among others, failure to implement Recommendation *No. 2, Item 4.2 from the 2018 Annual Report of PKBWK* regarding the removal of exit half-barriers.

4. On 3 February 2022 at 06:14 hrs on the Warlubie - Laskowice Pomorskie route, track no. 2, the Category B level crossing at km 437.386 of railway line no. 131 Chorzów Batory - Tczew, passenger train IC 5600 ran into a bus standing on the crossing.

After a freight train passed on track no. 1, the barriers started to go up and before they reached the vertical position the bus entered the crossing. At that point, train IC 5600, approaching the crossing, re-engaged the automatic crossing system. The bus was closed on the crossing and did not leave the crossing zone. As a result of the occurrence, the bus driver died instantly.

The PKBWK Investigation Team considered the causal factor of the occurrence to be as follows:

- Entry of the bus while the road traffic lights were giving the signal prohibiting entry beyond the traffic lights.

The Investigation Team considered the contributing factors of the occurrence to be as follows:

- The inability of lorries and buses to drive off the level crossing when the half-barriers closed without damaging the crossing's infrastructure and traffic safety equipment, resulting from the presence of the following facilities:
  - a concrete fencing and an S-4 traffic signal installed within the road gauge at the exit section of the crossing,
  - a tree growing 11 metres from the railhead and in front of the crossing,
  - a road in curve, sharp left turn immediately after the crossing.
- Failure of the bus driver to make a determined attempt to drive off the crossing by breaking a half-barrier.

The following can be concluded from an analysis of the aforementioned incidents that occurred in similar circumstances.

1. In all cases, the train approached the crossing at maximum speed, as indicated by the traffic safety devices, even though there was an obstacle in the train's path. The obstacle is often heavy vehicles, which, combined with speed, aggravates the consequences of occurrences.
2. Vehicle drivers do not have sufficient knowledge of how to behave a a Cat. B an automatic level crossing in case they are closed at the crossing. In an attempt to avoid damaging the semi-barriers and cars, they try to manoeuvre within the crossing. Such an approach in most cases ends in a collision with a train, the consequences of which are often tragic.
3. Traffic violations by level crossing users when traversing level crossings.

4. Failure to remove the exit half-barriers to allow road vehicles to exit safely from the crossing (implementation of Recommendation *no. 2, point 4.2 from the 2018 PKBWK Annual Report*).

V. CONCLUSIONS

1. A summary of the analysis and conclusions with regard to the causes of the occurrence

The analysis of safety at Category B level crossings in 2022- 2024 shows that the infrastructure manager performs its infrastructure maintenance responsibilities correctly. The Investigation Team raises no reservations concerning the execution of the railway carrier's tasks either.

The Investigation Team considered the causal factor to be as follows:

- the entry of the road vehicle onto the level crossing while the half-barriers were being lowered a signal was being given by the road traffic lights prohibiting entry beyond the lights, and the road vehicle's discontinuation of traversing and leaving the crossing.

The Investigation Team found the following to be contributing factors of the occurrence:

- stopping and leaving the road vehicle on the crossing in the gauge of track no. 1,
- the occurrence of a sudden stress reaction in the road vehicle driver as a result of an unexpected critical situation involving the closure of the lorry in the crossing zone between the closed barriers,
- failure of the driver of the road vehicle to take special care when traversing the level crossing,
- Failure to implement 100% of Recommendation no. 2 from the 2018 PKBWK Annual Report, which reads "*Infrastructure managers shall eliminate exit barriers in automatic level crossing systems at Category B level crossings where the four half-barrier solution is used, and, where justified by local conditions, shall notify the road manager of the need to put in place safeguards on the approach to a Category B level crossing to prevent road vehicles entering onto the level crossing on a lane that allows bypassing a closed barrier, in particular by means of separation strips or separators. (...)*".

In addition, the following systemic factor was identified:

- The system of crossing warning discs (TOP) in use, positioned at the trackside before level crossings, does not advise train drivers that the crossing zone (the length of the crossing) is occupied. Such a design of the system does not ensure compliance with safety requirements.

A train travelling at the highest permitted speed when there is an obstacle on the level crossing poses a threat to life, health, property and the environment. In order to improve safety, the Investigation Team recommends developing an plan for retrofitting level crossings with sensors for detecting objects in the crossing's danger zone (the length of the crossing) based on existing and new technical solutions.

Since 2018, the State Commission on Railway Accident Investigation has consistently recommended the removal of the half-barriers at Cat. B level crossings as a safety improvement at level crossings to allow vehicles to drive off the level crossing in the event a vehicle is closed in the zone secured by the barriers. Implementation of this recommendation reached 91% in 2023. An additional element contributing to safety improvements involves the public campaigns carried out by various entities to raise drivers' awareness, and legal regulations aimed at disciplining the drivers. The effectiveness of these measures is confirmed by statistics: the number of C66 incidents (damage to half-barriers or signals due to non-compliance with regulations) decreased from 87 in 2022 to 53 in 2024, while the number of B19 incidents (a railway vehicle running into a road vehicle) fell from 15 to 7 in the same period. In the opinion of the Investigation Team, the decrease is due to a synergy of the technical, organisational and educational measures, and these measures should be continued.

2. Measures taken since the occurrence

During the reconstruction of the damaged crossing safety equipment, a project was developed and executed taking into account the implementation of Recommendation *2, point 4.2 from the 2018 PKBWK Annual Report*. The level crossing has been fitted with entrance barriers and the exit barriers were removed.

3. Additional comments

During a post-occurrence inspection and after analysing the documentation collected, the Investigation Team found that it was difficult for the train drivers to evacuate from the cab in the event of an emergency. This fact was considered by the Investigation Team as another irregularity unrelated to the causes of the occurrence.

VI. SAFETY RECOMMENDATIONS

1) Infrastructure managers that have not implemented 100% of "*Recommendation No. 2 from the 2018 PKBWK Annual Report"* shall step up the implementation of the recommendation and submit to the President of the Office of Rail Transport a schedule of actions aimed at eliminating exit semi-barriers at Cat. B level crossings.

2) Railway carriers operating powered railway vehicles shall conduct safety inspections of train driver cabs, focusing in particular on whether the driver emergency evacuation is hindered where there are two seats in the cab. If any difficulties are identified, they shall take appropriate actions to eliminate them.

3) Infrastructure managers shall take actions to retrofit level crossings with a system for detecting obstacles in the crossing zone.

STATE COMMISSION ON RAILWAY ACCIDENT INVESTIGATION
CHAIRMAN

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Tadeusz Ryś

List of acronyms used in Report **No. PKBWK 7/2025**

#	Symbol (acronym)	Explanation
1	*2*	*3*
1.	EUAR	European Union Agency for Railways
2.	PKBWK	State Commission on Railway Accident Investigation (Polish: Państwowa Komisja Badania Wypadków Kolejowych)
3.	UTK	Office of Rail Transport (Polish: Urząd Transportu Kolejowego)
4.	IZ	PKP PLK S.A. Railway Line Plant
5.	ISE	Operation Section of the Railway Line Plant
6.	SSP	Automatic Crossing System (Polish: Samoczynny System Przejazdowy)
7.	SRK	Rail Traffic Control (Polish: Sterowanie Ruchem Kolejowym)
8.	SHP	Automatic Train Stop (Polish: Samoczynne Hamowanie Pociągu)