STATE COMMISSION ON RAILWAY ACCIDENT INVESTIGATION
Ministry of the Interior and Administration

REPORT No. PKBWK 5/2024

on the investigation of a railway accident
that occurred on 12 April 2022 at 09:22 hrs at Poznań Główny station
at turnout no. 140 in track 51, at km -0.181 of railway line no. 351
Poznań Główny - Szczecin Główny,
the area the infrastructure manager PKP PLK S.A. Railway Line Plant in Poznań

WARSAW, 10 June 2024

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 *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 L 132 of 27 April 2020)*

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I. SUMMARY

Type of occurrence: Accident.

Description: PKP CARGO S.A.'s train THE 575001 travelling from Bydgoszcz Wschód Towarowa to Poznań Główny consisted of active lead locomotive EU07-1529 and locomotive SM42-1290. The train was received from the direction of Poznań Wschód station to Poznań Główny station at 09:21 hrs on the permissive aspect displayed on the$^{B1/2/4}$ home signal. It then continued onto track 51 at the permissive aspect S13 "*proceed at a speed not exceeding 40 km/h and stop at the next semaphore"* displayed on the intermediate signal G2$^{1/2/m}$. This indication was valid until signal M51, the last one on the route, positioned at track 51b, marking the end of train route $G2^{2}_{51b}$. During the execution of the train route, the signaller "position C" entered the special command "ZW" into the computer railway traffic control system (*temporary route release*) for the release of the route until signal M51$^{1/2/4/m}$. Subsequently, the signaller "position D" gave a computer command to set the shunting route from shunt signal Tm60 to signal M55. As a result of the command (despite train THE 575001 proceeded at a speed of approximately 6 km/h), the switch of turnout no. 140 on the route was moved to the minus (-) position, directing it to turnout no. 141 on track 55. At that time, lead locomotive EU07-1529 was passing through turnout no. 140 and double tracking took place. This caused the locomotive to derail with two wheelstes of the first bogie and the first wheelset of the second bogie. The second locomotive did not derail because it entered the already switched switch of turnout no. 140.

Date of the occurrence: 12 April 2022, 09:22 hrs.

Location of the occurrence: Railway line no. 351 Poznań Główny - Szczecin Główny, turnout no. 140 in track 51 of Poznań Główny station, km -0.181; geographical location 52°23'59.9"N 16°54'37.9"E.

Consequences of the occurrence: Damaged turnout no. 140 and locomotive EU07-1529. Station track 51 from Tm60 to the fouling point of turnout no. 140 out of service until completion of repairs.

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)

Introduction into the computer system of a command to set a shunting route from track 51 to track 55 while train THE 575001 was proceeding on track 51 towards track 51b to execute train route $G2^{2}_{51b}$, which led to the switch of turnout no. 140 to be switched to the minus (-) position while being entered by locomotive EU07-1529, and to the derailment of the locomotive.

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) Inappropriate organisation of traffic through accepting of train THE 575001 on track 51b (route $G1^{2}_{51b}$) of Poznań Główny station with a plan to further divert the train to track 55, with the possibility of using direct route $G2^{2}_{55}$ (diverting to track 55).
2) Releasing the route by introducing the special command "ZW" during the execution of train route $G2^{2}_{51b}$.

3) The use of the special command "ZW" despite not fulfilling the conditions for its use provided in the Ie-20 Instruction (§13(4), §14(4) and §15(3)) without making entries in the relevant documentation and without notifying the maintenance staff.

Systemic factors:
(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, skills of the staff, procedures and maintenance)

1) Allowing the use of the special command "ZW" in the computer rail traffic control system for releasing routes $J53^{2}_{51b}$, $G1^{2}_{51b}$, $G2^{2}_{51b}$, without the required time delay indicated by *Technical Standards for Rail Traffic Control Equipment* and *Operator Manual for Poznań Railway Node E-20*.
2) The adopted organisation of traffic of passenger trains terminating on track 51 at Poznań Główny station, with the application of the special order "ZW" by signallers to release train routes: $J53^{2}_{51b}$, $G1^{2}_{51b}$, $G2^{2}_{51b}$, causing a hazard to rail traffic safety.
3) Non-compliance of the Technical Regulations of Poznań Główny station in Section 32, which establishes a route place for routes behind the *"IZ131c/d"* occupancy control section instead behind the turnout no. 140 occupancy detection section, as provided in : $J53^{2}_{51b}$, $G1^{2}_{51b}$, $G2^{2}_{51b}$ route sheets, posing a hazard to rail traffic safety.

Recommendations and their addressees:

1) In order to ensure safe organisation of traffic for trains terminating on track 51 at Poznań Główny station, PKP PLK S.A. IZ Poznań shall install an intermediate signal instead of the Tm60 shield to change the location of the route place.
2) Until the implementation of Recommendation 1, PKP PLK S.A. IZ Poznań shall specify - in *Section 22. Other provisions not covered in the preceding provisions* in Paragraph 12 of *Technical Regulations of Poznań station* - detailed rules of conduct in the event of the need to use the special command "ZW" deviating from the provisions contained in §46(4) and (8) of
Instruction Ir-1 and in §13(4) and §14(4) of Instruction Ie-20.
3) PKP PLK S.A., together with the system supplier, shall adapt the computer system at Poznań Główny station - special command "ZW",
specifying the required time delay in accordance with applicable *Technical Standards for Rail Traffic Control Devices*
and *Operator Manual for Poznań Railway Node E-20*.
4) PKP PLK S.A. IZ Poznań shall bring the road plan into line with the actual situation - (the location of indicator W4 at track 51).
5) Authorised railway infrastructure managers and infrastructure managers operating under a safety certificate and exempt from the requirement to obtain a safety authorisation shall verify, at posts equipped with computer rail traffic control equipment, the advisability of using the special order to release a route on an ad hoc basis (e.g. ZW; PZA; ...) with regard to compliance with the rules on the safety of operation of rail traffic.
6) PKP CARGO S.A. shall implement order no. DBK-550/R-03/KB/12 of the President of the Rail Transport Office of 30 May 2012 addressed to railway carriers on the obligation to install recording devices - digital cameras or video recorders in newly built and operating railway vehicles.
7) PKP PLK S.A. shall supplement the Hazard Record by adding another hazard: "*Clauses on traffic organisation in the Technical Regulations of the traffic service station incompatible with applicable regulations*".

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8) PKP PLK S.A. IZ Poznań shall take actions to rectify the irregularities referred to in Point 3.4 of Chapter IV, i.e. to improve the ergonomics of the workstations of signallers at the CTC signal box of Poznań Główny station.
9) Authorised infrastructure managers shall include in the Hazard Record the hazard associated with inappropriate ergonomics of signaller duty stations. In addition, they shall verify the ergonomics of signaller duty stations where several duty stations are located in close proximity in the same room; and if any irregularities are detected, they shall take actions to improve the working conditions of signallers.

II. THE INVESTIGATION AND ITS CONTEXT

1. The decision to establish an investigation

The Chairman of the State Commission on Rail Accident Investigation (hereinafter referred to as "PKBWK" or "the Commission") Mr. Tadeusz Ryś issued Decision no. PKBWK.590.8.2023 of 14 June 2023 on establishing an investigation into the circumstances of the railway occurrence that took place on 12 April 2022 at 09:22 hrs at Poznań Główny station, turnout no. 140, track 51, km -0.181 of railway line no. 140 Poznań Główny - Szczecin Główny. Pursuant to the provisions of Article 28e(4) of the Act of 28 March 2003 on rail transport (consolidated text: Journal of Laws of 2023, item 602, 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 number PL-10422.

2. The motivation to the decision to establish an investigation

In view of the request made by the infrastructure manager represented by the Chairman of the railway commission, as stipulated in Article 28e(3)(4) of the Railway Transport Act (letter of 30 May 2023), and after reviewing the submitted documentation and discussing it at a meeting on 13 June 2023 with the members of the railway commission, the Chairman of PKBWK decided
to establish an investigation to be conducted by the Commission in accordance with Article 28e(3)(4) of the Railway Transport Act by appointing a Commission Investigation Team (hereinafter referred to as the "Investigation Team").

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

The investigation was taken over from the railway commission 14 months after the date of the occurrence. The PKBWK Investigation Team used materials gathered by the railway commission and inspected the place of the occurrence during an on-site inspection.
In view of the need to clarify the contributing factors and recommendations, in particular concerning the use of the special command "ZW" in computer rail traffic control systems, and taking into account the nature of the occurrence, its seriousness and bearing in mind the complexity of the problem and the likelihood of similar cases occurring at infrastructure managers, the Investigation Team has extended the time limit for the completion of the investigation in order to reach a final position. In accordance with Article 28l(5a) of the Railway Transport Act, the Commission has drawn up Interim Report No. PKBWK 01/T1/2024 of 20 March 2024.

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

The Chairman of the Commission nominated an 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 PKBWK Chairman obliged specific persons from the railway commission to cooperate with the Investigation Team (letter no. PKBWK.590.8.1.2023 of 14 June 2023).
On 4 July 2023, the chairman of the railway commission formally submitted the documentation gathered by the railway commission in relation to the occurrence concerned to the head of the Commission's Investigation Team.

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

During 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

In the course of the investigation, the Investigation Team took into account the provisions of national regulations, the internal rules of the infrastructure manager and the railway carrier as well as the technical documentation of Poznań Główny station. Moreover, the Investigation Team relied on their own knowledge and experience.
The documentation prepared by the Investigation Team and the documentation gathered by the railway commission were used.
Within the investigation, the Investigation Team carried out inter alia the following activities:

- visual inspection of the place of the occurrence during an on-site visit,
- preparation of photographic documentation,
- analysis of the documentation and voice recorder recordings provided by the infrastructure manager and the railway carrier,
- analysis of the documentation provided by the manufacturer of the rail traffic control equipment,
- analysis of the data from the rail vehicle's event data recorder (EU07-1529).

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

European Union rules:

1) 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 L 119, 04.05.2016, p. 1, as amended).
2) 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 L 132, 27.04.2020).
3) Directive 2016/798/EC of the European Parliament and of the Council of 11 May 2016 on railway safety (OJ L 138, 04.05.2016, p. 102, as amended);

National rules:

1) Act of 28 March 2003 on rail transport (consolidated text: Journal of Laws of 2023, item 602, as amended).

2) Act of 7 July 1994 on the Construction Law (consolidated text: Journal of Laws of 2023, item 682, as amended).
3) Regulation of the Minister of Infrastructure of 18 July 2005 on general conditions for rail traffic operation and signalling (consolidated text: Journal of Laws of 2015, item 360, as amended).
4) 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 of 2021, item 101).
5) Act of 10 May 2018 on the protection of personal data (Journal of Laws of 2018, item 1000).
6) 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).

Internal instructions of infrastructure manager PKP PLK S.A.

1) Ir-1 Instruction on the conduct of train traffic operations.
2) Ir-2 (R-7) Instruction for signal box personnel.
3) Ir-3 (R-9) Instruction on drafting technical regulations.
4) Ir-5 (Ir-12) Instruction on the use of train radio equipment.
5) Ir-8 Instruction on the handling of serious accidents, accidents and incidents in rail transport.
6) Ir-9 Instruction on the shunting technique.
7) Ir-11 Train timetable manual.
8) Ie-1 Instruction on signalling.
9) Ie-2 (E-3) Instruction on fixed line telephone traffic communication.
10) Ie-4 (WTB-E10) Technical guidelines on the construction of rail traffic control devices.
11) Ie-5 (Ie-11) Instruction on the rules of operating and conducting works on rail traffic control devices.
12) Ie-6 (WOT-12) Guidelines for technical acceptance and commissioning of rail traffic control devices.
13) Ie-7 (E-14) Instruction on technical diagnostics and periodic inspections of rail traffic control devices.
14) Ie-14 Instruction on the organisation and use of radiotelephone networks.
15) Ie-20 Instruction on the operation of computer rail traffic control systems at PKP Polskie Linie Kolejowe S.A.
16) Ie-20a Guidelines for the preparation of workstation manuals for the operation of computer rail traffic control devices.
17) Ie-102 Technical requirements for indicators and signal discs.
18) Ie-104 Requirements on imaging, command input and event logging for computer workstations operating rail traffic control devices.
19) Id-1 Technical conditions on the maintenance of the surface of railway lines.
20) Id-12 (D-29) List of lines.
21) Ik-2 Instruction on inspections concerning railway traffic safety.
22) Technical Standards - Detailed technical conditions for the upgrading or construction of railway lines for speeds Vmax≤250 km/h VOLUME IV SIGNALLING, CONTROL AND TRAFFIC MANAGEMENT.

Internal instructions of railway carrier PKP CARGO S.A.

1) Ct-1 Instruction for a traction vehicle driver.

Documentation provided by Thales Polska sp. z o. o.

1) ESTW L90 5 Operator Manual for Poznań Railway Node E-20.
2) ESTW L90 5 Technical and Operational Documentation.
3) Operator Manual for the Command 900 system Poznań Railway Node E-20.

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

Since the Commission took over the investigation from the railway commission 14 months after the date of the occurrence, the Investigation Team relied mainly on the material gathered by the railway commission. Determining the exact location of the derailment site and the kilometre where the locomotive's head stopped was impossible due to shortcomings in the material taken over, and the traces of the derailment in the field had been obliterated. These difficulties did not affect the investigation, the determination of the mechanism of the derailment, the causal, contributing and systemic factors or the recommendations and conclusions presented.

9. Any interaction with the judicial authorities

Not applicable.

10. Other information relevant in the context of the investigation

Not applicable.

III. Description of the occurrence:

1. The occurrence and background information

1.1. The description of the occurrence type

An accident involving the switching of the switch in turnout no. 140 installed in station track 51 of Poznań Główny station underneath a passing locomotive EU07-1529 leading train THE 575001, which led to double-tracking and the derailment with two wheelstes of the first bogie and the first wheelset of the second bogie. The second locomotive did not derail because it entered the already switched switch of turnout no. 140.

1.2 The date, exact time and location of the occurrence

The occurrence took place on 12 April 2022 at 09:22 hrs, at Poznań Główny station, at junction no. 140 in track 51, km -0.181 of railway line no. 351 Poznań Główny - Szczecin Główny, the area of infrastructure manager PKP PLK S.A. Railway Line Plant in Poznań.

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 occurrence took place on the Poznań Główny Centralised Traffic Control (LCS) section located at Poznań Główny station. Train movements and rolling stock shunting are directed by a train dispatcher, with the assistance of signallers at operator stations: A, B, C, D and G from the PoA remote control signal box. The detailed scope of responsibilities of the individual operator stations is described in Section IV. 3.4.

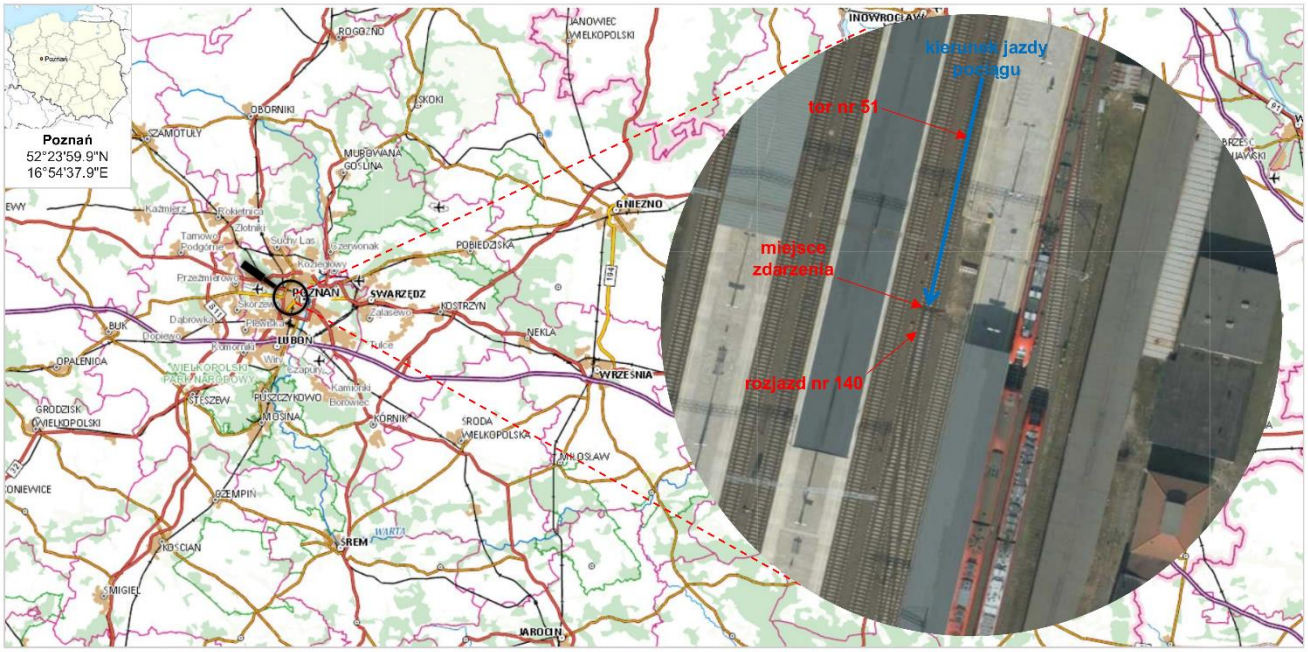


Figure 1 - A general view of the incident site (source: Geoportal)

Track 51 where the occurrence took place is located on the station plane of line no. 351. The beginning of turnout no. 140, where the derailment occurred, is at km -0.181 of that line. The turnout allows passage from track 51 onto track 55 via turnout route 140/141 and vice versa. Ahead of turnout no. 140, on the right, there is a dwarf shunting disc Tm60 relating to track 51.

Along the left-hand side of track 51 (looking in the train's driving direction), there is Platform 8 (formerly 4), 316 m long and 55 cm high; a W4 indicator is positioned on the leading edge of the platform and relates to the said track, as it applies only to trains carrying passenger traffic. Behind the leading edge of Platform 8 there is a sand-cushioned buffer stop which is the terminus of track 55a, leading to the left-hand ordinary turnout no. 141 from which track 55 starts. Along the track 55a and 55 buffer stop there is Platform 7 (formerly 4a), 184 m long and 55 cm high, connected to Platform 8. The aforementioned tracks are electrified.

Photograph 1 - A general view of the occurrence site (source: PKBWK's own material)

Meteorological conditions were good, with moderate cloud cover, no precipitation, visibility and audibility good, air temperature +10˚C, other weather phenomena not present. No works were being carried out at or near the site.

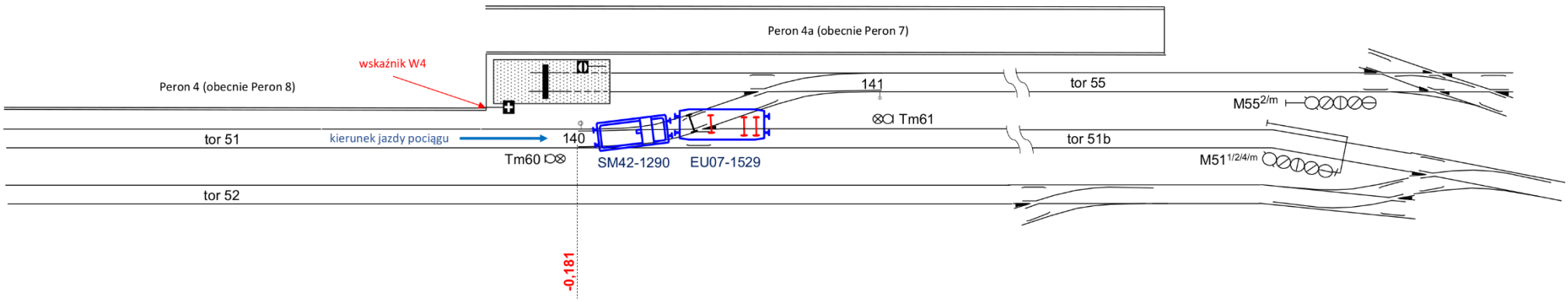


Figure 2 - A sketch of the accident scene

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

No one was injured as a result of the accident.

b) cargo, luggage and other property

None.

c) rolling stock, infrastructure and the environment

As a result of the derailment of locomotive EU07-1529 leading train THE 575001, the rolling surfaces of three wheelsets were damaged. The locomotive was sent for wheelset reprofiling. There was no other damage to the train set.
The half switch of turnout no. 140, the wheel detector and 35 alloy bolts were damaged.
There were no losses to the environment.

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, track 51 at Poznań Główny station was closed from the shunting disc Tm60 to the fouling point of turnout no. 140, with the overhead line over tracks 51, 55, 57 and 62 de-energised.
The occurrence did not affect the regularity of train operations.

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

- the train driver driving train THE 575001 - an employee of the carrier PKP CARGO S.A. Northern Plant of the Company,
- the pilot driver - an employee of the carrier PKP CARGO S.A. Western Plant of the Company,
- the dispatcher - an employee of PKP PLK S.A. Railway Line Plant in Poznań, Poznań Główny Operation Section,
- the dispatcher at "station C" - an employee of PKP PLK S.A. Railway Line Plant in Poznań, Poznań Główny Operation Section,
- the dispatcher at "station D" - an employee of PKP PLK S.A. Railway Line Plant in Poznań, Poznań Główny Operation Section.

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

Train THE 575001 travelling from Bydgoszcz Wschód Towarowa to Poznań Główny, led by electric locomotive EU07-1259, including diesel locomotive 6Dg/B.
Locomotive EU07-1259 of PKP CARGO S.A. carrying a rail vehicle identifier: PL-PKPC 91 51 5 140 101-4; type: 303Eb, year of manufacture 1970, serial number: 132; manufactured by PAFAWAG-Wrocław; rail vehicle type operation approval certificate no. T/2012/0284; technical railworthiness certificate no. COTO2415/2022 dated 7 April 2022, issued in Bydgoszcz, valid until 6 April 2030 for the mileage of 500,000 km counted from 113 km.
Train data:

- train length……..…… 30 m
- total weight of the train…….. 153 t
- required braked mass percentage…..… 54 %
- actual braked mass percentage…..… 81 %
- required braked mass…… 84 t

– actual braked mass…… 125 t

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

Track 51

Rail type……..	–	60E1, contactless track
Sleepers…….	–	pre-stressed concrete K94 type
Attachment type……	–	type SB
Ballast type……..	–	crushed stone
Turnout no. 140	–	common left Rz60E1 - 1:9 - 190
Highest permitted speed in the station.....	–	60 km/h for freight trains

Track condition good.

Turnout switch equipped with a EEA-5 type non-split switch drive with needle control, translation time 5s. Command and control of rail traffic is carried out using the Thales Command 900 computer remote control system - HMI system (for local and centralised control), the Thales ESTW L90 5 electronic interlocking, and the Thales AzLM electronic axle counter system. Each Thales ESTW L90 5 interlocking consists of the so-called interlocking module (IM), which controls the interlocking logic and field element controllers (respectively, IL and FEC), which in turn control trackside equipment such as switch actuators and signals.

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

The modernisation of Poznań Główny station did not provide for the installation of an intermediate signal at track 51 ahead of turnout no. 140 with preservation of the overlap, but instead a Tm60 dwarf shunting disc was designed and installed, allowing shunting work to be carried out if the route is not used in its entirety, thus making it necessary to release the route using the special command "ZW".

Due to the lack of ad hoc train route release with time delay, the solutions adopted in train traffic control devices at Poznań Główny station are contrary to *TECHNICAL STANDARDS - Detailed technical conditions for modernisation or construction of railway lines for speeds Vmax ≤ 250 km/h VOLUME VI SIGNALLING, CONTROL AND TRAFFIC MANAGEMENT"* applicable to railway traffic control devices.

In accordance with the Technical Standards, *in Station Traffic Control Systems: The overlap of the train route shall be released with a time delay in relation to the release of the last element of the route for which it was established. The time delay should be determined on a case-by-case basis taking into account the conditions existing at the station.*

Furthermore, the *"Operator Manual for Poznań Railway Node E-20" specifies that: "Release of the route by the operator, if the route has already been set and is to be released, can be done by a route release command. Two different commands are used depending on the state of the route:*

- release of the route without delay or with a time delay, from the starting point;

- release of the unused part of the route (always with a time delay), from the route destination point. The route release delay time is by design and is within the range of 0 to 120 seconds."

Furthermore, according to the aforementioned *Operator Manual*, the route release without time delay is permitted where:

- track sections of the route are not or have not been occupied,
- track sections of the approach area are not or have not been occupied.

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 12 April 2022, on the basis of an individual timetable, train number THE 575001 of the carrier PKP CARGO was launched from Bydgoszcz Wschód Towarowa to Poznań Główny. The purpose of the train's arrival was to carry out RSC (Radio System Compatibility) tests of the on-board equipment of locomotives EU07-1529 and SM42-1290 with the Global System for Mobile Communications – Railway (GSM-R) at Poznań Główny station.

On the Bydgoszcz Główna - Kobylnica section, train THE 575001 was operated by a single driver instructor with knowledge of the railway line sections up to Kobylnica station. At Kobylnica station, the train crew was supplemented by a driver with documented knowledge of the railway line section from Kobylnica station to Poznań Główny station. The train dispatcher at the "PoA" command box established the reason for the arrival at Poznań Główny station with the train driver and indicated the target track 70 without catenary for the locomotives to be delivered.

Subsequently, the dispatcher at the PoA command box gave ordered the signallers at stations C and D to prepare the route for the entry of train THE 575001 onto station track 51 (route $G2^{2}_{51b}$), then to switch it to track 55 and to deliver it on track 70.

After the driver had stopped the train in front of the $B^{1/2/4}$ home signal of Poznań Główny station set to the S1 "Stop" aspect, the driver instructor called the signaller at the "PoA" command box by radio-telephone, informing him of the stop, while checking the communication. The "station C" signaller acknowledged communication and informed the driver that there was no entry for the time being. Subsequently, after approximately 3 minutes, the "station C" traffic officer gave the computer command to set the train route from home signal $B^{1/2/4}$ to intermediate signal $G2^{1/2/4}$. Next, at 09:18:26 hrs (computer system time), he gave the order to set the train route from intermediate signal $G2^{1/2/m}$ to exit signal $M51^{1/2/4/m}$. At 09:18:31 hrs, train THE 575001 passed home signal $B^{1/2/4}$ and continued towards the intermediate signal. During the execution of the train route, the train crew received the following radio communication from the "station C" signaller, quote: "*575001, enter 51 for now, when possible the colleague will clear for 55 and you run up there*".

At 09:18:37 hrs, route $G2^{2}_{51b}$ was fixed on intermediate signal $G2^{1/2/m}$ of Poznań Główny station with the aspect S13 *"Proceed at a speed not exceeding 40 km/h, and Stop at the next signal"* (track 55 free, see Figure 3).

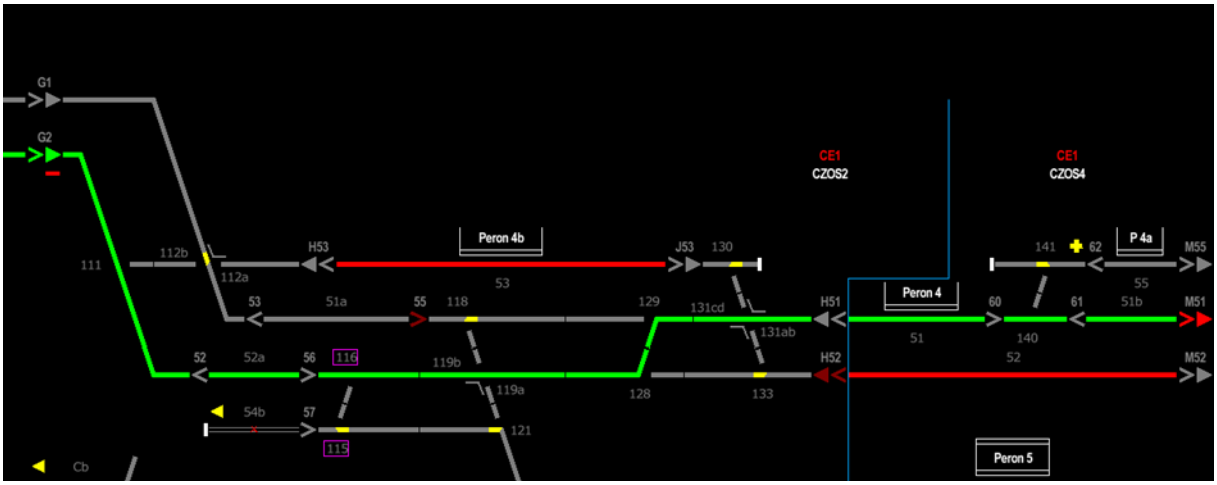


Figure 3 - Computer mapping of train route from the G2 signal to the M51 signal, 09:18:37 hrs (source: Thales)

At 09:20:26 hrs, the train passed intermediate signal G2[1/2/4]. Train THE 575001 entered Poznań Główny station at 09:21 hrs and continued at a speed not exceeding 32 km/h on tracks 51a and 51 towards track 51b to signal M51[1/2/4/m] terminating route $G2^{2}_{51b}$.
At 09:21:32 hrs, the train entered track 51 at the speed of approximately 26 km/h.

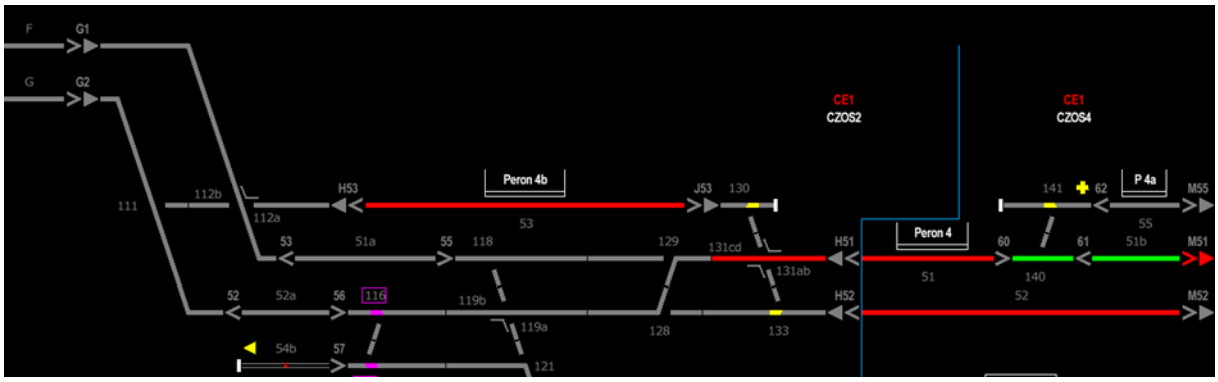


Figure 4 - The train's entry on track 51, 09:21:32 hrs (source: Thales)

At 09:21:41 hrs, the "station C" signaller issued the special order "ZW" to release the route from Tm60 to signal M51 with the train proceeding at approximately 26 km/h.

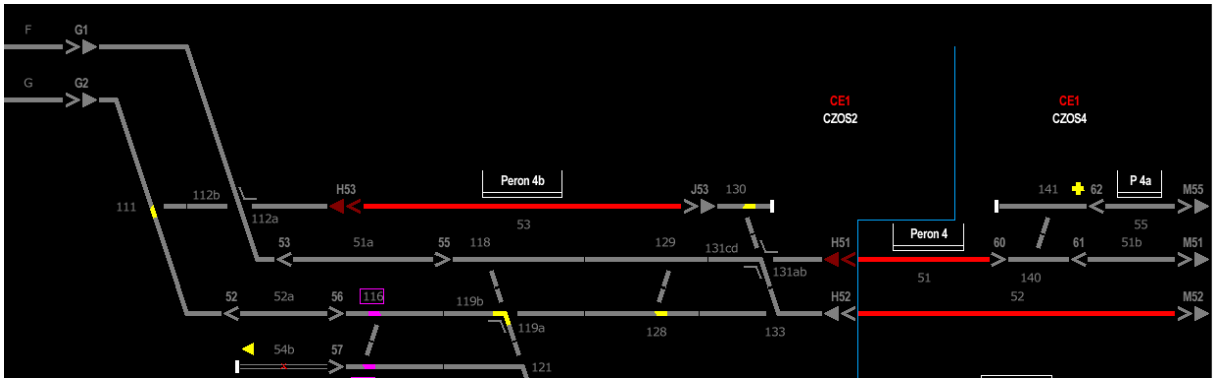


Figure 5 - Released route, 09:21:41 hrs (source: Thales)

At 09:22:22 hrs, the "station D" signaller gave the order to set the shunting route from shunting disc Tm60 to exit signal M55.

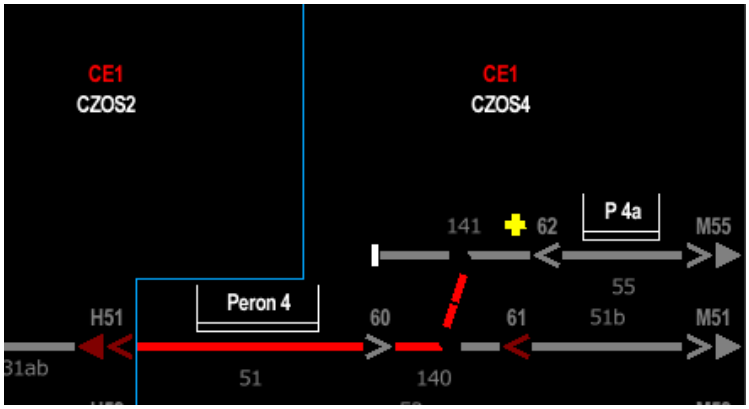


Figure 6 - The train's entry to switch isolation Iz140, 09:22:22 hrs (source: Thales)

At 09:22:25 hrs, the train occupied switch isolation Iz140, i.e. it drove two axles of the first bogie onto the switch of turnout no. 140 directing straight ahead (plus (+) position) at the speed of 19 km/h.

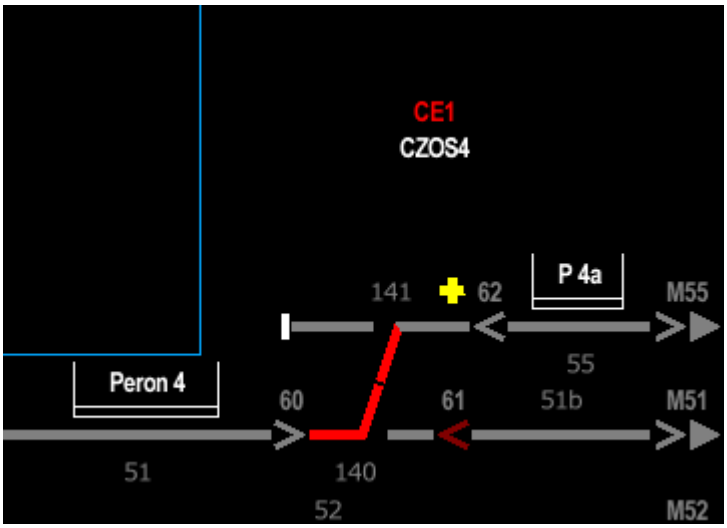
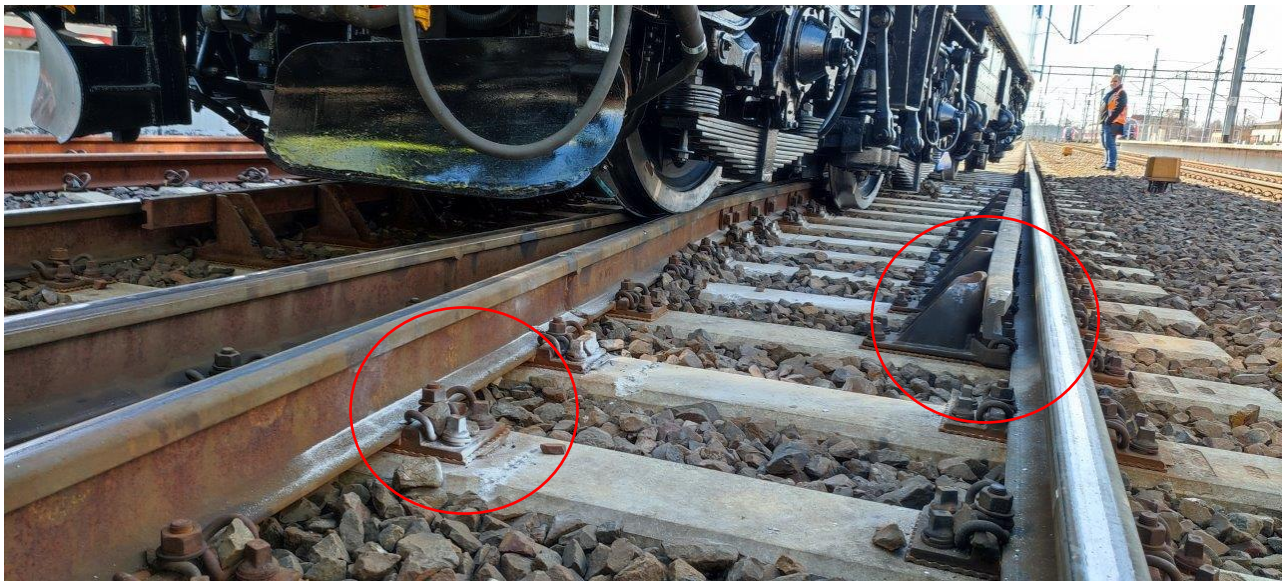


Figure 7 - Occupation of switch section IZ140/141 and release of track 51, 09:22:25 hrs (source: Thales)

At 09:22:29 hrs, the switch of turnout no. 140 gained control in the left (-) position and the second bogie was directed with its two wheelsets towards turnout no. 141, i.e. double-track running of locomotive EU07-1529 occurred: the first bogie was going straight forward, and the second bogie was going to in the turning direction of turnout no. 140.
At 09:22:30 hrs, the switch of turnout no. 141 gained control in the left (-) position.
At 09:22:30 hrs, the IT51 track section is released.
As a result of the double-tracking, the wheel-rail contact is lost and the right wheel of the second wheelset of the first bogie is derailed into the inside of the turnout. As a consequence of the derailment, the said wheel hits the right guide rail of the turnout and the first bogie is displaced to the inside of turnout no. 140. As a result of the impact on the guide rail, the locomotive bumps up violently, the bolt coupling is disconnected and the first wheel set of the second bogie falls inside the turnout, according to TELOC speed recorder at 09:22:35 hrs at the speed of 6.5 km/h. The second wheelset of the second bogie of the first locomotive did not derail. The second locomotive did not derail because it entered the already switched switch of turnout no. 140. Locomotive EU07-1529 travelled approximately 19 m in the derailed state. As a result of the derailment, the bolt coupling between the locomotives was disconnected and they were only connected by the brake coupling.

Photograph 2 - A view of the train after the derailment (material provided by the railway commission)



Photograph 3 - Traces of the derailed first wheelset of the second bogie (material provided by the railway commission)

Photograph 4 - The place of derailment of the first wheelset of the first bogie (material provided by the railway commission)

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 driver instructor reported the occurrence by telephone to the traffic controller at Poznań Główny station, who notified the dispatcher. A Uniroller rescue vehicle from Poznań Piątkowo station and a maintenance train from Poznań Górczyn station were dispatched to the scene. Police officers and the railway commission were called to the scene, and the latter commenced an investigation. The clean-up of the occurrence continued until 17:30 hrs on 12 April 2022.

IV. ANALYSIS OF THE OCCURRENCE

1. Roles and duties

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

Infrastructure Manager PKP PLK S.A.

The tasks of the infrastructure manager, hereinafter referred to as "the manager", include operation of rail infrastructure involving inter alia:

- operation of rail traffic;
- provision of railway infrastructure, provision of related services and levying of the related charges;
- maintenance of the rail infrastructure through carrying out works aimed at maintaining the condition and ability of the existing rail infrastructure to operate rail traffic safely, including supervision of the functioning of rail traffic control devices and track-side train safety control devices.

As part of the supervision of the operation of the rail traffic control equipment, in order to ensure the safety of train traffic in the years 2021 - 2023, in accordance with the Construction Law and internal regulations at CTC Poznań Główny, the diagnostic team carried out inspections of the maintenance of the structure in terms of checking its technical condition and suitability for use, and conducted diagnostic tests of the rail traffic control equipment.

The inspections and diagnostic tests carried out did not reveal any irregularities in terms of:

- the entry in Section 32 *"Train movement on the permissive aspect displayed on an intermediate signal"* of the technical regulations of Poznań Główny station, PoA command box, concerning the location of the route place for routes $J53^2_{51b}$, $G1^2_{51b}$, $G2^2_{51b}$ behind the occupancy control section of switch *IZ131c/d*, contradicting the entries in the route sheets;
- the use of the special command "ZW" by signallers in violation of the rules laid down in Instruction Ie-20 for the release of train routes: $J53^2_{51b}$, $G1^2_{51b}$, $G2^2_{51b}$.

Detailed provisions on the location and meaning of the W4 indicator are included in §112(2)(4) of the Regulation of the Minister of Infrastructure of 18 July 2005 on general conditions of railway traffic operation and signalling (Journal of Laws No. 172, item 1444), consolidated text of 23 January 2015 (Journal of Laws 2015, item 360):

"Indicator W 4 , 'Stop Indicator' indicates where the train head stops: a simple white cross on a black rectangular background (Figure 168):

a) the indicator shall be used to indicate the location at the station or stop which can be reached by the head of the train stopping there; the stopping train shall be stopped at such a distance ahead of the indicator as to enable the most convenient movement for passengers,

b) the indicator shall be positioned at the end of the platform or ahead of the fouling point on the right-hand side of the track to which it refers; the indicator positioned at the end of the platform, which is not at the same time the end of the train route, shall apply only to trains having a stop at that platform,

c) the indicator may be in the form of a luminous beacon with milky white glass or an unlit shield, depending on local conditions."

Railway carrier PKP CARGO S.A.

The rail vehicle designated to carry out a transport task by the railway carrier held a rail vehicle type operation approval certificate and a technical railworthiness certificate. The designated train crew that operated the train held all ratings and qualifications required by law. The train was driven on the basis of a timetable. The technical condition of the rail vehicles involved provided for their safe operation and did not affect the occurrence.

The responsibilities of railway carriers concerning safe operation of a rail vehicle are laid down in the infrastructure manager's Instruction Ir-1 on the conduct of train traffic, Instruction Ie-1(E-1) – Signalling instruction and the internal instruction of the railway carrier, and Instruction Ct-1 (Mt-1) - Instruction for a traction vehicle driver. 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

Railway carrier PKP CARGO S.A., which provides the rolling stock, is responsible for its serviceability, technical condition and compliance with the vehicle maintenance process.

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

Based on the investigation material gathered, the Investigation Team concluded that the rail products supplier Thales Polska spółka z o. o., whose computer railway traffic control system is installed at Poznań Główny station, was involved in the incident.

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

The President of the Office of Rail Transport (UTK) supervises railway traffic safety. At the request of PKBWK, the authority made available the reports on the inspections carried out by UTK in 2017, 2018, 2019 and 2020.

1.5. Notified bodies, designated bodies or risk assessment bodies

Based on the investigation material gathered, 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

Based on the investigation material 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 railway vehicle

Electric locomotive EU07-1529 was equipped by the manufacturer with a Hasler Bern TELOC15 electronic event data recorder.

The locomotive was not equipped with a foreground image recording system.

The Investigation Team analysed the driving parameters recorded in the system to investigate the train's driving characteristics immediately prior to and after the occurrence.

The chart below shows the following driving parameters of train THE 575001:

analogue signals:

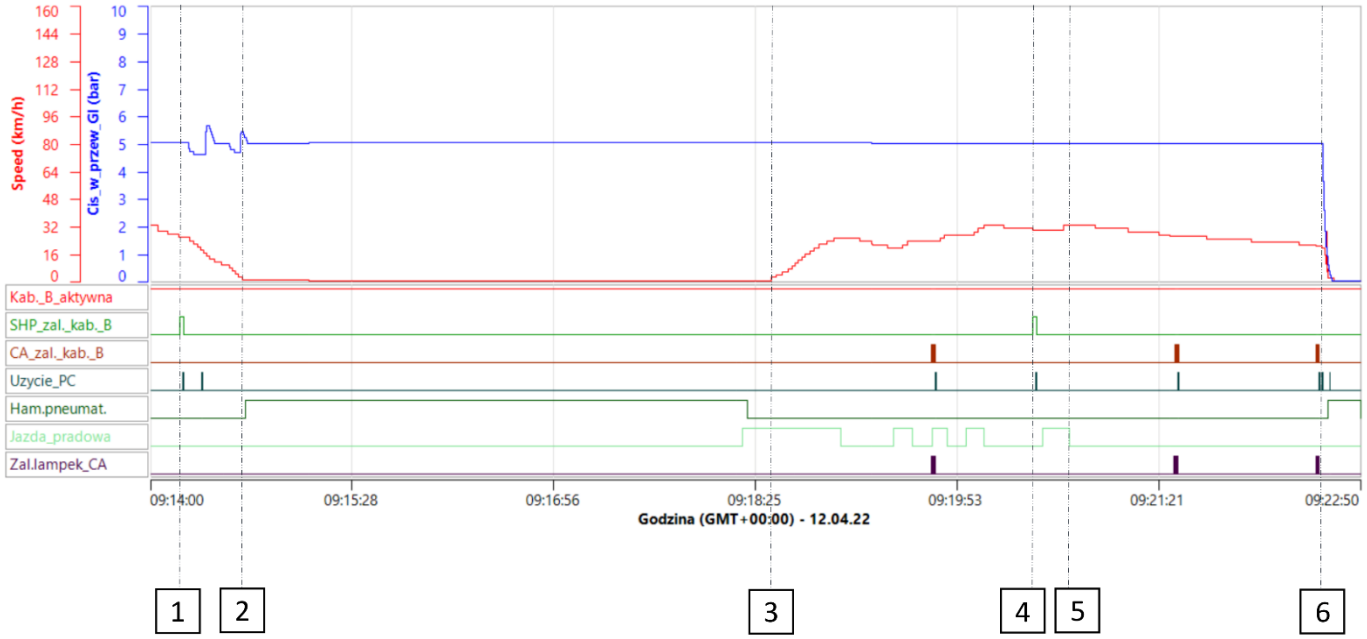
- time,
- speed,
- main line pressure,

digital signals:

- "Kab._B_aktywna" - driving with Cabin B,
- "SHP_zal._kab._B" - passage over automatic train stop (SHP),
- "CA_zal._kab._B" - activation of the active vigilance device (CA),

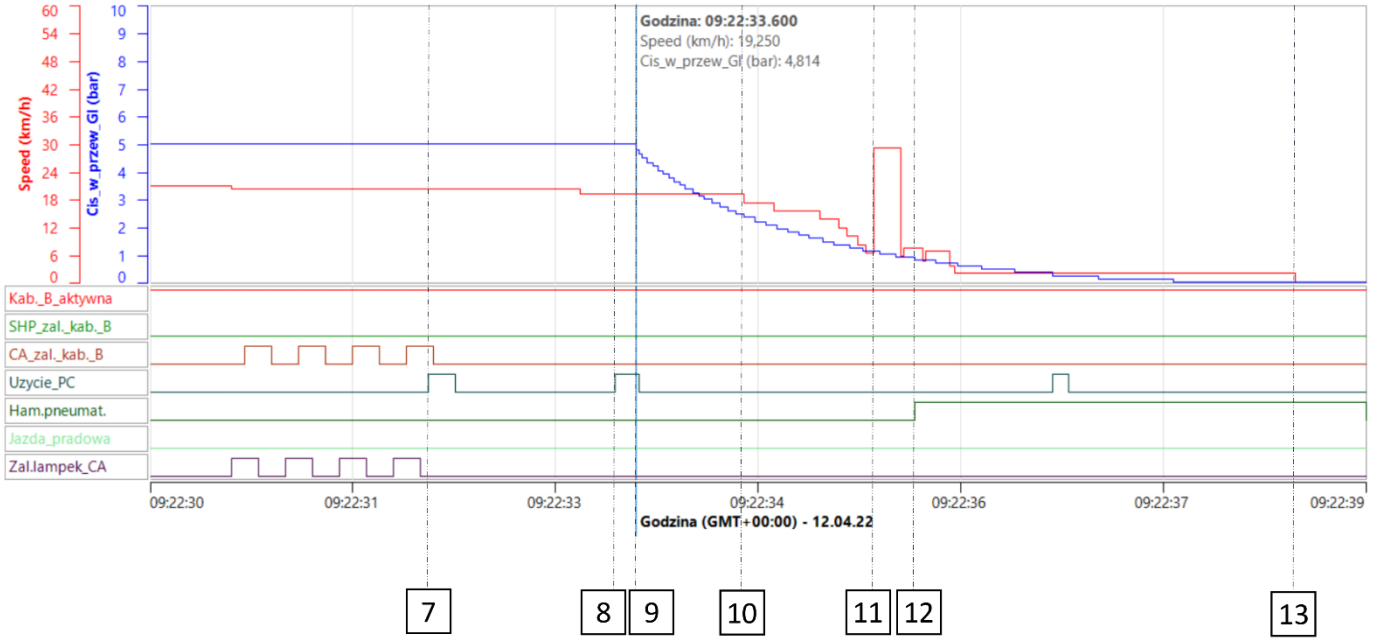
- "Uzycie_PC" - use of the passive vigilance device,
- "Ham.pneumat." - use of air brake,
- "Jazda_pradowa" - electric/non-electric driving,
- "Zal.lampek_CA" - the active vigilance device light is on.

Figure 8 - A chart of the locomotive's driving parameters



1. 09:14:12 hrs - passage over the SHP of home signal $B^{1/2/4}$ at the speed of 25.67 km/h
2. 09:15:09 hrs - stop at signal $B^{1/2/4}$
3. 09:18:31 hrs - start from home signal $B^{1/2/4}$
4. 09:20:26 hrs - passage over the SHP of intermediate signal $G2^{1/2/4}$ at the speed of 29.82 km/h
5. 09:20:42 hrs - non-electric driving until the derailment
6. 09:22:33 hrs - entry of the locomotive to turnout no. 140

Figure 9 - The locomotive's driving parameters during the occurrence



7. 09:22:32 hrs - use of the passive vigilance button (PC) at the speed of 20.48 km/h
8. 09:22:33 hrs - use of the PC button at the speed of 19.25 km/h
9. 09:22:33 hrs - the locomotive enters turnout no. 140 at the speed of 19.25 km/h; pressure drop in brake main line from 5.032 [bar]
10. 09:22:34 hrs - the speed drops to 6.5 km/h
11. 09:22:35 hrs - a sudden increase in the speed to 29.39 km/h (the moment the axle of the set was rolled over due to loss of contact between the wheel and the rail)
12. 09:22:35 hrs - implementation of braking from the speed of 7.56 km/h
13. 09:22:38 hrs - the locomotive stops

The speed values given in Points 11 and 12 are derived from the parameters recorded at the time of free-rolling and are not actual speeds. It is therefore not possible to establish, on the basis of the driving parameter readouts, a reliable distance travelled from the time of the derailment until the time the locomotive stopped.

3. Human factors

3.1. Human and individual characteristics

The Investigation Team did not identify any impact of human or individual characteristics on the occurrence.

3.2. Job factors

Poznań Główny station is generally designed for passenger traffic. The organisation of railway traffic adopted in the area of track 51, and the positioning of the W4 indicator at the end of the platform, require passenger trains with a scheduled stop to stop ahead of that indicator. In order to avoid the additional shunting work involved in receiving and dispatching trains from station track 51, it was decided that signallers would use the special computer command "ZW" for releasing train routes without fulfilling the conditions required under Instruction Ie-20, with no corresponding regulations included in the station regulations. The aforementioned solution, accepted by the superiors and supervision on the side of the infrastructure manager, resulted in trains being accepted on track 51 without ensuring that they stop ahead of turnout no. 140. Signallers routinely assumed that every train stopped ahead of the W4 indicator, and then proceeded to resolve the route by using the special command "ZW". This routine action led to the acceptance of train THE 575001 on track 51 of Poznań Główny station with the intention of further diverting it onto track 55, despite the possibility of using direct route $G2^{2}_{55}$ (diverting onto track 55).

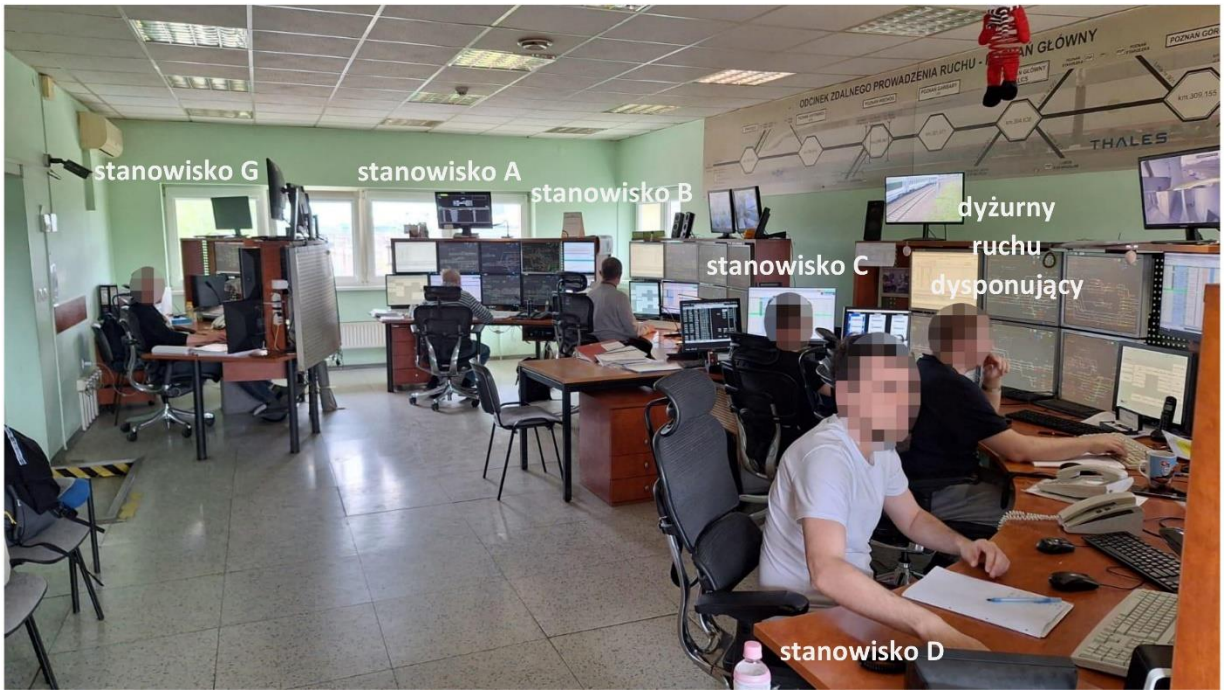
One of the requirements associated with the position of the driver instructor, as well as the driver, is the knowledge of the internal regulations concerning rail traffic technology and organisation, including very good knowledge of the signalling instructions. The personnel driving train THE 575001, the driver instructor assisted by a driver with documented knowledge of the railway line sections, strictly complied with the provisions of Instruction Ir-1 on the conduct of train traffic operations by carrying out the entire train route, i.e. from intermnediate signal $G2^{1/2/4}$ to exit signal $M51^{1/2/4/m}$, without stopping at indicator W4.

3.3. Organisational factors and assignments

According to the provisions of Instruction Ir-9 on the shunting technique, the necessary conditions for starting a shunting run are:
- briefing by the shunting supervisor (in this case the "station D" signaller) on the work plan for the traction team;
- issuing an authorisation for shunting, which at the same time is the shunting order to the driver.
The shunting work plan briefing was carried out by the wrong signaller (the signaller at "station C" instead of the signaller at "station D") at the wrong place and time while the train was driving. The shunting was to be carried out in the control area controlled by the signaller at "station D", who, once the train route had been completed, should proceed to the shunting work plan briefing and establish route for the shunting run.

3.4. Environmental factors

Train movements and rolling stock shunting are directed by a train dispatcher, with the assistance of signallers at operator stations: A, B, C, D and G from the PoA remote control command box**:**
- **station A:** conducts train movements and participates in rolling stock shunting either in the role of the shunting manager for unpiloted rolling stock runs or through arranging routes and granting authorisations for other shunting runs at Swarzędz station and Poznań Antoninek junction post and the tangential routes: Swarzędz - Kostrzyn Wlkp., Swarzędz - Nowa Wieś Poznańska, Swarzędz - Stary Młyn, Poznań Antoninek - Nowa Wieś Poznańska, and internal routes: Swarzędz - Poznań Wschód (on track no. 1), Swarzędz - Poznań Antoninek (on track no. 2), Poznań Antoninek - Poznań Wschód (on track no. 2),
- **station B:** conducts train movements and participates in rolling stock shunting either in the role of the shunting manager for unpiloted rolling stock runs or through arranging routes and granting authorisations for other shunting runs at Poznań Wschód station and the tangential routes: Poznań Wschód - Kobylnica, Poznań Wschód - Czerwonak, and the internal routes: Poznań Wschód - Swarzędz (on track no. 1), Poznań Wschód - Poznań Antoninek (on track no. 2), Poznań Wschód - Poznań Główny,
- **station C:** conducts train movements and participates in rolling stock shunting either in the role of the shunting manager for unpiloted rolling stock runs or through arranging routes and granting authorisations for other shunting runs at Poznań Główny station in the northern part of the station (from home signals A, B, C and D to the axis of the passenger tunnel) and the tangential route Poznań Główny - Poznań Główny PoD and the internal route Poznań Główny - Poznań Wschód,
- **station D:** conducts train movements and participates in rolling stock shunting either in the role of the shunting manager for unpiloted rolling stock runs or through arranging routes and granting authorisations for other shunting runs at Poznań Główny station in the southern part of the station (from home signals R1, R2, S1, S2, V1, V2 to the axis of the passenger tunnel) and the tangential routes Poznań Główny - Poznań Starołęka, Poznań Główny - Luboń koło Poznania Lu, and the internal route Poznań Główny - Poznań Górczyn,
- **station G:** conducts train movements and participates in rolling stock shunting either in the role of the shunting manager for unpiloted rolling stock runs or through arranging routes and granting authorisations for other shunting runs at Poznań Górczyn station and the tangential routes Poznań Górczyn - Poznań Starołęka, Poznań Górczyn - Palędzie, and the internal route Poznań Główny - Poznań Górczyn.



Photograph 5 - The control room of the PoA command box

Photograph 6 - Operator stations of signallers C and D, and operating station of the dispatcher

The ergonomics of the signaller workstations at the PoA command box is inappropriate.

The PoA command box room is constantly occupied by six employees who operate train movements and shunting in the assigned sections. Due to the lack of workstation separation, the employees are exposed to noise and distraction. Continuous twelve-hour shift work in such conditions compromises the working comfort, which may lead to a threat to the safety of train traffic.

3.5. Any other factors relevant for the purpose of the investigation

None identified.

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

The relevant regulatory framework conditions::

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 following hazards contained in Points 7, 8 and 13 of the *Record* are related to the occurrence under investigation:
7. Railway staff
7.4. Inappropriate organisation of shunting work
7.4.2. Inappropriate briefing on shunting work
7.5. Errors in the transmission of shunting signals
7.6.2. Inappropriate operation of rail traffic control equipment
7.6.3. Unauthorised operation of rail traffic control equipment
7.7. Errors resulting from breach of rules, instructions or regulations
7.7.3. Failure to comply with rules, instructions and internal regulations
7.8.18. Inappropriate operation of rail traffic control equipment
7.8.19. Unauthorised operation of rail traffic control equipment
8. Construction, inspections, repairs, renovation, modernisation and dismantling
8.1. Adoption of wrong design assumptions
8.1.4. Adoption of a wrong concept for the design of rail traffic control equipment
13. Organisation (organisational changes, provisions in internal regulations, etc.)
13.1. Irregularities concerning formal and legal requirements
13.1.15. Unclear provisions in the Technical Regulations of the Traffic Service Station
13.1.27. Inappropriate ergonomics of the workstation at the technical station
In view of the identified systemic factor no. 3, the Investigation Team sees the need to supplement the Hazard Record by adding another hazard "*Clauses on traffic organisation in the Technical Regulations of the traffic service station incompatible with applicable regulations*".

4.2. The safety management system of the involved railway undertaking(s) and infrastructure manager(s) including the basic elements stated in Article 9(3) of Directive (EU) 2016/798 and any EU legal implementing acts

The entities involved in the railway occurrence that took place on 12 April 2022 at 09:22 hrs at Poznań Główny station at turnout no. 140 on track 51, at km -0.181 of railway line no. 351 Poznań Główny - Szczecin Główny, have Safety Management Systems (SMS) approved by the President of the Rail Transport Office.

The following procedure of the infrastructure manager is linked to the occurrence under investigation: SMS-PG-01 Provision of rail infrastructure and operation of rail traffic.
The purpose of the procedure is to set out the rules for the provision of rail infrastructure and operation of rail traffic in compliance with safety requirements, with particular regard to transport of:
1) special shipments,
2) dangerous goods,
3) high-risk dangerous goods (TWR).
The procedure is obligatory for all organisational units of PKP PLK S.A. whose scope of activities specified in the regulations includes tasks related to the provision of access to rail infrastructure and operation of rail traffic.
Documents related to this procedure include:
- Safety Management System Book of PKP Polskie Linie Kolejowe S.A.;
- Railway Transport Act;
- Regulation on the provision of rail infrastructure;
- Regulation on general conditions for railway traffic and signalling;
- Organisational Regulations of PKP Polskie Linie Kolejowe S.A.;
- Internal regulations, legal acts and procedures applicable to the applicant and carrier using rail infrastructure managed by PKP PLK S.A.;
- Instruction Ir-1 on the conduct of train traffic operations.
Operation of train traffic is carried out according to the provisions of:
1) Instructions,
2) train timetable,
3) SMS procedures,
4) crisis management procedures.
Failure to comply with the provisions of SMS Procedure PG01 led to a breach of regulations, giving rise to factors that led to the occurrence at Poznań Główny station on 12 April 2022 at 09:22 hrs.

4.3. The management system of the entity/entities in charge of maintenance and maintenance workshops including the functions stated in the Article 14(3) and Annex III of Directive (EU) 2016/798 and any subsequent implementing acts

As regards maintenance of railway vehicles, maintenance activities for Maintenance Level P4 were carried out and a certificate of technical railworthiness of a railway vehicle was issued for locomotive EU07-1529 with the date 6 April 2022. PKP CARGO S.A. did not comply with order No. DBK-550/R-03/KB/12 of the President of the Rail Transport Office of 30 May 2012 addressed to railway carriers concerning the obligation to install recording devices - digital cameras or video recorders in railway newly built and in-service vehicles.

4.4. The results of supervision performed by the national safety authorities in accordance with Article 17 of Directive (EU) 2016/798

No factors influencing the occurrence were identified on the side of the national safety authority.

4.5. The authorisations, certificates and assessment reports granted by the Agency, the National Safety Authorities or other conformity assessment bodies

Thales Polska spółka z o. o.

The condition for the release to service of structures and types of equipment affecting the level of railway safety is to obtain a type authorisation certificate for the first unit thereof. Thales has complied with these conditions and holds, among others, Certificates of Authorisation for the type of equipment intended for railway operations No. U/2009/0062 for the Command 900 type remote control system and No. U/2013/0281 for the ESTW L90 5 type computer station equipment installed at Poznań Główny station.

5. Previous occurrences of a similar character

As part of the investigation, the Investigation Team CAT. B15 accidents that occurred in similar circumstances between 2019 and 2022 (up to the date of the occurrence concerned). A total of 61 accidents of the aforementioned category occurred in the said period, of which:
- in 2019 - 14 occurrences,
- in 2020 - 21,
- in 2021 - 20,
- in 2022 - 6.

A brief description of the occurrences and their consequences.
Particular attention should be given to the following accidents:
Railway accident which occurred on 31 October 2020 at 02:30 hrs on the siding of ENEA Wytwarzanie S.A. at turnout no. 33, in the area of the user of the railway siding of ENEA Wytwarzanie sp. z o.o. in Świerże Górne.
At 01:15 hrs on 31 October 2020 at turnout no. 33 there was a derailment of locomotive 15D-O31 running alone. As a result of the occurrence, three axles of the second bogie derailed.
Causes of the accident.
Direct cause: Shifting of turnout no. 33 in track no. 17 from the position opposite to the basic position in the direction of track 19c to the basic position in the direction of track 17 under running shunting locomotive 15D-031 (07).
Root cause: Premature release of the route by the signaller for the shunting run of locomotive 15D-031, from track 15w to track 19c via turnouts no. 34, 33, and 31.
Indirect cause: Increased inflow of information in the communication channels available to the signaller (radio, telephone) at the time of operation of the MOR-3 rail traffic control system involved in the occurrence. Lack of required concentration while assessing the traffic situation at the siding. Unreasonable haste in action.
Systemic cause: Non-compliance with the procedures on the part of the signaller as regards the correct operation of the MOR-1 monitor imaging system in the MOR-1.01 variant, in terms of assessing the information on the state of the equipment and the traffic situation on the tracks of the siding while entering route setting orders.

Category B15 accident which occurred on 30 November 2019 at 08:02 hrs at Lublinek station on track no. 2, km 7.183 of line no. 14 Łódź Kaliska-Tuplice, in the area of the infrastructure manager PKP PLK S.A., the organisational unit of the infrastructure manager competent for the place of the occurrence: Railway Line Plant in Łódź.
On 30 November 2019 at 08:02 hrs, during the entry of train no. 512030 travelling from Gdańsk Port Północny to Stryków (the carrier: PKP CARGO S.A.), the seventh and sixth wagons from the end of the train set, loaded with containers, derailed after the switch of turnout no. 32 was switched under the seventh wagon from the end of the train set.
Causes of the accident.
Direct cause: switching of the turnout under a moving train.
Root cause: premature release of the route.
Indirect cause: failure to properly observe an approaching train until it has passed the signal point.

Category B15 accident which occurred on 18 February 2020 at 04:45 hrs at turnout no. 23 at Dęblin station, km 60.447 of line no. 26 Łuków - Radom, in the area of the infrastructure manager Railway Line Plant in

Lublin, the organisational unit of the infrastructure manager competent for the place of the occurrence: Operation Section in Dęblin.
During a shunting run from track no. 8 to track no. 4a, and on to track no. 2, the first axle of the second bogie of Electric Multiple Unit EN57AL-3007 derailed.
Causes of the accident.
Direct cause: Releasing the route and the switching the switch under moving rolling stock after initiation of the route setting process in the computer equipment.
Root cause: Failure of the signaller to ensure that the driver has not started shunting in the direction of track 4b.
Late notification by the operator - 10min before the scheduled departure of the train - of damage to the EMU and the need to replace the damaged EMU with a serviceable one.

V. CONCLUSIONS

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

The analysis of the material gathered shows, among other things, that:
- the dispatcher decided to accept train THE 575001 on track 51 and to subsequently direct it to track 55;
- the "station C" signaller, carrying out the order of the dispatcher, accepted train THE 575001 on track 51 of Poznań Główny station with the intention to further direct it to track 55, which necessitated the use of an additional shunting route. The signaller did not use direct route $G2^2_{55}$ directing the train to track 55 from intermediate signal G2$^{1/2/m}$ to exit signal M55$^{2/m}$;
- the shunting work plan briefing was carried out by the wrong signaller (the signaller at "station C" instead of the signaller at "station D") at the wrong place and time, i.e. while the train was driving. The shunting was to be carried out in the control area controlled by the signaller at "station D", who, once the train route had been completed, should proceed to the shunting work plan briefing and establish route for the shunting run;
- as part of the modernisation of Poznań Główny station, instead of installing an intermediate signal at track 51 ahead of turnout no. 140 with preservation of the overlap, a Tm60 dwarf shunting disc was designed and installed. The adopted traffic organisation for passenger trains terminating on track 51 forces either the use of additional shunting work or the route release with the special command "ZW". In the opinion of the Investigation Team, such organisation requires installation of an intermediate signal in place of the Tm60 shunting disc to ensure railway safety.

The Investigation Team identified the following as causal factors in the occurrence:
Introduction into the computer system of a command to set a shunting route from track 51 to track 55 while train THE 575001 was proceeding on track 51 towards track 51b to execute train route $G2^2_{51b}$, which led to the switch of turnout no. 140 to be switched to the minus (-) position while being entered by locomotive EU07-1529, and to the derailment of the locomotive.

The Investigation Team found the following to be contributing factors of the occurrence:
1) Inappropriate organisation of traffic through accepting of train THE 575001 on track 51b (route $G1^2_{51b}$) of Poznań Główny station with a plan to further divert the train to track 55, with the possibility of using direct route $G2^2_{55}$ (diverting to track 55).
2) Releasing the route by introducing the special command "ZW" during the execution of train route $G2^2_{51b}$.
3) The use of the special command "ZW" despite not fulfilling the conditions for its use provided in the Ie-20 Instruction (§13(4), §14(4) and §15(3)) without making entries in the relevant documentation and without notifying the maintenance staff.

The Investigation Team found the following to be systemic factors of the occurrence:
1) Allowing the use of the special command "ZW" in the computer rail traffic control system for releasing routes $J53^2_{51b}$, $G1^2_{51b}$, $G2^2_{51b}$, without the required time delay indicated by *Technical Standards for Rail Traffic Control Equipment* and *Operator Manual for Poznań Railway Node E-20*.
2) The adopted organisation of traffic of passenger trains terminating on track 51 at Poznań Główny station, with the application of the special order "ZW" by signallers to release train routes: $J53^2_{51b}$, $G1^2_{51b}$, $G2^2_{51b}$, causing a hazard to rail traffic safety.
3) Non-compliance of the Technical Regulations of Poznań Główny station in Section 32, which establishes a route place for routes behind the *"IZ131c/d"* occupancy control section instead behind the turnout no. 140 occupancy detection section, as provided in : $J53^2_{51b}$, $G1^2_{51b}$, $G2^2_{51b}$ route sheets, posing a hazard to rail traffic safety.

2. Measures taken since the occurrence

At the request of the railway commission, Section 22 of the Technical Regulations of Poznań Główny Station received Amendment No. 3 reading: "*Due to the necessity of manual release of turnouts no. 140/141 and track No. 51b for train routes from signals G1, G2, J53 to track no. 51 (routes G11 51 ; G22 51 ; J532 51) - the place of train head stop shall be indicator "W4 "positioned on the left side of track no. 51 ahead of turnouts no. 140/141. The continuation of train movement (from indicator W4) may take place on the permissive aspect on signal M51, and shunting movement on aspect "Ms2 shunting allowed" displayed on the shunting disc Tm60 positioned on the right side of track 51 (at indicator W4).*

3. Additional comments

1) Following P4 maintenance of locomotive EU07-1529, the railway carrier PKP Cargo did not implement order No. DBK-550/R03/KB/12 of the President of the Rail Transport Office of 30 April 2012 addressed to railway carriers concerning the obligation to install foreground image recording devices - digital cameras or video recorders in newly built and in-service rail vehicles in accordance with PKBWK recommendation No. PKBWK-076-305/RL/r/11 of 22 November 2011.
2) In the plans of Poznań Główny station (rail traffic control and road traffic), the location of indicator W4 is not in line with the terrain.
3) The schematic plan of the station (road) is drawn to the wrong scale.

VI. SAFETY RECOMMENDATIONS

1) In order to ensure safe organisation of traffic for trains terminating on track 51 at Poznań Główny station, PKP PLK S.A. IZ Poznań shall install an intermediate signal instead of the Tm60 shield to change the location of the route place.
2) Until the implementation of Recommendation 1, PKP PLK S.A. IZ Poznań shall specify - in *Plot 22. Other provisions not covered in the preceding provisions* in Paragraph 12 of *Technical Regulations of Poznań station* - detailed rules of conduct in the event of the need to use the special command "ZW" deviating from the provisions contained in §46(4) and (8) of Instruction Ir-1 and in §13(4) and §14(4) of Instruction Ie-20.
3) PKP PLK S.A., together with the system supplier, shall adapt the computer system at Poznań Główny station - special command "ZW", specifying the required time delay in accordance with applicable *Technical Standards for Rail Traffic Control Devices* and *Operator Manual for Poznań Railway Node E-20*.
4) PKP PLK S.A. IZ Poznań shall bring the road plan into line with the actual situation - (the location of indicator W4 at track 51).
5) Authorised railway infrastructure managers and infrastructure managers operating under a safety certificate and exempt from the requirement to obtain a safety authorisation shall verify, at posts equipped with computer rail traffic control equipment, the advisability of using the special order to release a route on an ad hoc basis (e.g. ZW; PZA; ...) with regard to compliance with the rules on the safety of operation of rail traffic.
6) PKP CARGO S.A. shall implement order no. DBK-550/R-03/KB/12 of the President of the Rail Transport Office of 30 May 2012 addressed to railway carriers on the obligation to install recording devices - digital cameras or video recorders in newly built and operating railway vehicles.
7) PKP PLK S.A. shall supplement the Hazard Record by adding another hazard: "*Clauses on traffic organisation in the Technical Regulations of the traffic service station incompatible with applicable regulations*".
8) PKP PLK S.A. IZ Poznań shall take actions to rectify the irregularities referred to in Point 3.4 of Chapter IV, i.e. to improve the ergonomics of the workstations of signallers at the CTC signal box of Poznań Główny station.
9) Authorised infrastructure managers shall include in the Hazard Record the hazard associated with inappropriate ergonomics of signaller duty stations. In addition, they shall verify the ergonomics of signaller duty stations where several duty stations are located in close proximity in the same room; and if any irregularities are detected, they shall take actions to improve the working conditions of signallers.

STATE COMMISSION ON RAILWAY ACCIDENT INVESTIGATION
CHAIRMAN

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Tadeusz Ryś

List of entities and acronyms that appear in Report No. PKBWK 5/2024

Item	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.	PKP PLK S.A.	Infrastructure manager
5.	PKP PLK S.A. IZ Poznań	Railway Line Plant in Poznań
6.	PKP CARGO S.A.	Railway carrier
7.	Thales Polska sp. z o. o.	Supplier of rail traffic control equipment
8.	LCS	Local Control Centre (Polish: Lokalne Centrum Sterowania)

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