REPUBLIC OF SERBIA
CENTER FOR INVESTIGATION OF ACCIDENTS IN TRANSPORT
SECTOR FOR INVESTIGATION OF ACCIDENTS IN RAILWAY TRAFFIC
NEMANJINA 11, 11000 BELGRADE

No. ŽS - 01/23

No. 340-00-1/2023-02-1-87

Date: 31.07.2024.

FINAL REPORT ON SERIOUS ACCIDENT INVESTIGATION

Serious accident type:	Train collision
Train Nos:	25412 and 49028/73478
Location:	Municipality Odžaci, between the settlements Ratkovo and Odžaci, open track between the station Ratkovo and Odžaci
Date:	17.11.2023.
Time:	18:42

This Report presents the results of investigation of a serious accident, collision of the consecutive trains No. 25412 and 49028/73478, which occurred on 17.11.2023. at 18:42 on the regional line No. 207 Novi Sad - Odžaci - Bogojevo, between the stations Ratkovo and Odžaci.

The Working Group for investigation of this serious accident was formed by the Director of the Center for Investigation of Accidents in Transport of RS, by Decision No. 340-00-1/2023-02-1-9 of 23.11.2023.

In accordance with the Article 33 of the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18) and the Article 23 of the Directive 2004/49/EC of the European Parliament and of the Council of EU (Railway Safety Directive), the Center for Investigation of Accidents in Transport (hereinafter referred to as: CINS) drafted and published this Final Report.

In this report, all values are expressed as part of the International System of Units (SI).

The meaning of abbreviations used in the text is explained in the Glossary.

CINS has been established in accordance with the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15). The founder is the RS and the holder of founding rights is the Government of the RS.

Sector for Investigations of Accidents in Railway Traffic carries out tasks within the competence of the CINS in relation to rail traffic with the aim of possible improvement of safety on the railway by issuing safety recommendations. The investigative procedure in the field of railway traffic is conducted on the basis of the provisions of the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18).

CINS conducts investigations following the serious accidents on the railway system with a view to possible improvement of railway safety and the prevention of new accidents caused by the same or similar causes. Serious accident in railway traffic means any train collision or derailment of trains, resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety.

In addition to serious accidents, CINS may also investigate other accidents and incidents that could lead to a serious accident, including the technical failure of structural subsystems or interoperability constituents.

CINS has the discretion to decide whether to open an investigation of other accidents and incidents.

CINS is independent in its work and performs independent accident investigations. The aim of an investigation is to identify the causes and the possibility of improving safety on the railways and to prevent accidents by issuing safety recommendations.

Professional activities related to safety investigations are independent of judicial inquiry or any other parallel investigations which objective is to determine responsibility or the degree of guilt.

Glossary:

CINS	Center for Investigation of Accidents in Transport
RS	Republic of Serbia
SRJ	Federal Republic of Yugoslavia
IŽS	Infrastructure Railways of Serbia
ZJŽ	Community of Yugoslav Railways
ŽTP	Railway transport enterprise
ŽS	Railways of Serbia
SP	Traffic affairs
GP	Construction affairs
ETP	Electrotechnical affairs
SKP	Traffic commercial affairs
OJ	Organizational unit
SS	Safety signalling
TT	Telegraph-telephone/Telephone-telegraph
APB	Automatic track block
TK	Telecommand
RDV	Radio dispatch leading
DMV	Diesel motor train
EMV	Electro motor train
TMD	Heavy motor car
ECM (eng.)	*Entity in Charge of Maintenance*
a.d.	Joint stock company
d.o.o.	Ltd.
OJT	Basic Public Prosecutor
MUP	Ministry of Interior
PU	Police Directorate
PS	Police Station
PI	Police Unit

C O N T E N T :

1. Summary

1.1. Short description of the serious accident

On November 17, 2023, at 18:42, at km 56+050 on the regional railway line No. 207 Novi Sad - Odžaci - Bogojevo, between the stations Ratkovo and Odžaci, while traveling in the direction from Ratkovo station towards Odžaci station, on the open track, near the switching point (located at km 56+320) of the automatic level crossing at km 37+306, there occurred overtaking and collision of the trains No. 25412 (DMV 711-077/078, railway undertaking "Srbijavoz"a.d.) and 49028/73478 (locomotive 753-782 and nine S series wagons loaded with containers, railway undertaking "Transagent Operator"d.o.o.). The collision occurred when the front of train No. 25412 (the front part of DMV 711-078), which was moving, struck the end of train No. 49028/73478 (into the last wagon No. 33 68 4952 037-2), which was stationary due to a locomotive failure (753-782). After the impact, train No. 49028/73478 (which was stationary) remained in place (did not move), while the train No. 25412 continued to move for approximately 6 m, with the front part of DMV 711-078 climbing onto the rear part of the flat wagon No. 33 68 4952 037-2, pushing it forward and deforming the container CNEU 453486-3 which was loaded on the wagon. During this accident, except for the wheels on the first axle of the first bogie of DMV 711-078 (in the direction of movement), which lifted above the track (approximately 30 cm from the top edge of the rail), all other wheels of the vehicles in both trains remained on the rails (did not derail).

In this serious accident there were no fatally injured. The total number of injured is 58 (fifty eight) persons (passenger and railway workers of "Srbijavoz"a.d.. which were in the train No. 25412), out of which 5 (five) persons were seriously injured, and 53 (fifty three) persons were slightly injured.

There exists a material damage on the railway vehicles.

1.2. Serious accident causes determined by investigation

The direct cause of the serious accident is that two trains were at the same time at one distance between the stations, where one train was stationary (train No. 49028/73478), while the other train was moving (train No. 25412), which is contrary to the provision of paragraph 3 of Article 122 of the Traffic Rulebook ("Official Gazette of RS" No. 34/22 and 107/22). The train dispatcher of the Ratkovo station dispatched train No. 25412 in the direction of the Odžaci station without the previously requested permission for the train No. 25412 from the train dispatcher of the Odžaci station, which is contrary to paragraphs 1 and 2 of Article 121 and paragraph 1 of Article 133 of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/22 and 107/22).

Workers of the railway infrastructure manager and railway undertakings who perform their duties at the station confirm by their signature that they are familiar with the provisions of the station's Business Order in accordance with paragraph 5 of Article 27 of the Traffic Rulebook ("Official Gazette of the RS" Nos. 34/22 and 107/22). In the specific case, the train dispatcher at Ratkovo station who was involved in a serious accident was primarily required to be familiar with the Ratkovo Station Business Order Part I and Appendix IV of the Station Business Order (Instructions for Handling the Inter-Signal Dependency Device) by the employer "IŽS"a.d. before starting work at Ratkovo station, which was not done. An examination of the submitted

investigation material shows that the train dispatcher at Ratkovo station who was involved in the serious accident started working at Ratkovo station on the night shift of April 9/10, 2022, while he was only made familiar with the Ratkovo Station Business Order Part I after more than three months of work at Ratkovo station, which he confirmed by his signature on July 15, 2022. According to the Letter No. 15/2024-12.13-125 dated May 8, 2024, from the Station Manager of Odžaci (submitted by "IŽS"a.d. via email on May 8, 2024), the train dispatcher did not confirm by his signature that he was familiar with the Instructions for Handling the Inter-Signal Dependency Device at Ratkovo station (see point 3.6.2.).

1.3. Main recommendations and information on subjects to whom the Report is submitted

Aiming to improve safety on the railway line and to prevent occurrence of the new accidents, CINS has issued the following safety recommendations:

To the Directorate for Railways:

SR_01/24 The Directorate for Railways, in accordance with Article 37 of the Law on Safety in Railway Traffic ("Official Gazette of the RS", No. 41/18), should amend and supplement the Rulebook on Technical Conditions and Maintenance of the Railway Telecommunication Network ("Official Gazette of the RS", No. 68/21), in part II. Technical conditions for the railway telecommunication network, where the minimum technical requirements for the equipment of railways with telecommunication devices should be unambiguously and precisely defined depending on the speed of train movement, railway categorization, volume of railway traffic, and similar factors (see points: 2.2.4. and 3.3.6.).

SR_02/24 "IŽS"a.d. should, in terms of maintaining public railway infrastructure related to the elements of the control, management, and signaling subsystem, replace and supplement the missing and technically faulty elements of the SS devices and installations on the regional railway line 207 Novi Sad - Odžaci - Bogojevo, so as not to compromise the designed technical functionality of the elements of the control, management, and signalling subsystem, in accordance with the provisions of Articles 55 and 56 of the Law on Railways ("Official Gazette of the RS", Nos. 41/18 and 62/23) (see points: 2.2.3.2.1, 3.2.3, 3.3.1, 3.4.1, 4.2.5.1, and 4.2.5.2.).

SR_03/24 "IŽS"a.d., in terms of maintaining the public railway infrastructure in relation to the elements of the control, management and signaling subsystem, to replace and supplement the missing telecommunications devices and facilities on the regional railway line 207 Novi Sad - Odžaci - Bogojevo, which are missing and have been switched off due to technical malfunctions, as the designed technical functionality of the elements of the control, management and signaling subsystem would not be impaired, in the sense of the provisions of Art. 55 and 56 of the Law on Railways ("Official Gazette of RS", Nos. 41/18 and 62/23) (see points: 2.2.4, 2.2.4.1, 2.2.4.2. and 3.3.1.)

SR_04/24 "IŽS"a.d. should consider the possibility of replacing the SS devices, on the railway line 207 Novi Sad - Odžaci - Bogojevo, that lack enforced technical dependencies between the positions of switches and entry signals, as well as the absence of exit signals with technical dependencies, and telecommunication devices with limited technical capabilities by installing SS devices with a higher level of enforced technical dependencies and more modern commercially available telecommunication devices. This is aimed at reducing the risk of human factor influence on train traffic regulation and increasing railway traffic safety (see points: 2.2.3.2, 2.2.4, 3.4.1, 3.4.3, and 4.3.4.).

SR_05/24 "IŽS"a.d. to form a Team for the assessment of the elements of the human factor in the occurrence of accidents and incidents in order to create a critical elements model, making a classification of them according to their importance and a ranking list of representation (identification of all risks) in order to work on the expedient structuring of preventive measures and the prediction of human behavior in crisis situations in order to reduce the impact on the occurrence of new accidents and incidents (see points 3.7, 4.2.7.2, 4.2.7.4. and 4.2.7.5.).

SR_06/24 **"**IŽS"a.d. should conduct professional training for the staff responsible for regulating traffic (train dispatchers) on the railway line 207 Novi Sad - Odžaci - Bogojevo regarding the regulation of train traffic in accordance with the provisions of Articles 121, 122, 133, and 141 of the Traffic Rulebook ("Official Gazette of the RS" Nos. 34/22, 107/22) (see points 3.3.3, 4.2.6.1, 4.2.6.2, 4.3.1, and 4.3.4.).

SR_07/24 "IŽS"a.d. should make changes and additions to the Instructions on the Organization and Work of the Operational Service in the area of "Infrastructure of Railways of Serbia"a.d. ("Official Gazette of Railways" Nos. 21/17, 21/18, 37/18, and 28/23) and harmonize, in Articles 3 and 34, the deadline within which the train driver is obliged to inform the traffic staff about the type of fault of the traction vehicle, regardless of the category of the railway line, with the provision from Article 234 of the Traffic Rulebook ("Official Gazette of the RS" Nos. 34/22, 107/22) (see points: 3.3.3, 3.3.4, 3.3.7. and 4.3.4.).

SR_08/24 "IŽS"a.d. should, considering that the provisions regarding informing the traffic staff about the fault of the traction vehicle relate to train drivers, who can be railway workers of railway undertakings, make changes and additions to the Instructions on the Organization and Work of the Operational Service in the area of "Infrastructure of Railways of Serbia"a.d. ("Official Gazette of Railways" No. 21/17, 21/18, 37/18, and 28/23), by providing provisions that railway undertakings should be familiar with the mentioned instructions (see points: 3.3.8 and 4.3.4.).

2. Direct facts on the serious accident

2.1. Serious accident basic data

2.1.1. Date, time and location of the serious accident

There occurred a serious accident on the regional railway line No. 207 Novi Sad - Odžaci - Bogojevo, between the stations Ratkovo and Odžaci, in the municipality of Odžaci, on November 17, 2023, at 18:42. The location of the serious accident is on an open railway track near the state roads IIA class, marking 110 (approximately 1250 m in a straight airline) and IIA class, marking 111 (approximately 720 m in a straight airline). In the immediate vicinity of the railway track, from the site of the serious accident to the state road IIA class, marking 110, there is a field road parallel to the railway track. The area where the serious accident occurred is uninhabited.

The appearance of the serious accident is shown in Figures. No. 2.1.1.1. and No. 2.1.1.2.

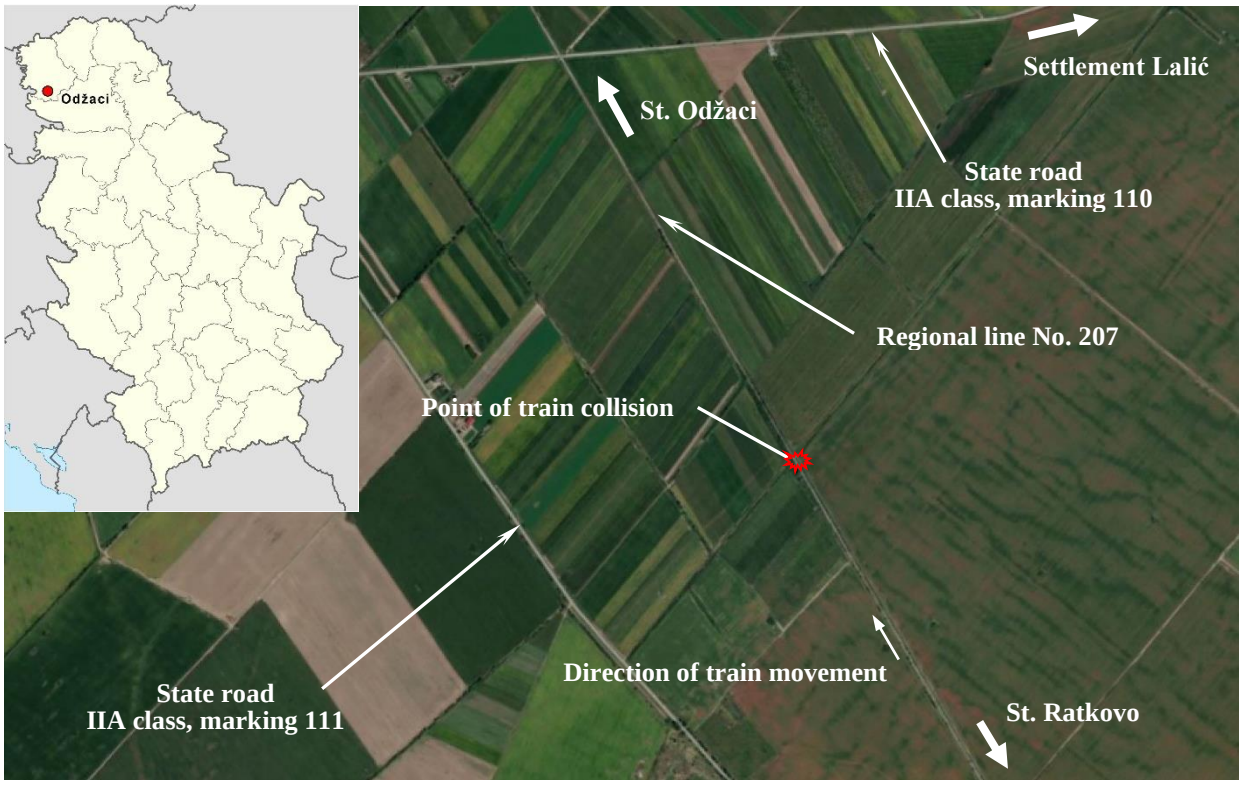


Figure 2.1.1.1: Satellite image of the serious accident site area (source: *Bing maps*)

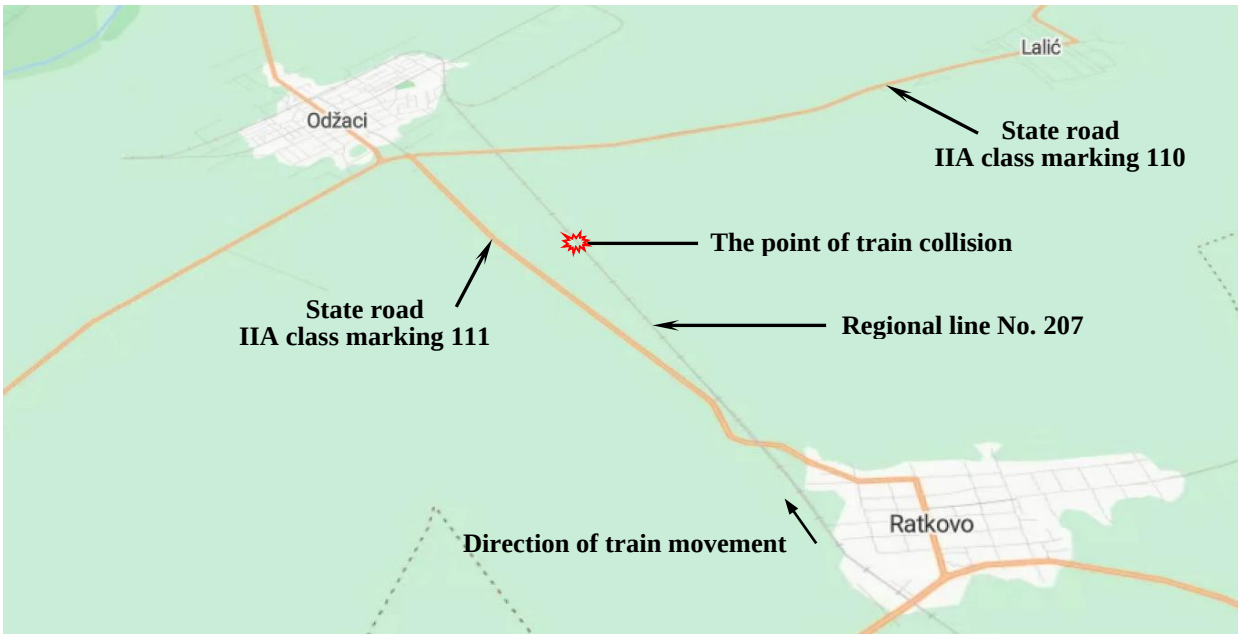


Figure 2.1.1.2: Cardgraphic representation of the area of the serious accident site (source: *Bing maps*)

2.1.2. Serious accident description and location and the work of emergency and rescue services

On the regional railway line No. 207 Novi Sad - Odžaci - Bogojevo, between the stations Ratkovo and Odžaci, while driving in the direction from the station Ratkovo to the station Odžaci, at km 56+050, near the switching point (which is located at km 56+320) of the automatic level crossing at km 37+306, there was a collision between train No. 25412 (DMV 711-077/078, railway undertaking "Srbijavoz"a.d.), which was in motion, and train No. 49028/73478 (locomotive 753-782 and nine cars of series S loaded with containers, railway undertaking "Transagent Operator"d.o.o.), which was stationary on the open track.

The collision occurred when the front of train No. 25412 (the front part of DMV 711-078), which was in motion, collided with the rear of train No. 49028/73478 (the last wagons numbered 33 68 4952 037-2), which was stationary due to a locomotive malfunction (locomotive 753-782).

Upon impact, due to the kinetic energy of train No. 25412 in motion, there was climbing of the front part of train No. 25412 (DMV 711-078) onto the rear part of the flat wagon No. 33 68 4952 037-2. After the collision, train No. 25412 continued to move for approximately 6 m, pushing ahead and deforming container CNEU 453486-3, which was loaded on the rear of flatcar No. 33 68 4952 037-2.

Except for the wheels on the first axle of the first bogie of DMV 711-078 (viewed in the direction of movement), which lifted above the tracks (approximately 30 cm from the top edge of the rail), all other wheels of the vehicles in both trains were on the rails (they did not derail).

There were no fatalities in this serious accident. A total of 58 (fifty-eight) individuals (passengers and railway workers of "Srbijavoz"a.d. who were in train No. 25412) were injured, including 5 (five) individuals seriously injured and 53 (fifty-three) individuals with minor injuries.

At the scene, to provide assistance to the injured, personnel from the Emergency Medical Service of the Health Center Odžaci, members of the MUP RS, Sector for Emergency Situations, Department for Emergency Situations in Sombor, and officers from the MUP RS, PU in Sombor, and PS Odžaci were deployed.

The mitigation of the consequences of this serious accident was carried out by engaging the expertise and resources of "IŽS"a.d., "Srbijavoz"a.d., and "Transagent Operator"d.o.o.

Due to this serious accident, there was a disruption in railway traffic between the stations Ratkovo and Odžaci. The traffic interruption lasted until November 18, 2023, at 14:30.

2.1.3. Decision to investigate, investigative team composition and operation of the investigation

The Main Investigator in Railway Traffic received the initial notification about the serious accident on 17.11.2023. at 19:38 via phone from the Dispatcher of "Transagent Operator"d.o.o. and then, at 19:55, from the Head of the Central Operations Department of "IŽS"a.d. and at 21:25, by phone from the Dispatcher of the Central Operations Department of "Srbijavoz"a.d. Based on the received information and the facts established by the investigation team at the scene of the serious accident, the Main Investigator in Railway Traffic initiated an investigation into the serious accident in accordance with the Law on Investigation of Accidents in Air, Railway, and Maritime Traffic ("Official Gazette of RS" Nos. 66/15 and 83/18).

The composition of the Working Group was determined by Decision No. 340-00-1/2023-02-1-9 dated November 23, 2023. of the Director of the CINS on the basis of articles 6 and 32 of the Law on the Investigation of Accidents in the Air and Railway Traffic ("Official Gazette of the RS" Nos. 66/15 and 83/18).

2.2. Serious accident background

2.2.1. Involved railway staff, executors, other persons and witnesses

In a serious accident, the following individuals were involved: the train driver of train No. 25412, employed by the railway operator "Srbijavoz"a.d, Traction Section Subotica, the conductors on train No. 25412 (two conductors), employed by the railway operator "Srbijavoz"a.d, SKP Sector Belgrade, SKP Section Novi Sad, OJ for SKP Subotica, Sombor station; the train driver of train No. 49028/73478 (locomotive 753-782), employed by the railway undertaking "Transagent Operator"d.o.o, the dispatcher at Ratkovo station employed by the public railway infrastructure manager "IŽS"a.d, SP Section Novi Sad, Odžaci station (Ratkovo, Parage, Odžaci, Kalvarija, Karavukovo, Bač); and the dispatcher at Odžaci station employed by the public railway infrastructure manager "IŽS"a.d, SP Section Novi Sad, Odžaci station.

Other staff, contractors, other individuals, and witnesses were not involved in the serious accident.

2.2.2. The trains that participated in the serious accident and their composition

2.2.2.1. The train No. 25412

Train No. 25412 operated on the route Novi Sad - Bogojevo - Sombor - Subotica. The composition of train No. 25412 consisted of a DMV series 711, owned by the railway undertaking "Srbijavoz"a.d, as follows: motor wagon No. 95 72 5711 077-6 and motor wagon No. 95 72 5711 078-4 (DMV 711-077/078). For the specified DMV, "Srbijavoz"a.d. possesses a Vehicle Usage Permit (EIN) No. RS5120160205 issued on 12.1.2017, by the Directorate for Railways and a Permit for Use in Traffic I-01-1 No. 340-20-2/2017 issued on 12.1. 2017, by the Directorate for Railways.

The DMV series 711, manufactured by "Metrowagonmash"a.d. from Mytishchi, Russian Federation, is intended for passenger transport on standard gauge tracks with a width of 1435 mm, equipped with low platforms. It operates as an independent (autonomous) transport vehicle. The DMV consists of two motor wagons, powered by a power unit (diesel engine and hydraulic power transmission). The interior is connected into a single spatial unit with comfortable second-class seats (a total of 120 seats) and a space designated for standing (a total of 126 standing places according to the criterion of 4 passengers/m²). The passenger area is fully air-conditioned and equipped with security video surveillance.

The appearance of the DMV series 711 is shown in Figure 2.2.2.1.1.

Figure 2.2.2.1.1: The appearance of DMV series 711

Technical data (some features):

Total length over buffers	44650 *mm*
Box width	2900 *mm*
Roof height from upper rail edge - with air-conditioning	4134 *mm*
Own weight	88,5 *t*
No. of axles	8
Axle arrangement	*B'2'-2'B'*
No. of seats	120
No. of standing positions (at 4 individulas/m^2)	126
Max construction speed	120 *km/h*
Max exploitation speed	100 *km/h*

2.2.2.2. The train No. 49028/73478

Train No. 49028/73478 of the railway undertaking "Transagent Operator"d.o.o. was traveling on the route Novi Sad Marshalling yard - Bogojevo - Sombor - Subotica as special consignment number 914/23 according to telegram No. 15 of 15.01.2023. "IŽS"a.d. The train consisted of locomotive 753-782 and nine cars with letter designation Sggmrs loaded with containers, total length 267 m (54 axles) and total gross weight 672 t.

According to data obtained from the railway undertaking "Transagent Operator"d.o.o. (data submitted by letter No. A969/2023 dated 28/12/2023 and by e-mail dated 16.01.2024), locomotive 753-782 No. 92 54 2753 782-2 was produced in 2008 in the Czech Republic, and was put into traffic 12.03. 2009. The owner and entity in charge of maintenance (ECM) is Taťová strojní společnost a.s, Ostrava, Přívoz, Czech Republic. For locomotive 753-782 "Transagent Operator"d.o.o. has a Vehicle Use Permit (EIN) No. RS5120220018 issued on 07.08.2022. by the Directorate for Railways in which a restriction for use was entered: "the locomotive cannot be used on tracks equipped with an auto-stop device".

The 753-782 series locomotive is a four-axle diesel electric locomotive designed for traffic on tracks with a normal gauge of 1435 mm, intended for traction all types of trains on all categories of tracks. There is a driver's cab at both ends of the locomotive.

The appearance of locomotive 753-782 is shown in Fig. 2.2.2.2.1.

Figure 2.2.2.2.1: The appearance of loc. 753-782

Technical data (some features):

Total length over buffers	16660 *mm*
Max height above upper rail edge	4430 *mm*
Manufacture date	2008.
Own mass	72 *t*
Axle arrangement	*Bo' - Bo'*
Max allowed speed	100 *km/h*

Wagons with the letter designation Sggmrs are six-axle flat wagons intended for transporting containers. Technical data of the wagon (some features):

Total length over buffers	25900 *mm*
Own mass	29,5 *t*
Max axle load	22,5 *t*
Loading length	2 x 13820 *mm*
Loading width	2600 *mm*
Loading height	1155 *mm*

In table 2.2.2.2.1. an overview of the wagons that were part of train No. 49028/73478 was given.

Table 2.2.2.2.1: Overview of the wagons in the train No. 49028/73478 (viewed from locomotive 753-782)

Serial wagon No.	Letter designation of the wagon series	Individual wagon No.	Owner	Holder	ECM
1	*Sggmrs*	33 68 4952 152-9	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*
2	*Sggmrs*	33 68 4954 451-3	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*
3	*Sggmrs*	37 80 4952 310-3	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*
4	*Sggmrs*	33 68 4953 190-8	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*
5	*Sggmrs*	33 68 4954 174-1	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*
6	*Sggmrs*	33 68 4952 199-0	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*
7	*Sggmrs*	31 81 4953 002-0	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*
8	*Sggmrs*	31 81 4953 003-8	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*
9	*Sggmrs*	33 68 4952 037-2	-	*VTG Schweiz GmbH*	*VTG Rail Europe GmbH*

2.2.3. Infrastructure and SS system

The description of the railway and facilities in the following text is given according to the data obtained from "IŽS"a.d. (documents: No.15/2023-1385 dated 26.12.2023 of the Sector for SP, No. 20/2023-2386 of 15.12.2023 of the Sector for GP and No. 21/2023-1603 of 20.12.2023 of the Sector for ETP, submitted in the attachment of letter No. 1/2023-2412 dated 27.12.2023, as well as the data submitted from "IŽS"a.d. by electronic mail dated 17.01.2024).

2.2.3.1. Infrastructure

The regional railway line No. 207 Novi Sad - Odžaci - Bogojevo between the Sajlovo junction and Bogojevo station is a single-track, non-electrified railway line. Regarding a serious accident, between Ratkovo and Odžaci stations, the designed axle load is 225 kN, and the axle load per linear meter is 80 kN/m. The designed speed for the relevant section of the railway is 120 km/h.

According to the Timetable Booklet 4.2 (which was valid at the time of the serious accident), on the section of the railway between Ratkovo and Odžaci stations, the maximum allowed speed for passenger trains was 100 km/h, and the maximum allowed speed for freight trains was 80 km/h. According to the same Timetable Booklet, there were no speed restrictions on the relevant distance between the stations.

At the time of the serious accident, on the section of the railway between Ratkovo and Odžaci stations, from km 52+250 to km 52+350, there was a restricted speed runnings of 50 km/h, introduced by telegrams No. 82F and 83F dated 09.12.2022 by "IŽS" a.d, due to poor track geometry at the level crossing at km 52+303.

Between Ratkovo (km 50+500) and Odžaci (km 59+000) stations, the railway is on an embankment 85 cm high, on flat terrain. On the relevant section of the railway, there are two curves (from km 50+769 to km 51+166 a right curve with R=700 m and from km 51+726 to km 51+954 a left curve with R=2000 m). The rest of the railway is straight. In the immediate vicinity of the serious accident site, at km 56+042, there is a culvert.

The overview of the gradient profile on the section of the railway between Ratkovo and Odžaci stations is given in Table 2.2.3.1.

Table 2.2.3.1: Gradient profile (viewed in direction of the growing stationing)

Serial No.	Gradient break stationing		Gradient [‰] (± - rise/fall)	Length [m]
	(start)	(end)		
1.	43+955,00	50+705,00	0	6.750,00
2.	50+705,00	51+455,00	-0,3	750,00
3.	51+455,00	52+155,00	-0,7	700,00
4.	52+155,00	53+875,00	0	1.720,00
5.	53+875,00	54+895,00	10	1.020,00
6.	54+895,00	55+605,00	0	710,00
7.	55+605,00	56+005,00	-2,4	400,00
8.	56+005,00	56+705,00	0	700,00
9.	56+705,00	58+205,00	-0,2	1.500,00
10.	58+205,00	59+305,00	0,2	1.100,00

The designation for the railway line was taken according to the Regulation on the categorization of railway lines belonging to the public railway infrastructure (“Official Gazette of RS”, Nos. 92/2020, 6/2021, 33/2022 and 63/2023).

2.2.3.2. SS system

Train traffic on the regional railway line No. 207 from Novi Sad - Odžaci - Bogojevo, between the Sajlovo junction and Bogojevo station, is regulated within station sections as on a single-track railway not equipped with APB, MZ, or TK devices, with mandatory request and granting of permissions. On the section of the railway where the serious accident occurred, train traffic within station sections was regulated by dispatchers from the neighboring staffed official positions Ratkovo and Odžaci, in accordance with the provisions of Chapter XIII of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/22 and 107/22) and the timetable material for the years 2022/2023.

The stations on the section from Sajlovo junction to Bogojevo are secured with mechanical (Futog), electromechanical (Gajdobra and Odžaci) SS devices with entry mechanical signals and pre-signals, inter-signal dependency devices with entry light signals and outer distant signals (Petrovac-Gložan and Ratkovo), as well as central control panels with electro-relay devices (Karavukovo and Bogojevo) with entry and exit light signals where the dependency of signals and switch positions is achieved.

Level crossings within station areas are equipped with mechanical barriers operated by station traffic staff. Level crossings on the open track are equipped with automatic level crossing protection devices with half-barriers, road light signals, and control signals.

2.2.3.2.1 SS devices at the station Ratkovo

The Ratkovo station is provided with a device for inter-signal dependence of light input signals. The aspect of a signals of entry signals are pre-signaled by special light pre-signals. The entry signals are not dependent on the switches.

The entry signal Au from the Gajdobra station is installed at km 50+095, and the special pre-signal PAu of this signal is installed at km 49+095. The entry signal Bu from Odžaci station is installed at km 51+545, and the special pre-signal PBu of this signal is installed at km 52+545. In Ratkovo station, pre-signals were turned off due to the theft of signaling equipment and associated cables.

In terms of securing, switches are fully applied switches, they are operated and locked with locks on site and are not dependent on the main signals.

The unique keys of the locked switches and derails are located in the dedicated cabinet with the track situation in the train dispatcher's office. Duplicate switch keys, as well as the derail key, are kept by the train dispatcher in a separate cabinet, so each duplicate key must be sealed separately by SS maintenance service.

In Ratkovo station, a mechanical road crossing device with barriers has been installed at km 50+336 (handled in front of the train dispatcher's office and is dependent on the entry signal from the direction of Gajdobra station).

At km 52+303 on the regional railway line No. 207 Novi Sad - Odžaci - Bogojevo, between the official positions Ratkovo and Odžaci, there is a road crossing secured by an automatic device with half-barriers, light and sound signals, and traffic signs on the road. The dispatcher at Ratkovo station monitors its functionality via light indications on the station control panel, as well as the approaching train through light control signals.

The equipment of Ratkovo station with signaling and safety devices is in accordance with the requirements of Article 34 of the Law on Railway Traffic Safety ("Official Gazette of RS" No. 41/2018).

2.2.3.2.2 SS devices at the station Odžaci

Odžaci station is secured with an electromechanical permission block device and is protected on both sides by mechanical image signals with pre-signals. The electromechanical permission block device consists of one central and two turnout electromechanical permission block devices. The central block device is located in the train dispatcher's office. The central block device is interlocked with the block devices located at switch block 1 and switch block 2. Until the dispatcher releases the block permission, the switchman cannot set the entry signals, which are main signals and unambiguous.

The entry signal from the direction of Ratkovo station is installed at km 58+115.83, and the pre-signal for this entry signal is installed at km 57+411. The entry signal from the direction of Karavukovo station is installed at km 59+794.31, and the pre-signal for this entry signal is installed at km 60+512.01.

The switches, in terms of securing, are fully applied switches, set and locked with locks on site and are not interlocked with the main signals.

The unique keys for the locked switches and derails are kept in a designated cabinet with a track situation in the train dispatcher's office. The duplicate switch keys, as well as the key for the derail, are stored with the dispatcher in a separate cabinet, ensuring that each duplicate key is individually sealed by the SS equipment maintenance service.

The equipment of Odžaci station with signaling and safety devices is in accordance with the requirements of Article 34 of the Law on Railway Traffic Safety ("Official Gazette of RS" No. 41/2018).

2.2.4. Means of communication

The description of the communication means is provided according to the data obtained from "IŽS"a.d. (Letter No. 21/2023-1603 dated 20.12.2023 from the ETP Sector, attached to the Letter No. 1/2023-2412 dated 27.12.2023 from "IŽS"a.d.).

Due to the theft of aerial TT cables that previously existed on railway line No. 207 Novi Sad - Odžaci - Bogojevo, and the resulting inability to communicate via telephone line OV 4 No. 41-420 on the Novi Sad - Bogojevo route, the primary communication system for traffic staff during train traffic regulation is the radio communication system. The radio communication system consists of 13 (thirteen) fixed radio stations of the Motorola DM 2600 type. To unify the operation of the fixed radio stations (establishing connections between the fixed radio stations), a repeater of the Motorola SLR 5500 type, mounted on Fruška Gora at the Crveni Čot location, is used. This radio communication system is connected to a digital recording device manufactured by SRC Soft, type PC3, located in the TT room at Novi Sad station. The use of radio communication is carried out in accordance with the provisions of the Radio Communication Usage Instructions on the Novi Sad - Odžaci - Bogojevo railway line ("Official Gazette ŽS" No. 2/21). The following official positions are included in the radio communication system: Novi Sad Marshalling Yard, Novi Sad,

Junction Sajlovo, Futog, Petrovaradin-Gložan, Gajdobra, Ratkovo, Odžaci, Odžaci Kalvarija, Karavukovo, Bogojevo Selo, and Bogojevo, as well as the traffic dispatcher workplace in Novi Sad.

At the time of the serious accident, the radio communication system was working properly.

The mentioned radio communication system ensures the establishment of a semi-duplex connection, through a repeater, and allows a message to be transmitted at one time only from one stable radio station (out of a total of 13 in the above-mentioned official positions), and received at all other radio stations included in the radio communication system. Simultaneous transmission and reception of messages on one stable radio station or simultaneous transmission of messages from two stable radio stations is not possible, which makes this communication system a device with limited communication capabilities.

In the event that communication between traffic staff cannot be carried out using a radio link, communication is carried out through the public fixed telecommunications network of the operator "Telekom Srbija" in accordance with the provisions of the Temporary Instructions for the use of telecommunications connections when regulating traffic on certain lines of the ŽTP "Belgrade", executive order No. 63-48/94 dated 2.6.1994. These lines are not included in the recording device.

In the reply of "IŽS"a.d, from Letter No. 21/2023-1603 dated 20.12.2023. of the Sector for ETP, it was established that there is no telecommunication connection (comunication) between the train dispatcher and the train driver on this line.

Communication between the traffic control staff (train dispatchers) of the Ratkovo and Odžaci stations and the train staff (train driver) is possible only by mobile phones, by calling through the network of the mobile telephony operator and via fixed telephone lines connected to the public fixed telecommunications network of the operator "Telekom Srbija". This type of communication does not constitute evidentiary communication.

In the Rulebook on technical conditions and maintenance of the railway telecommunications network ("Official Gazette of RS", No. 68/21), in part II. The technical conditions for the railway telecommunication network do not clearly and precisely define the minimum technical requirements for equipping railways with telecommunications devices depending on the speed of train movement, categorization of railways, volume of railway traffic and the like.

2.2.4.1. Telecommunication devices at the station Ratkovo

As stated in the previous section, a fixed radio station of type Motorola DM 2600 is used as the basic communication system, which is used for mutual communication between train dispatchers when regulating traffic on railway line 207 Novi Sad - Odžaci - Bogojevo.

Also, in the Ratkovo station there is a line of the fixed telecommunications network of the operator "Telekom Srbija".

Letter No. 15/2023-1385 dated 26.12.2023 was submitted by "IŽS"a.d. of the SP Sector, attached to which is the Ratkovo Station Business Order, Part I, No. 15/2022-12-844 dated 10.06.2022.

In the Business Order of the Ratkovo station, Part I, A - Description of the infrastructure facilities of the associated interstation facilities, in point 4.1. Basic data on the types of telecommunication facilities, it is stated: "Ratkovo station is included in telephone line Ov 4 No. 41-420 on the line Novi Sad - Bogojevo". This provision is in contradiction with Article 1 of the

Instructions for the use of radio communication on the Novi Sad - Odžaci - Bogojevo railway line ("Official Gazette of ŽS"No. 2/21).

Considering the provisions from Article 16 of the Instructions on the organization and regulation of train traffic by alternative means of transport during the continuous closure of the section of the Novi Sad - Subotica railway No. 4/2022-3524-722 of 01.04.2022. on-site inspection by CINS and statements of the workers of "IŽS"a.d. given during the hearing in the CINS premises, it can be stated that the telephone line Ov 4 No. 41-420 has not been in operation for a long time, due to the theft of aerial cables that existed on this railway.

In the submitted Business Order of the Ratkovo station, Part I, B - Provisions regarding the organization and regulation of traffic, in point 1.3. The position of train dispatcher, in the part related to the duties of the train dispatcher, it is stated that the train dispatcher "Gives bell signals to announce the running of trains", which is not possible considering the theft of aerial TT cables on this line.

2.2.4.2. Telecommunication devices at the station Odžaci

As stated in the previous section, a fixed radio station of type Motorola DM 2600 is used as the basic communication system, which is used for mutual communication between train dispatchers when regulating traffic on line 207 Novi Sad - Odžaci - Bogojevo. The local telecommunication connection between the dispatcher and the switcher on block 1 and block 2 is made by induction telephones, and these conversations cannot be recorded.

There is also a line of the fixed telecommunications network of the operator "Telekom Srbija" in the Odžaci station, which was not in operation at the time of the serious accident.

Letter No. 15/2023-1385 dated 26.12.2023 was submitted by "IŽS"a.d. of the SP Sector, attached to which is the Station Business Order of the Odžaci station, Part I, No. 15/2018-338 dated 20.03.2018.

In the Business Order of the Odžaci station, part I, A - Description of infrastructure facilities and associated inter-station facilities, in point 4.1. Basic data on the types of telecommunication facilities, it is stated "Odžaci station is included in telephone line Ov 4 No. 41-420 on the Novi Sad - Bogojevo line". This provision is in contradiction with Article 1 of the Instructions for the use of radio communication on the Novi Sad - Odžaci - Bogojevo railway line ("Official Gazette of ŽS" No. 2/21).

In view of the provisions of Article 16 of the Instructions on the organization and regulation of train traffic by alternative means of transport during the continuous closure of the Novi Sad - Subotica railway section No. 4/2022-3524-722 dated 01.04.2022, on-site investigation by CINS and statements of the workers of "IŽS"a.d. given during the hearing in the CINS premises, it can be stated that the telephone line Ov 4 No. 41-420 has not been in operation for a long time, due to the due to the theft of aerial cables that existed on this railway.

In the submitted Business Order of Odžaci station Part I, B - Provisions regarding the organization and regulation of traffic, in point 1.3. The position of train dispatcher, in the part related to the duties of the train dispatcher, it is stated that the train dispatcher: "Gives bell signals to announce the running of trains", which is not possible considering the theft of aerial TT cables on this line.

2.2.5. Works executed at or near the accident site

At the distance between the stations Ratkovo and Odžaci, 17.11.2023 from km 54+300 to km 54+600 in the day shift, works on mechanical removal of vegetation were carried out in intervals (four intervals) when there was no traffic. No other works were carried out near the site of the serious accident.

2.2.6. Activation of the railway emergency plan and sequence of events

The Infrastructure Manager "IŽS"a.d. and the railway undertakings "Srbijavoz"a.d. and "Transagent Operator"d.o.o. immediately notified CINS, the Main Investigator in railway traffic accidents, about the serious accident. They formed a joint investigation committee that conducted an investigation in accordance with applicable regulations. Upon completion of the investigation, an Investigation Report was drafted (subject U-402/23), document No. 15/2024-240 dated 08.03.2024, by "IŽS"a.d.

Immediately after the collision, the conductors accompanying train No. 25412 and the train driver informed the emergency medical service, police, and interested parties at "Srbijavoz"a.d. Following this, the train driver and other conductors provided first aid to injured passengers and took preventive measures to prevent panic among passengers. The first conductor, due to sustained injuries, could only provide verbal support. Upon the arrival of police and emergency medical service teams, they continued to assist passengers in collaboration with them.

According to the conductor's estimate, at the time of the collision, there were approximately 90 passengers aboard train No. 25412 (DMV 711-077/078).

Following the on-site investigation, activities to mitigate the consequences of the accident were initiated. In order to facilitate the separation of DMV 711-077/078 and the last wagon of train No. 49028/73478, the front part of train No. 49028/73478 (locomotive 753-872 and the first 8 cars) was first removed from the scene to Odžaci station.

The separation of the vehicles (DMV 711-077/078 and the last wagon of train No. 49028/73478) and their transfer from the accident site to Odžaci station was carried out with the engagement of an emergency train owned by "IŽS"a.d., specifically through the involvement of the Center for Rescue Train Operations, OJ for Rescue Train Operations in Belgrade, with the use of traction vehicles from the railway undertaking "Srbija Kargo"a.d.

The interruption of traffic between Ratkovo and Odžaci stations lasted until 18.11.2023, at 14:30 when the railway line was reopened for train traffic.

2.2.7. Activation of emergency plan of public rescue services, police and medical services and sequence of events

Due to this serious accident, members of the MUP RS, Sombor PU, Odžaci PS, members of the RS MUP, Emergency Situations Sector, Fire and Rescue Unit in Odžaci, as well as members of the Odžaci Health Center, Emergency Medical Service were engaged.

According to the information provided by the Basic Court in Sombor (attached to letter No. Su VIII-42-17/24 dated March 19, 2024), the duty service of the Police Station in Odžaci dispatched a team of two police officers to the scene. Upon their arrival at the scene, these police officers carried out the evacuation of passengers who were in passenger train No. 25412, as well as the evacuation of injured persons to the vehicles of the Emergency Medical Service in Odžaci. Following the instructions of the OJT in Sombor, they secured the accident site until the investigative team from the PS in Odžaci arrived, consisting of authorized personnel and a forensic technician. Subsequently, at the scene, they conducted alcohol testing for the drivers of the freight train (train No. 49028/73478) and the passenger train (train No. 25412), as well as for the dispatcher and switch operator at Ratkovo railway station.

From the Secretariat of the MUP RS (Letter 02 No. 011-95/24-3 dated 22.02.2024), information was provided that according to the records kept in the Department for Emergency Situations in Sombor, a report of a serious accident was received on 17.11.2023. at 18:45 by PS 192, after which the team of the Fire and Rescue Unit in Odžaci with two vehicles and four rescue firefighters was dispatched to the scene. The team arrived at the scene the same day at 19:00, where it was established that two people were injured. With the presence of the Emergency Medical Service team, the extraction of both injured passengers was started, and after being pulled out, they were taken care of by the Emergency Medical Service team.

According to the data provided by the Health Center in Odžaci (letter No. 615-3823 dated 05.02.2024), the Emergency Medical Service of the Health Center in Odžaci is on 17.11.2023. received a call from a passenger of a passenger train at 18:50, when the doctor on duty was informed about the train collision. Immediately after that call, the same information was reported by the police station in Odžaci. 2 (two) complete medical teams (doctor, nurse and driver) came to the scene, and there were 4 (four) more doctors (arrived from other services or from home) and 5 (five) nurses, who cared for patients arriving from the scene of a serious accident by private transport. One team with a special medical car immediately took a suspected seriously injured patient from the ambulance to the Emergency Center of the University Clinical Center of Vojvodina for examination by a neurosurgeon. There were 2 (two) more doctors on standby. Before the full knowledge of the number of injured and the severity of injuries, help was called from the emergency medical service of the Sombor Health Center, which arrived with 2 (two) ambulances and 2 (two) complete medical teams. Upon their arrival at the scene, it turned out that there was no need for engagement, because the resources of the Odžaci Health Center were sufficient to complete the treatment of the injured. A total of 47 (forty-seven) patients were examined in the Odžaca Health Center. Of that number, 1 (one) patient was transported to the University Clinical Center of Vojvodina, and 2 (two) patients to the Sombor General Hospital to the admission-triage department.

2.3. Fatally injured, injured and material damage

2.3.1. Pasengers, third persons and the railway staff including contractors

According to the data submitted by the Health Center in Odžaci (letter No. 615-3823 dated 05.02.2024), General Hospital "Dr. Radivoj Simović" Sombor (letter No. 23-9828/2023-1 dated 26.12.2023), General Hospital Subotica (letter No. 01-10314 dated 29.12.2023), the Emergency Center of the University Clinical Center of Vojvodina (letter No. 01-1362 dated 28.12.2023), as well as data submitted by the Basic Court in Sombor (in the attachment of letter number Su VIII-42-17/24 of March 19, 2024), there were no fatalities in this serious accident. A total of 58 people were injured. Out of the total number of injured persons, five persons were seriously injured, and 53 persons were slightly injured. All injured persons were on train No. 25412. Of the total number of injured, 55 were passengers, and three were railway workers, employees of "Srbijavoz"a.d. A tabular overview of the number of fatally injured and injured persons is shown in table 2.3.1.1.

Table 2.3.1.1: Overview of the fatally injured and injured indviduals

	Passenger	Railway staff	Third parties	Total
Fatally injured	-	-	-	-
Seriously injured	4	1	-	5
Slightly injured	51	2	-	53

2.3.2. Goods, luggage and other assets

According to the information provided by the railway undertaking "Transagent Operator"d.o.o. via email dated 05.04.2024, at the time of the serious accident wagon No. 33 68 4952 037-2 was loaded with two containers (container No. CNEU 453486-3 was loaded with goods weighing 23,900.00 kg and container No. CNEU 465897-2 was loaded with goods weighing 17,122.20 kg). Container CNEU 453486-3 sustained damage, resulting in material damage amounting to 4,000.00 EUR. According to the official average exchange rate of the National Bank of Serbia on 17.11.2023 (1 EUR = 117.1900 RSD), this damage amounts to 468,760.00 RSD. Container CNEU 465897-2 was undamaged and complete (along with the cargo) were transferred to a road transport vehicle (truck). The cargo from damaged container No. CNEU 453486-3 was transferred to another container (CNEU 464789-6), which was then loaded onto a road transport vehicle (truck) and dispatched further. The total amount of costs for transferring the cargo from the damaged container, transferring two containers to a road transport vehicle (truck), and the truck transportation of two containers amounts to 1,286,568.32 RSD. It is not known whether there was any loss of cargo loaded into the damaged container, as the railway undertaking "Transagent Operator"d.o.o. had not received any information or claims for compensation of cargo loss from the cargo owner up to the publication of this report.

The total material damage to goods and other property caused in this serious accident amounts to 1,755,328.32 dinars (RSD). According to the official middle exchange rate of the National Bank of Serbia on 11.17.2023 year, which amounted to 1 EUR (euro) = 117.1900 RSD (dinars), the total material damage to goods and other property caused in this serious accident amounts to 14,978.48 EUR (euro).

2.3.3. Railway vehicles, infrastructure and the environment

Railway vehicles were damaged in a serious accident. There was no damage to the infrastructure. No material damage was caused to the property of third parties.

The structure of the caused material damage is given according to the following:

Damage on DMV 711-077/078:	184,340,000.00	RSD
Costs of rehabilitation the wagon No. 33 68 4952 037-2 for transport to the workshop:	225,138.00	RSD
Damage on the wagon of individual No. 33 68 4952 037-2:	No data submitted	
Total costs of the intervention of the emergency train “IŽS”a.d. with the costs of hiring “Srbija Kargo”a.d. traction vehicles	5,170,076.00	RSD
The total direct material damage:	**189,735,214.00**	RSD

Note: After the rehabilitation of wagon No. 33 68 4952 037-2 for transport to the workshop, it was sent by the railway undertaking “Transagent Operator”d.o.o. to the workshop for inspection and repair. By email dated May 21, 2024, from the railway undertaking “Transagent Operator”d.o.o, CINS was informed that the repair of the wagon has been completed, but no information was provided about the amount of material damage caused in the serious accident on wagon No. 33 68 4952 037-2.

The damage is expressed in the official currency of the RS (Dinar - RSD).

According to the official middle exchange rate of the National Bank of Serbia on November 17, 2023, which is 1 EUR (Euro) = 117.1900 RSD (Dinar), the total material damage incurred in the serious accident amounts to 1,619,039.28 Euros (EUR).

The material damage in this report is presented based on invoices, estimates, and documents confirming the reported damage amounts provided by “IŽS”a.d, “Srbijavoz”a.d, and “Transagent Operator”d.o.o.

2.3.4. External circumstances - weather conditions and geographical features

The scene of the serious accident is located in the municipality of Odžaci, near the settlement of Odžaci, in an uninhabited area. The terrain configuration near the site of the serious accident is flat. Nearby, approximately 1250 m in a straight line, are the state roads IIA class, marking 110, and approximately 720 m in a straight line is the state road IIA class, marking 111. In close proximity to the railway, from the site of the serious accident to the state road IIA class, marking 110, there is a field road that runs parallel to the railway.

The geographical coordinates of the serious accident site are: 45° 29' 28.2" N and 19° 17' 26.8" E.

According to the information provided by the Sector for GP, in an email from “IZS”a.d. dated January 17, 2024, the part of the railway where the serious accident occurred has a horizontal

alignment and a gradient of 0‰ (flat) over a length of 700 meters (from km 56+005 to km 56+705). Immediately ahead of the site of the serious accident (viewed from Ratkovo station towards Odžaci station), the railway has a descent with a gradient of -2.4‰ over a length of 400 m (from km 55+605 to km 56+005).

The letter from the Republic Hydrometeorological Service of Serbia No: 925-1-603/2022 dated December 12, 2023, provided data that on November 17, 2023, in the area between Ratkovo and Odžaci, the maximum air temperature was 10.9°C, the minimum was 6.4°C, and the minimum air temperature at 5 cm above ground was 2.8°C. The ground was wet and moist throughout the day. Dew was observed between 00:00 and 02:15, moderate rain from 02:15 to 06:00, light to heavy rain from 09:42 to 12:40, and strong winds were observed from 14:52 to 15:29 and from 17:44 to 23:57. The precipitation measured at 07:00 on November 18, 2023, was 8.1 mm. Precipitation is measured at 07:00 and represents the amount that fell in the previous 24 hours (from 07:00 the previous day to 07:00 the current day).

At 18:00, the air temperature was 8.1°C, atmospheric pressure was 1001.3 mb, the ground was wet, the maximum wind gusts were from 10.8 m/s to 13.8 m/s from the northwest, relative humidity was 78%, and visibility was 10 km.

At 19:00, the air temperature was 7.3°C, atmospheric pressure was 1001.9 mb, the ground was wet, the maximum wind gusts were from 10.8 m/s to 13.8 m/s from the northwest, relative humidity was 70%, and visibility was 10 km.

Meteorological visibility is the transparency of the atmosphere, expressed as the maximum distance at which objects can be identified by a normal observer during daylight or light sources at night.

The data was issued based on measurements and observations at the Meteorological Station in Sombor, which is climatologically representative for the requested area.

At the time of conducting the investigation into the serious accident by the investigative team CINS, it was nighttime. The weather was clear, windy, and there were no precipitation events. Conducting the investigation was challenging due to the nighttime conditions. The air temperature was approximately 4°C.

3. Minutes on investigation and examination

The data, facts, and evidence regarding the serious accident were collected and determined based on:

- Investigation conducted by the Working Group of CINS at the scene,
- Material provided by the infrastructure manager "IŽS"a.d,
- Material provided by the railway undertaking "Transagent Operator"d.o.o,
- Material provided by the railway undertaking "Srbijavoz"a.d.,
- Material provided by the Basic Court in Sombor,
- Material provided by the MUP RS,
- Material provided by the Health Center in Odžaci,
- Material provided by the General Hospital in Subotica,
- Material provided by the General Hospital in Sombor,
- Material provided by the University Clinical Center of Vojvodina,
- Material provided by the Republic Hydro-Meteorological Service.

3.1. Summary of testimonies

The CINS Working Group conducted hearings with employees who were involved in the serious accident on January 29, 2024, January 30, 2024, and March 11, 2024, at the CINS premises.

From the employees of "IŽS"a.d, the following were heard: the train dispatcher of Ratkovo station, the train dispatcher of Odžaci station, and the switchman of Ratkovo station, who were on duty at Ratkovo and Odžaci stations at the time of the serious accident.

From the employees of "Transagent Operator"d.o.o, the driver who was in possession of locomotive 753-782 of the train No. 49028/73478 at the time of the serious accident was heard.

From the employees of "Srbijavoz"a.d, two conductors and a driver who were on duty with train No. 25412 (DMV 711-077/078) at the time of the serious accident were heard.

Statements from "IŽS"a.d, "Srbijavoz"a.d, and "Transagent Operator"d.o.o. were provided, including transcripts of hearings with train crew members of train No. 25412 (train driver and two conductors), train crew of train No. 49028/73478 (train driver), and personnel regulating traffic at Gajdobra, Ratkovo, and Odžaci stations (three train dispatchers and three switchmen).

From "IŽS"a.d, a report on irregularities during work (SP-9) No. 19 dated November 17, 2023, issued by the train dispatcher of Odžaci station, who was on duty at Odžaci station at the time of the serious accident, was provided.

From "Srbijavoz"a.d, a report on irregularities - problems (K-91) No. 32/2023-1-3-144 dated November 20, 2023, issued by the first conductor accompanying train No. 25412, was provided.

Summaries of testimony for the Ratkovo station train dispatcher, the Odžaci station train dispatcher, the Ratkovo station switchman, the driver of train No. 49028/73478, the driver of train No. 25412 and the two conductors of train No. 25412 were given according to hearings conducted by the CINS Working Group.

The statements taken by the CINS on the spot on the day of the serious accident from the participants in the serious accident match in all essential facts with the statements given during the hearing conducted by the CINS Working Group.

3.1.1. Railway staff

The train dispatcher of Ratkovo station stated that on the day of the serious accident, the electromechanical device at Ratkovo station was malfunctioning, specifically unable to set the entrance and display the green light. He mentioned that there was increased traffic at Ratkovo station that day and he had to handle four track closures due to vegetation cutting alongside the tracks, requiring him to issue permits, set entries and exits, issue check out, request permission, a workload similar to handling 7 to 8 trains. He noted being fatigued towards the end of his shift due to increased volume of work (second to last before annual leave and retirement, having foregone leave due to staff shortages). He provided a phonogram to the train driver of the train No. 25412 for the train's entrance into the station, stating the entrance signal was faulty, and station staff's aspects of a signals were permisionative for entry. He noted the preceding train to the train No. 25412 was freight train No. 49028/73478. He instructed the switchman to set the exit for train No. 49028/73478 from track four, dispatching it from Ratkovo station at 18:13. He did not receive check out from Odžaci station for the last train before train No. 25412. At the time train No. 25412 entered Ratkovo station, the switchman signaled "forward" at the switch block and he signaled "slow down" in front of the station building. After handling passengers upon train No. 25412's arrival, and without check out from Odžaci, it was dispatched. He heard of locomotive 753-782's defect and the stopping of the train No. 49028/73478 on the open Ratkovo-Odžaci track, after the train No. 25412's dispatch, when the train driver called from mobile to fixed telephone, and immediately grasped what he has done. He survived the shock because he realized what he had done and was worried about the worst. The train dispatcher has 40 years and five months of experience, having worked almost 39 years at Zmajevo station (a station with electro-relay interlocking using a Westinghouse device). After that, he has been at Ratkovo station (with an electromechanical device, where switches are not dependent on the entry signals). He notes that at Zmajevo, where the APB device prevents mistakes, everything at Ratkovo depends on you, the switchman, and the locomotive driver, so he did not feel comfortable transitioning to Ratkovo station. He also mentions that to perform a crossing at Ratkovo according to regulations, much more time is needed than is usually practiced. To comply with regulations, Ratkovo station needs two switchmen, but only one works, and he has to cover 600 to 700 m from one side to the other. He states that they signed the existing old Business Order of Ratkovo station, Part I. They have not received training for working with the device at Ratkovo, nor have they signed that they are trained and qualified to operate it.

The train dispatcher of Odžaci station stated that he began his shift shortly before the serious accident occurred. He emphasizes that regular communication with neighboring official positions for traffic regulation is done via a recorded link, occasionally using a city phone where conversations are not recorded. On the mentioned day, there were no disruptions or malfunctions in the communication devices or means, except that the city phone at Odžaci station was not working. Before the serious accident, the last permission he gave was for train No. 49028/73478, and he received the authorization from Ratkovo station for that train. He notes that due to the fact that freight train No. 49028/73478 had not arrived in Odžaci within the expected time, according to the schedule, he did not immediately inform the previous station (Ratkovo station) that the train had not yet arrived because it is common practice that trains are delayed due to night-time operations and the type of cargo (adding a few minutes to the regular travel time), so he was

waiting the train in front of the station. He established communication with the train dispatcher of Ratkovo station by calling from his mobile phone to the fixed phone at Ratkovo station, where the train dispatcher of Ratkovo station responded with the comment "now it's too late." He highlights that there is a trend of increasing the number of trains, and since the new timetable for 2023/2024 (which came into effect on December 10, 2023), there are approximately 20 trains during the day shift.

The switcher of Ratkovo station stated that during his day shift, he communicated verbally with the train dispatcher of Ratkovo station. When he was outside the office, he used his mobile phone to call the train dispatcher, as there was no other means of communication due to equipment malfunctions affecting the input signals. He mentioned that the last train before train No. 25412, dispatched towards Odžaci station, was freight train No. 49028/73478 (which he believes was the train that broke down and stopped on the open track). Following the dispatcher's orders, he secured the entry route for train No. 49028/73478 onto the fourth track after passenger train No. 25413 from Odžaci to Gajdobra passed through. He also secured the exit route for train No. 49028/73478, as instructed by the dispatcher. Regarding securing the entry route for train No. 25412 onto the third track at Ratkovo station, since the entry signal was not working, the train dispatcher ordered him to proceed with bringing the train into the station, which he did. Train No. 25412 had a brief stop at Ratkovo station, approximately 2 minutes (due to it being Friday and having more students and pupils). Afterward, he received instructions from the train dispatcher to secure the exit route for train No. 25412. He noted that when he set the route for the exit from the fourth track for train No. 49028/73478, using switch No. 5, he waited for the train to exit before returning switch No. 5 to its normal position directing towards the third track. At the moment when train No. 25412 was departing from the station, he was on the opposite side, near the entry signal from the direction of Ratkovo.

The the train driver of the train No. 49028/73478 stated that he received permission to enter Ratkovo station on the fourth track from both the train dispatcher and the switcher of Ratkovo station. Before entering Ratkovo station, he communicated with the train dispatcher of Ratkovo station who informed him that the entry signal was malfunctioning, and he should proceed based on manual signals from the switcher. Upon entering the station, the train dispatcher handed him Order Form 2 for crossing and instructed him to proceed to the track-limit. He also mentioned that the train dispatcher informed him that after the passenger train No. 25413 passed, the switcher would come to set the route, and then he could continue further. Train No. 49028/73478 had an operational stop at Ratkovo station for about twenty minutes. Afterwards, the switcher arrived, set the route, gave the "Proceed" signal, and, in agreement with the train dispatcher, he departed Ratkovo station towards Odžaci station. He first noticed a problem with the locomotive's operation when the red light came on and started beeping, causing the train to stop between Ratkovo and Odžaci stations. From the moment of stopping the train before the switch-on point at “Lalić” level crossing he attempted to fix the issue and called a technical colleague for assistance. He tried calling Odžaci station twice but couldn't reach them. After that, he called Ratkovo station and spoke to the train dispatcher, informing him that the locomotive had stopped and he couldn't restore its operation. From the moment the train stopped until he established communication with the train dispatcher of Ratkovo station, he estimated that 10 to 15 minutes had passed. At the moment of impact from behind, he felt the collision and immediately called the train dispatcher from Ratkovo station, asking what had hit him from behind, as he couldn't determine it himself.

The train driver of train No. 25412 stated that the train arrived at Ratkovo station on the third track and received instructions in Gajdobra that the entry signal at Ratkovo station was faulty, and manual signals from station personnel were in effect. At Ratkovo station, there was only passenger handling for about a minute or two, as scheduled. He received departure clearance from the train

dispatcher who was at the head of the train, both conductors acknowledged and gave the aspect of a signal “Ready to depart”. During the journey from Ratkovo to Odžaci, there were no stops. When he first noticed an obstacle on the track, namely train No. 49028/73478, he had already begun braking earlier due to something suspicious, a darker shade in the surroundings. He claims he first saw the end-of-train signal from a distance of about 200 m, and noticed two end-of-train signals on the freight train, of a new square shape. He mentions giving the aspect of a signal “Watch out” because of the level crossing near the location where the serious accident occurred. It later turned out that the end of the freight train was beyond that crossing. Upon seeing the end-of-train signal, he activated the “external” and pneumatic brakes and pressed the emergency button, estimating he wouldn't be able to stop the train in time. He then ran from the drivers cabin to the passenger area and shouted a few times, “Hold on, we're going to hit”. After the serious accident, he remembers it being dark, with no yelling or screaming from passengers who remained calm. He then saw his first conductor colleague who was disoriented, and they used his phone to call the police. He was worried about the train catching fire and, working together with the other conductor, they checked and confirmed that there was no leaking fuel. The stress caught up with him a day or two after the serious accident.

The first conductor of train No. 25412 stated that the train arrived at Ratkovo station on the third passing track. He estimates that the train handling at Ratkovo station took about a minute to a minute and a half. During passenger handling, he was at the first set of doors, while his colleague was at the second set of doors, after which train No. 25412 departed from Ratkovo station towards Odžaci station. During the emergency braking and the collision, he was on the platform between the first and second compartments, near the handles for entering the train. He adds that after the serious accident, he physically felt very distressed. Some passengers showed signs of injuries, and at that moment, as much as he could manage because himself was injured, he took his phone and called emergency services and the police. During the impact, he was thrown from one side to the other of the structure. The train's lighting went out at the moment of impact.

The final conductor of train No. 25412 stated that upon arrival at Ratkovo station, passenger handling took about one to two minutes, after which he and his colleague confirmed readiness for departure, closed the doors, and the train departed from Ratkovo station. During the journey from Ratkovo to Odžaci, before the site of the serious accident, the train did not stop anywhere. At the moment of braking and just before the serious accident occurred, he was in the rear part of the train. He assumed they had hit something but didn't know what. He checked on passengers and provided assistance where he could, called emergency services and the police. After the serious accident, he had injuries all over his body and experienced stress.

3.1.2. Other witnesses

By the Letter Su VIII-42-17/24 dated March 19, 2024, from the Basic Court in Sombor, 49 Witness Statements were delivered (for five railway workers and 44 passengers of train No. 25412). According to the witness statements of the passengers’ records, there were no problems during the journey until the moment of the serious accident. At the moment of impact, some passengers fell to the floor or collided with other objects, resulting in injuries. The injuries varied and were documented by medical professionals. Witnesses stated that after the impact, the train lights went out, making it difficult to provide assistance. Immediately after the serious accident, emergency services and the police were informed by “Srbijavoz”a.d. staff. Medical teams arrived promptly at the scene to provide assistance, while some capable passengers made their own way to medical facilities.

At the time of the on-site investigation conducted by CINS, there were no witnesses to the serious accident.

3.2. Safety management system

3.2.1. Organizational Frame and Method of Issuing and Executing Orders

In accordance with the current Safety Management System Rulebook, "IŽS"a.d. notified CINS about the accident.

In accordance with the current Safety Management System Rulebook, "Srbijavoz"a.d. notified CINS about the accident.

In accordance with the current Safety Management System Rulebook, "Transagent Operator"d.o.o. notified CINS about the accident.

The infrastructure manager "IŽS"a.d. and railway undertakings "Srbijavoz"a.d. and "Transagent Operator"d.o.o, in accordance with the Law on Railway Traffic Safety ("Official Gazette of the RS" No. 41/18), formed a joint investigation committee that conducted the serious accident investigation. Upon completion of the investigation, an Investigation Report was compiled (case U-402/23), file No. 15/2024-240 dated 08.03.2024, by "IŽS"a.d.

3.2.2. Requirements that railway staff must meet and the manner they are applied

"Srbijavoz"a.d. has ensured the management of competencies through the Safety Management System (SMS) Rulebook, i.e., processes to ensure that all employees directly involved in the conduct of railway traffic are trained and competent, as well as the planning of workload.

In relation to the serious accident involving the train driver and conductors employed at "Srbijavoz"a.d, all activities related to professional training, competence, and working time planning were carried out in accordance with applicable regulations.

"Transagent Operator"d.o.o. has ensured the management of competencies through the Safety Management System (SMS) Rulebook, i.e. processes to ensure that all employees directly involved in the conduct of railway traffic are trained and competent, as well as the planning of workload.

In relation to the serious accident involving the train driver employed at "Transagent Operator"d.o.o, all activities related to professional training, competence, and working time planning were carried out in accordance with applicable regulations.

"IŽS"a.d. has ensured the management of competencies through the Safety Management System (SMS) Rulebook, i.e. processes to ensure that all employees directly involved in the conduct of railway traffic are trained and competent, as well as the planning of workload.

In relation to the serious accident involving the train dispatchers employed at "IŽS"a.d, it can be stated that they had passed the professional exam and were medically fit to perform their duties. Activities related to the planning of working time were carried out in accordance with applicable regulations. The obligation of the employer, i.e. "IŽS"a.d, was to ensure that before starting work at the specific official position, all railway workers were acquainted in a proven manner with the Business Order of that official position and all instructions related to the performance of work.

This was not done in the case of the train dispatcher who was on duty at Ratkovo station at the time of the serious accident.

3.2.3. Procedures for internal audits and controls and their results

"IŽS"a.d. as the infrastructure manager, has established the Safety Management System (SMS) Rulebook. The Safety Management System encompasses the organization and all procedures and processes established within "IŽS"a.d. for the safe conduct of railway traffic.

Risk control related to the maintenance of railway infrastructure (subsystems of infrastructure, energy, control, management, and signaling - trackside) and railway vehicles used for maintenance by "IŽS"a.d. is based on the implementation of defined activities for regular and extraordinary maintenance and their monitoring and control. Regular and extraordinary maintenance includes continuous supervision, controls, inspections, repairs, and overhauls.

The requirements, standards, and procedures for maintenance at "IŽS"a.d. are established based on legal regulations, general and specific company acts, manufacturer instructions, and standards.

"IŽS"a.d. as the infrastructure manager, has defined through the Safety Management System (SMS) Rulebook: procedures ensuring that personnel entrusted with responsibilities within the organization have the authority, professional competence, and necessary resources to meet their tasks; clearly defined areas of responsibility relevant to safety and the distribution of responsibilities according to functions related to them and their interfaces; procedures ensuring that tasks relevant to safety are clearly defined and delegated to personnel with the required professional competence; descriptions of how responsibilities for each safety-relevant process within the infrastructure manager's organization are assigned; procedures for regular supervision of task execution by superiors who intervene if tasks are not properly executed; procedures ensuring that personnel and their representatives are adequately represented and consulted in defining, proposing, verifying, and improving the safety aspects of operations involving personnel.

Out of the SS devices that are installed in the Ratkovo station, there is only an entrance light signal with pre signals of the entrance signals from the direction of Gajdobra and Odžaci stations, which are handled through the station set. Due to the theft of the signaling equipment and accompanying cables, the pre-signals were not in operation (switched off).

Regarding the serious accident, it can be stated that "IŽS"a.d. did not maintain certain elements (SS and telecommunications devices) of the public railway infrastructure in accordance with Article 55 of The Law on Railways ("Official Gazette of RS" Nos. 41/2018 and 62/2023).

"Srbija Voz"a.d, as a railway undertaking, has established the Safety Management System (SMS) Rulebook. The general purpose of the Safety Management System (SMS) is to ensure that "Serbia Voz"a.d. achieves its business objectives in a safe manner.

The purpose of establishing the Safety Management System (SMS) in "Srbija Voz"a.d. is to ensure the safe management of its activities in accordance with the provisions of the Railway Safety and Interoperability Law ("Official Gazette of RS" Nos. 104/13, 66/15 - other law, and 92/15) and the Statute of the Joint Stock Company for Passenger Railway Transport "Srbia Voz", Belgrade ("Official Gazette of RS" No. 60/15).

Planning in the safety management process is carried out by adopting other plans in specific elements essential to the safety management process: Maintenance plans for rolling stock to

increase technical reliability and achieve greater safety in rolling stock operations, the Framework plan and program for training executive workers in “Srbija Voz”a.d. and their professional competence checks, plans for checking the health fitness of executive and operational workers.

Rolling stock must maintain the prescribed technical level of reliability and follow maintenance plans (EV-62) and their cycles of control-technical inspections and regular repairs to be as reliable as possible in operation, in accordance with the Rulebook on the Maintenance of Railway Vehicles and other legal and sub-legal acts that are part of the Safety Management System Rulebook of “Srbija Voz”a.d.

Within “Srbija Voz”a.d, internal control is organized in all organizational units, particularly in the area of rolling stock maintenance during regular repairs, in control-technical inspections, and with rolling stock. There is also special control of executive staff regarding the application of regulations, use of alcohol, rest between duties, and more. Besides this type of control, there is also control through the Internal Control Center, which is tasked with performing control at all levels in all organizational units of the company, on all relevant issues.

All these activities and business processes of “Srbija Voz”a.d. are risk generators in traffic operations. These risks are identified and quantified through the definition of operational business processes. Instructions, rulebooks, technical documentation, and legal regulations are applied in work processes, fulfilling instructions and maintaining defined records and business documentation.

Regarding the serious accident, regular and extraordinary maintenance of the rolling stock (DMV 711-077/078) at “Srbijavoz”a.d. was carried out in accordance with applicable regulations.

“Transagent Operator”d.o.o, as a railway undertaking, has established the Safety Management System (SMS) Rulebook. The primary goal of this system is to maintain and continuously improve the achieved level of railway traffic safety on the railway network where the company operates. The Safety Management System encompasses the organization and all procedures and processes established and implemented for the safe conduct of railway traffic according to the type and scope of railway transport activities. This system relates to railway traffic safety but is functionally connected with all other aspects and activities of the company directly or indirectly related to traffic safety.

The Safety Management System must enable the control of all risks associated with the activities of the manager or railway operator, including contract maintenance services, other individuals and companies, and risks arising from third-party activities. Risk control involves managing risks in a way that ensures an acceptable level of railway traffic safety, i.e. a level defined by the company's own safety objectives.

“Transagent Operator”d.o.o. as a railway operator, has defined through the Safety Management System Rulebook that all company employees performing traffic safety-related activities must have an adequate level of education, professional competence, and necessary health fitness for the jobs they are responsible for. The required level of competence and fitness of employees must be continuously maintained and improved as needed.

“Transagent Operator”d.o.o. uses leased traction vehicles in its transportation activities. The lease agreement includes maintenance services and the company's obligations regarding the provision of operational data to the entity responsible for maintenance (ECM). Through the “fullease” contract model, the maintenance risk is transferred to the entity responsible for maintenance designated by the locomotive owner. Maintenance interval alignment with the purpose and manner of vehicle use is conducted by the contracted ECM (outsource).

Regarding the serious accident, regular and extraordinary maintenance of the rolling stock (locomotive 753-782) leased by “Transagent Operator”d.o.o. was carried out in accordance with applicable regulations.

3.3. Relevant international and national regulations

3.3.1. Law on Railways (“Official Gazette RS“ Nos. 41/2018 and 62/2023)

II Railway infrastructure

...

1. Public railway infrastructure management

...

Obligations of the infrastructure manager

Article 10 (excerpt)

The infrastructure manager is obligated to ensure the safe and uninterrupted organization, regulation, and management of railway traffic, unobstructed access to and use of public railway infrastructure, and access to service facilities entrusted to their management and the services they provide in those facilities to all interested applicants for the allocation of infrastructure capacity, under equal, non-discriminatory, and transparent conditions, as well as the continuous, uninterrupted, and high-quality maintenance and protection of railway infrastructure

...

IIIA Construction, reconstruction, renewal, and maintenance of public railway infrastructure

...

Maintenance of public railway infrastructure

Article 55 (excerpt)

Public railway infrastructure must be maintained in a condition that ensures safe and uninterrupted railway traffic, as well as high-quality and orderly transport, in accordance with regulations governing railway traffic safety and technical regulations and standards.

Maintenance of public railway infrastructure includes regular maintenance and extraordinary maintenance.

The technological unit for maintenance consists of all elements of public railway infrastructure. Maintenance intervenes in individual elements, bringing them to a condition that does not reduce the technological function of the railway line and prevents the creation of bottlenecks on the railway.

...

Article 56

Regular maintenance works include, in particular: maintenance and replacement of elements of the superstructure of the railway line (switches, tracks, and track connections) with the same or other types that maintain the parameters of the railway line at the designed level; works on the lower structure of the railway line (drainage and slope arrangement); removal of trees, shrubs, and undergrowth from the railway zone; replacement and renewal with the same or other materials of culverts and bridges, provided their openings are not changed; replacement and supplementation of elements of signal-safety and telecommunications devices and installations; replacement and supplementation of elements of stationary electric traction installations, as well as other installations for the transformation and transmission of electric power for train traction; adaptation and repair of buildings at railway service points and other facilities at railway service points that are used for railway traffic, without changing their structure and external appearance; cleaning of snow and ice from tracks, installations, and surfaces on station platforms, stops, and other areas.

3.3.2. Law on Railway Traffic Safety ("Official Gazette RS" No. 41/18)

VII. Subsystem control, management, and signaling

1. Subsystem to which national technical regulations apply

a) Signal and safety devices

Technical conditions

Article 34 (excerpt)

Official positions from which the management and regulation of railway traffic on the railway line are carried out, depending on the maximum train speed, must be equipped with signal and safety devices and installations, as follows:

1) For train speeds on regional and local railway lines through the switch area up to 50 km/h - with entry or protection signals that do not have to be technically interdependent and dependent on the position of the switches on the route to indicate whether further travel is allowed at regular or restricted speed. Exceptionally, these stations may only be secured with approach signals;

...

Maintenance of signal and safety devices

Article 35

Signal-safety devices must be maintained in a condition that ensures safe and orderly railway traffic.

The Directorate prescribes the manner and deadlines for maintaining signal-safety devices.

b) Railway telecommunication network

Technical conditions

Article 37

The railway telecommunication network is a set of telecommunication systems and devices connected into a technological unit in terms of operation and use.

Main railway lines, regardless of the train speed, as well as other railway lines for train speeds from 100 to 160 km/h, must be equipped with track devices through which a radio link is established between the traction vehicle staff and the dispatch center staff.

The Directorate prescribes the technical conditions for railway telecommunication networks.

Maintenance of the railway telecommunication network

Article 38

The railway telecommunication network must be maintained in a condition that ensures the safe conduct of railway traffic and the orderly performance of transport in railway traffic.

The Directorate prescribes the manner and deadlines for maintaining the railway telecommunication network.

3.3.3. Traffic Rulebook (*"Official Gazette RS "No. 34/22, 107/22*)

II. Technical equipment of railway lines

...

3. Signal-safety devices at stations and on the line

...

a) Station signal-safety devices

Types of station signal-safety devices

Article 11. (excerpt)

Station signal-safety devices are:

...

2) Inter-signal dependency interlocking devices - devices that involve the setting of switches and derails on site and the electrical operation of signals, preventing simultaneous setting of entry signals from different directions to display a signal for allowed movement; these devices do not include interdependence between entry signals and switches, nor the control of the clearance of station tracks;

...

4. Means of Communication

Types of telecommunication devices

Article 23 (excerpt)

In the regulation and operation of railway traffic, communication is carried out using telecommunication devices:

1) Telephone connections;

2) Radio-dispatch connections (hereinafter: RDV);

3) Radio connections;

4) Telefax.

...

Communication using devices that enable reliable and continuous recording of messages is considered proof communication.

Telephone and radio connections without recording devices are not considered proof communication means.

Messages related to the regulation of train movements are transmitted using proof communication means.

...

IV. Station Business Order

General Provisions on Station Business Order

Article 27 (excerpt)

...

Employees of the railway infrastructure manager and railway undertakings who perform duties at the station confirm by their signature that they are familiar with the provisions of the station's Business Order.

...

XIII. Train traffic regulation

1. General provisions on train traffic regulation

Method of train traffic regulation

Article 121 (excerpt)

Train traffic is regulated by requesting and granting permissions, departure noticing trains, or pre-notifying and reporting trains and providing check out.

Permissions, departure notices, departure pre-notices, reports, and check outs are given and received personally by the train dispatcher, while reports and check outs are given and received by the signaler.

Successive trains operate one after another only at a spatial interval.

In certain cases (e.g., snow plows), trains also operate at a time interval.

...

Spatial Interval

Article 122 (excerpt)

For regulating train traffic at a spatial interval, the tracks are divided into:

1) Station spatial sections, where two neighboring stations regulate the following of trains within the station interval;

...

Only one train is present on the same track in the same spatial section at the same time.

3. Regulation of train traffic on tracks not equipped with automatic block signal devices, inter-station dependency devices, and remote control

Permission

Article 133. (excerpt)

On single-track lines, on double-track lines during single-track operations, and on double-track lines during double-track operations when specified, the train dispatcher must request permission from the next station before dispatching the train.

...

Permission is requested before giving the signal for announcing the train's departure with the electric signal bell, but no more than 10 minutes before the train's departure.

Granting permission is the confirmation from the next station that it has not dispatched and will not dispatch an opposing train, shunting composition, or track vehicle in the direction of the station requesting permission and that it can receive the offered train at the station.

Permission is requested via a phonogram:

“Do you accept train No. ..... (train dispatcher’s last name)”

Permission is granted via a phonogram:

“I accept train No. ..... (train dispatcher’s last name)”

If the queried station for any reason does not grant permission for the offered train, it responds to the request with a phonogram:

“Let train No. .... wait (train dispatcher’s last name)”

When the reason for refusing the train's acceptance ceases, the queried station itself grants permission for the previously offered train with the appropriate additional information.

At official positions secured only by approach signals, permission for the train is granted only if the route for that train is secured, unless a general order mandates the train's stop at the approach signal.

If it is anticipated that the train will not depart within 10 minutes of receiving permission, the station that granted the permission is notified via a phonogram:

“Permission for train No. .... is canceled (train dispatcher’s last name)”

...

Notifications and pre-notifications

Article 140 (excerpt)

Official positions that directly participate in regulating train movements report the departure of the train to the next official positions and level crossings. Reporting the departure of the train is called a departure notice. The departure notice is given immediately upon the departure or passing of the train.

The departure notice is given via a phonogram:

"Train No. ..... departed (passed) R, or at ..... (hour and minute), or ahead of schedule at ..... (hour and minute)".

...

Check out

Article 141 (excerpt)

Stations and signal boxes confirm to the preceding official position that the preceding spatial section is clear with a check out.

Check out is always given only from one occupied official position to another for each train, immediately upon its arrival or passage.

When the train has completely entered the station and the entry signal behind it is set to display the stop signal, the train dispatcher notifies the preceding station or signal box with a phonogram:

"Train No. .... here (train dispatcher's last name)".

The train is considered to have fully entered the station when the last vehicle with the end signal has passed the appropriate boundaries markers or the isolated sections.

If five minutes have passed since the departure notice (notification) from the preceding station and the train has not arrived, the official position expecting the arrival (or passage) of the train immediately informs the preceding station that the train has not yet arrived, without waiting for a check out prompt from the preceding official position. The same procedure is followed when the station anticipates holding the train before the entry signal for more than five minutes.

...

XV. Train movement on the railway track

...

3. Exceptional stopping of the train on an open track

Exceptional stopping due to disturbance on the train

Article 234 (excerpt)

Train staff stops the train on an open track as soon as they notice anything that could endanger the further movement of their train or another train.

If a disturbance is noticed on the train, the train staff will immediately secure the train from moving on its own and then attempt to resolve the disturbance. The train is secured from moving on its own by the train driver or, if necessary, by aspect of a signal or orally, instructing the train staff to secure the train from moving on its own. If the train driver anticipates that the train will be delayed for more than 15 minutes, they inform both neighboring stations via telephone or RDV and on the TK line, the TK dispatcher, and if necessary, request assistance.

For trains with only the train driver on the locomotive, the train driver leaves the locomotive after taking measures prescribed in Article 232, Paragraph 3 of this Rulebook.

If one of the neighboring stations could not be notified, the other neighboring station informs about the train stoppage and all orders issued to the train crew.

Assistance is requested by telephone, via RDV, by stopping the train traveling on the second track of a double-track or parallel track, or by sending train or track personnel to the nearest telephone or official position.

When requesting assistance, the reason, kilometer position of the front and rear of the train, and additional equipment needed for assistance are stated.

If assistance is requested through sent personnel, the train driver records the information from paragraph 6 in a hand notebook which provided to the sent personnel. Orders received by telephone sent personnel writes in the hand notebook, and the form return to the engineer. If the sent personnel go to the possessed station, further instructions are issued by the train dispatcher or authorized station personnel with a general order carried by the sent personnel to the train driver.

For trains possessed only with train driver, if assistance cannot be requested for any reason, the train driver remains on the train and waits for assistance.

...

9. Communication of the traction vehicle crew with the neighboring stations, that is, the TK dispatcher

Notification of train stopping on the track

Article 251

The locomotive crew of a train stopped before the main signal, at a level crossing, or on an open track, communicates with neighboring stations, and on TK lines with the TK dispatcher, via RDV or telephone closest to the train stopping location.

The connection between the train driver and the train dispatcher of the neighboring station is established via RDV, through a TK dispatcher who reliably identifies the requested station and then forwards the connection to the train.

After establishing the connection, the train driver provides the following information: train number, stopping location (signal number, level crossing, kilometer position of the track, etc.), reason for the stoppage, name and surname.

Upon receiving the notification, the train dispatcher of the neighboring station announces the full name of the station, name and surname, and then issues instructions.

Notification of disturbance on the train

Article 252

Notification of any disturbance occurring with a train on an open track the train driver provides to the dispatcher of the next station in the presence of the train dispatcher of the preceding station. If the train is withdrawing to the station, the notification is given to the train dispatcher of the preceding station in the presence of the dispatcher of the next station.

The train dispatcher to which the notification is given first consults with the train dispatcher of the neighboring stations on the necessary measures and then issues orders in his presence.

If the notification or order is given via RDV, the dispatcher of the neighboring station is not present, but an agreement is reached beforehand as per paragraph 2 of this Article.

The train driver provides notification to the TK dispatcher of any disturbance occurring with a train on an open TK track.

3.3.4. Rulebook 2, Traffic Rulebook ("Official Gazette of ZJŽ", No. 3/94, 4/94, 5/94, 4/96, and 6/03)

Note: Upon the enactment of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/22, 107/22), this Rulebook ceases to be valid.

Anomalies during train driving on an open track

Article 63 (excerpt)

Exceptional Stopping of a Train on an Open Track

Train personnel stop the train on an open track as soon as they notice anything that could endanger the further driving of their own or other trains.

If any disturbance is observed on the train, the train crew must immediately attempt to rectify it upon stopping. If the freight train conductor (train driver) anticipates that the train will be delayed for more than 15 minutes, via telephone or RDV, they inform both neighboring stations, and on TK lines, TK-dispatcher, and if necessary, request assistance.

3.3.5. Rulebook on maintenance of railway vehicles ("Official Gazette of RS", No. 101/2015, 24/2016 and 36/2017)

...

Appendix 9.

Maintenance of lighting devices and sirens

1. Front and rear lights and sirens on the traction vehicle and other vehicles with a drivers cabin must be in working order all the time when the traction vehicle is used for its intended purpose in railway traffic.

2. Checking the correctness of front and rear lights and sirens is performed during periodic inspections.

3. Checking the correctness of the front and rear lights consists of checking the connection points, installations, correctness of the lights and adjustment of the light beam.

...

3.3.6. Rulebook on technical conditions and maintenance of railway telecommunication network ("Official Gazette of RS", No. 68/21)

II. Technical Conditions for Railway Telecommunication Network

General Conditions

Equipment of Workplaces

Article 6

Workplaces directly involved in train traffic management are equipped with:

1) Railway telephone connection;

2) Telecommunication console;

3) Auxiliary telephone;

4) Equipment for displaying accurate time;

5) Connection to the data transmission system;

6) Other appropriate technical solutions in accordance with technological advancements.

Workplaces where employees participate in managing traffic on lines equipped with RDV system, in addition to the equipment listed in paragraph 1 of this article, are equipped with suitable communication equipment for RDV system.

The minimum equipment of individual workplaces with telecommunication devices essential for safe and uninterrupted railway traffic management is determined according to the following categories of track equipment:

1) Tracks where train traffic is remotely controlled entirely from the traffic control center and equipped with RDV system;

2) Tracks equipped with RDV system but not remotely controlled from the traffic control center;

3) Tracks where train traffic is not remotely controlled and not equipped with RDV system.

3.3.7. Instructions on the organization and operation of the operational service in the area of "Infrastuktura železnica Srbije"a.d. ("Official Gazette of ŽS" Nos. 21/17, 21/18, 37/18 and 28/23)

I. Introductory provisions

...

Meaning of terms, concepts and abbreviations

Article 3 (excerpt)

Certain terms and concepts used in this Guide have the following meanings:

...

• A defect of a locomotive is a malfunction of the locomotive on a train that requires the train to be held at a station or on an open track, but of a nature that cannot be rectified and the locomotive cannot be restored for continued operation. Instead, it must be replaced with another locomotive. A locomotive defect also includes a malfunction that causes a passenger train delay of more than 30 minutes or a freight train delay of more than 60 minutes, regardless of whether the locomotive has been replaced or not.

• A breakdown of a locomotive is a malfunction of the locomotive on a train that requires the train to be held at a station or on an open track, but of a nature that can be rectified and the locomotive can be restored for continued operation. If the breakdown is severe, the train driver must notify the train dispatcher or the dispatcher within 10 minutes and inform them of the possibility of resolving it.

...

V. Operational measures to ensure the smooth traffic of trains

Operational measures to ensure the traffic of trains in cases of locomotive breakdowns and malfunctions

Article 34: (excerpt)

...

(b) – breakdowns and defects in traction vehicles

...

4. Operative measures that should be foreseen in cases where there is a breakdown of a traction vehicle, i.e. the disabling of a traction vehicle that is of such a that the traction vehicle can be enabled to continue driving, include the following:

- notification of the type of breakdown must be given by the train driver within a time not longer than 10 minutes on main lines, or 30 minutes on regional and local lines
- A train with a locomotive in a state of malfunction waits on an open track until the train driver resolves the issue and resumes operation or declares a defect of the traction vehicle
- A train with a traction vehicle in a state of breakdown does not depart from a station until the train driver provides notification that the breakdown has been resolved and the train can continue its journey, or until a traction vehicle defect is declared
- The local operational department or section only considers options to secure a functional traction vehicle if the train driver cannot resolve the malfunction and cannot continue the train's operation, or if a locomotive defect is declared, in order to make quicker and more effective decisions regarding securing a working traction vehicle

5. Operational measures to be taken in cases where a traction vehicle defect occurs, rendering the locomotive incapable of continuing its operation, include the following:

- Immediately upon learning about the traction vehicle defect, it is necessary to notify the railway undertaking responsible for the train where the traction vehicle defect occurred.
- In agreement with the railway undertaking, ensure a functional traction vehicle is provided for the respective train, and handle the defective traction vehicle according to the railway undertaking’s requirements.

- If a functional locomotive cannot be provided to the railway undertaking within a relatively short period, the Central Operational Department will designate which traction vehicle will be used and inform the railway undertakings whose traction vehicle are involved, independently of the railway undertaking.

3.3.8. Network Statement for 2023 by "IŽS"a.d. No. 5/2021-370-155 dated November 17, 2021 (including 11 amendments, corrections, and interpretations, valid from September 6, 2023)

Note: This Network Statement was in effect at the time of a serious accident. The stated provisions are identical in the Network Statement that is valid during 2024 and in the Network Statement that will be valid during 2025 (source: "IŽS"a.d. website).

3.4.2 Procedure for accepting staff of the railway undertakings (excerpt)

...

The undertaking is responsible for the training of staff, the validity of periodic knowledge checks, familiarity with the state of the tracks, and local conditions at official positions. The undertaking is obliged to comply with the applicable legal regulations of the Republic of Serbia in this regard.

...

6. Operational Rules

6.1 Introduction

Traffic on the railway infrastructure shall be conducted in such a way as to ensure the protection of human life, property, and the environment. A undertaking operating traffic on the railway infrastructure is obliged to adhere to the regulations and provisions that apply to conducting traffic on the specific railway infrastructure.

6.2 Operational Work Rules (excerpt)

The list of valid rulebooks and instructions related to operational work rules is given in Appendix 2.

...

6.3 Special measures applied in case of traffic disruptions

...

6.3.2 Operational Rules (excerpt)

To reestablish normal traffic flow, operational rules for regulating railway traffic as prescribed by the Law on Railway Traffic Safety, the Traffic Rulebook ("Official Gazette of RS" No. 34/22 and 107/22), the Instruction on Certain Procedures for Performing Traffic Services in the Area of "Infrastruktura Železnice Srbije"a.d. ("Official Gazette of ŽS" No. 43/22), the Instruction on the Organization and Operation of the Operational Service in the Area of "Infrastruktura Železnice Srbije"a.d. ("Official Gazette of ŽS" No.s 21/17, 21/18, and 37/18), and other internal acts of IŽS are applied.

In cases where traffic on a section of the railway is disrupted due to a defect in the traction vehicle of the railway undertaking, to clear the railway for the normalization of traffic as quickly as possible, the operational service of IŽS takes operational measures prescribed by the provisions of Article 34 of the internal act Instructions on the Organization and Operation of the Operational Service in the Area of "Infrastrukture železnice Srbije"a.d. ("Official Gazette of ŽS" Nos. 21/17, 21/18, and 37/18).

...

Appendix 2: Internal regulations and technological procedures (excerpt)

The internal regulations and technological procedures applied by IŽS are listed in the Register of Regulations Relevant to Traffic Safety, specifically in point 1.3 Internal general regulations of "Infrastrukture železnice Srbije"a.d.

The Register of regulations relevant to railway traffic safety is published on the website of "Infrastrukture železnice Srbije"a.d.

...

3.4. Functioning of the railway vehicles and technical installations

3.4.1. Control, management and signalling

In the stations Ratkovo and Odžaci, the pre-signals were not operational, as they were disabled due to theft of signal equipment, cables, and wire transmission mechanisms. At the time of the serious accident, train traffic regulation in these stations and on the inter-station distance Ratkovo - Odžaci was managed from the work positions of the train dispatchers at Ratkovo and Odžaci stations, within the station interval. At the time of the serious accident, there was a malfunction in the inter-signal dependency device at Ratkovo station. For this reason, during the period of the malfunction, the train dispatcher at Ratkovo station could not remotely operate the entry signals from either direction. Instead, the entry of trains into the station, according to the train dispatcher's order, was regulated by the aspect of a signal "Proceed" given by the switchman, who awaited the trains at the station's entry signal.

At the time of the serious accident, there were malfunctions in the SS devices at Ratkovo and Odžaci stations. Table 3.4.1.1 below provides an overview of the unresolved malfunctions and other irregularities in the functioning of the SS and telecommunication devices at Ratkovo and Odžaci stations, based on the material provided by "IŽS"a.d.

Table 3.4.1.1: Verview of unresolved malfunctions and other irregularities in the functioning of SS and telecommunication devices at Ratkovo and Odžaci stations

Serial No.	Malfunction description	Time of malfunction	Time of resloving malfunction	Expert explanation
Ratkovo station				
1.	Pre-signals disabled due to theft of signal equipment and accompanying cables	No date clarified, sometime before 01.04.2022.		
2.	The device does not accept train entry commands from one side	17.11.2023. 18:10	17.11.2023. 22:50	Contacts on the PSB relay cleaned, insert fallen out of the lock and returned
Odžaci station				
3.	Pre-signals disabled due to damaged equipment and theft of wire transmission mechanisms.	No exact date, sometime before 01.04.2022.		
4.	Malfunction on the public PTT telephone line (line of the fixed telecommunication network operated by "Telekom Srbija").	No exact date and time		

Considering that in case of inability to use radio communication, communication with traffic personnel can be conducted using the public fixed telecommunication network operated by "Telekom Srbija", according to the provisions of the Temporary Instruction for the Use of Telecommunication Connections in Traffic Regulation on Certain Railway Tracks of "ŽTP Belgrade", No. 63-48/94 dated June 2, 1994, under item 4, in table 3.4.1.1. a fault on the public fixed telecommunication network line operated by "Telekom Srbija" is listed. This fault was not recorded in the Fault Log at the apparatus and line (V-11) at Odžaci station. In the material

provided by “IŽS”a.d, in letter No. 21/2023-1603 dated December 20, 2023, from the ETP Sector, which includes information on the technical equipment and condition of telecommunication facilities on the Novi Sad - Odžaci - Bogojevo railway line, no fault on this line was mentioned.

3.4.2. Infrastructure

The regional railway line No. 207 Novi Sad - Odžaci - Bogojevo, between Ratkovo station (km 50+477) and Odžaci station (km 58+975), is a single-track line designed for a speed of 120 km/h.

According to Timetable Book 4.2 (which was valid at the time of the serious accident), on the section between Ratkovo and Odžaci stations, the maximum permitted speed for passenger trains was 100 km/h, while the maximum permitted speed for freight trains was 80 km/h. There were no speed restrictions on this inter-station distance according to the same timetable book. Additionally, on the regional railway section from km 52+250 to km 52+350, a restricted speed of 50 km/h was introduced on December 12, 2021, due to poor track geometry at the level crossing at km 52+303 (as per email from “IŽS”a.d, Sector for GP, Department for maintenance of the lines Novi Sad, dated January 17, 2024). This speed restriction was also documented in Timetable Book 4.2 (valid from December 10, 2023, to December 14, 2024) for the same section.

The location of the serious accident is on a horizontal and straight section of the track.

“IŽS”a.d. provided data indicating that between January 1, 2023, and the occurrence of the serious accident, mechanical vegetation clearance was conducted between Ratkovo and Odžaci stations, covering an area of 8,900 m² within the timeframe from November 6, 2023, to November 17, 2023.

3.4.3. Telecommunication tools

At the time of the serious accident, there were no recorded disturbances or faults on the communication equipment used by the personnel regulating traffic at Ratkovo and Odžaci stations, including radio communication and installed radio stations for communication purposes.

During the hearing by the CINS Working Group, the train dispatcher at Odžaci station mentioned that there was a malfunctioning public fixed telecommunication network telephone operated by “Telekom Srbija” which had not been operational for several days.

On the section of the railway between Ratkovo and Odžaci stations, there are no communication devices between the train dispatcher and the train driver. In practice, this communication is conducted via mobile phones (train driver and train dispatcher), or through calls made from a mobile phone (train driver) to the public fixed telecommunication network telephone of the station (train dispatcher).

The appearance of the station set and the radio station equipment in the train dispatcher's office at Ratkovo station is depicted in Image 3.4.3.1.

Figure 3.4.3.1: The appearance of the radio station and station set at the office of the train dispatcher of station Ratkovo

3.4.4. Railway vehicles

Train No. 49028/73478 (locomotive 753-782 and 9 freight wagons of series S) was operating on the route Dimitrovgrad - Subotica. The train was assembled and braked in accordance with applicable regulations. Prior to the serious accident, train No. 49028/73478 was traveling from Ratkovo station to Odžaci station (from the beginning to the end of the track, in the direction of increasing mileage).

The locomotive was operated from driver's cab II. According to the train driver's statement, during the journey between Ratkovo and Odžaci stations, due to a hydraulic malfunction or oil temperature problem, the audible and visual alarm indicating a fault was activated, the diesel engine of the locomotive was shut down, and the train was forced to stop. Based on the "Report on the malfunction of locomotive 753-782" issued by the specialist for coordination and monitoring of maintenance of rolling stock at "Transagent operator"d.o.o. Belgrade (provided in the attachment to the email dated January 16, 2024), measurements and tests conducted after the serious accident revealed that there was a fault in the auxiliary contact of the blade-type fuse FU11, resulting in no supply and digital impulse at point PRH of the NES electronic regulator, as the electrical circuit was open. At the time of the serious accident, train No. 49028/73478 was stationary on an open track.

The appearance of the driver cab II of locomotive 753-782 from train No. 49028/73478 is shown in Figure 3.4.4.1.

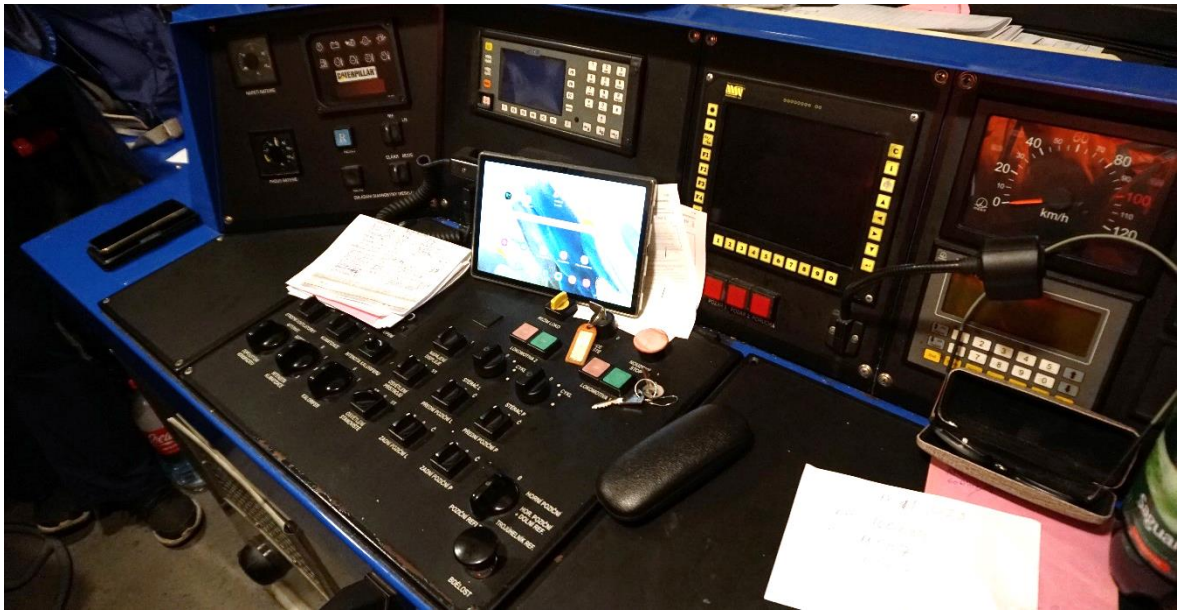


Figure 3.4.4.1: The appearance of the driver cab II of locomotive 753-782 from train No. 49028/73478

At the site of the serious accident, due to the extent of damage to the last wagon of train No. 49028/73478, the position of DMV 711-077/078 of train No. 25412, as well as nighttime conditions, it was not possible to determine the presence of the end signal. According to the statement of the train driver of train No. 49028/73478, in Novi Sad station marshalling yard, two end signals with reflective material were handed over to the wagon examiner, and the train was properly signaled upon departure from Novi Sad station marshalling yard. According to the statement of the train driver of train No. 25412, while approaching the freight train, two square-shaped end signals were observed at the end of train No. 49028/73478.

On locomotive 753-782, speed measuring devices manufactured by MESIT are installed, namely: central unit Type TTZ43.1LT7, analog speedometer Type TTU43.3A, and digital speedometer Type TTU43.2A. Certification data for the speed measuring devices installed on locomotive 753-782 were not provided by "Transagent operator"d.o.o, the lessee of this locomotive, as they were not received from the equipment maintenance provider (ECM) (Taťová strojní společnost a.s, Ostrava, Přívoz), despite repeated requests from the railway carrier "Transagent operator"d.o.o. Data processing from the memory of the electronic speedometer device of locomotive 753-782 (data processing details provided by railway carrier "Transagent Operator"d.o.o in letter No. A969/2023 dated December 28, 2023) revealed that train No. 49028/73478 passed through Gajdobra station without stopping at 17:38 and was traveling towards Ratkovo station at a speed between 36 and 44 km/h. The train then stopped at Ratkovo station at 17:56 (the train was restarted at 17:57 from Ratkovo station at a speed of 12 km/h and stopped at 18:00 near the boundary marker). After that, the train departed from Ratkovo station at 18:09. From the departure from Ratkovo station to the stop at km 56+050 near Odžaci station, the train did not make any stops. During the journey on the mentioned section of the line, the maximum speed of the train was 44 km/h. After reaching the maximum speed of 44 km/h, the speed started to decrease, with the train continuing to move under inertia, maintaining constant pressure in the main air pipe. At 18:24, there was a decrease in pressure in the main air pipe to 3.7 bar, after which the train stopped (speed dropped to 0 km/h). Thereafter, no change in speed was recorded. All times are given according to the clock of the speedometer device.

Train No. 25412 (DMV 711-077/078) operated, regularly, on the route Novi Sad marshalling yard - Subotica. The train was signaled and braked in accordance with applicable regulations. At the time of the serious accident, train No. 25412 was moving in the direction from Ratkovo station towards Odžaci station. After covering a distance of approximately 5500 m from departure at Ratkovo station, the front of train No. 25412 collided with the rear of train No. 49028/73478.

The appearance of motor wagon 711-078 DMV 711-077/078 at train No. 25412 after the collision, after they were transferred to Odžaci station and loaded onto the flatbed wagon, is shown in Figures 3.4.4.2 and 3.4.4.3.

Figure 3.4.4.2: External appearance of the driver cab of the motor wagon 711-078 DMV 711-077/078 at the train No. 25412 after the serious accident

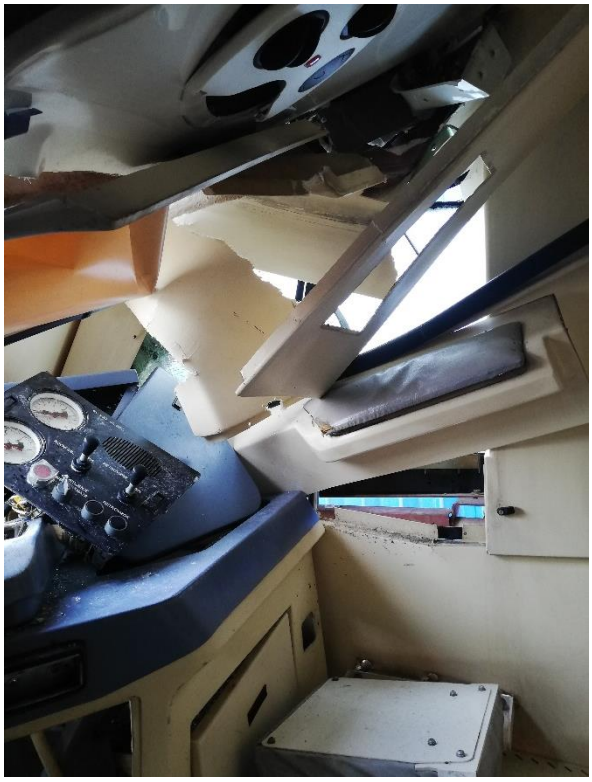


Figure 3.4.4.3: The appearance of the passenger compartment and the driver cab DMV 711-077/078 at the train No. 25412 after the serious accident

The DMV 711-077/078 is equipped with a speed measuring and recording device type TELOC 1500, manufactured by HaslerRail from Bern, with serial No. 11043771. For this device, "Srbijavoz"a.d. provided Report No. 3/04-2023 on the testing and verification of the TELOC 1500 speed measuring and recording device dated May 4, 2023, and Certificate No. 3/04-2023 confirming that the electronic speedometer TELOC 1500, serial No. 11043771, is functional and compliant with Appendix 6 of Instruction 230.

By processing data retrieved from the memory of the electronic speed measuring device on DMV 711-077/078 (Data from TELOC 1500 speedometer device No. 39/2023-250-1 dated December 18, 2023), it was determined that train No. 25412 departed from Gajdobra station at 18:24:39 and traveled to the Parage stop at a maximum speed of 100 km/h. The train stopped at the Parage stop at 18:31:39 and resumed at 18:31:41. Subsequently, following Order I/34, the train stopped at a level crossing at km 44+303 at 18:32:38 and resumed at 18:32:43. On the stretch from Parage stop to Ratkovo station, the train traveled at a maximum speed of 100 km/h. Upon entering Ratkovo station, the maximum speed was 37 km/h. The train arrived at Ratkovo station at 18:37:58 and after a stopping of 43 seconds, departed at 18:38:41. Upon leaving Ratkovo station through the station area, the maximum speed was 40 km/h. From the departure of Ratkovo station, after covering 832 m, the maximum speed was 50 km/h and was maintained over a length of 100 m (restricted speed from km 52+250 to km 52+350), after which the train continued towards Odžaci station at a maximum speed of 99 km/h. At 18:43:34, a decrease in main air pressure and an increase in brake cylinder pressure were observed, initiating rapid braking at a speed of 93.2 km/h. During the process of initiating rapid braking at a speed of 52 km/h, in the same second, at 18:43:43, within an interval of 2/100 seconds, the train speed decreased from 52 km/h to 36 km/h.

The train stopped at km 56+050 at 18:43:47. All times are reported according to the clock of the speed measuring device.

3.5. Traffic management and regulation

3.5.1. Action undertaken by the staff that manages the traffic regulation and control and signaling

The operation of consecutive trains No. 49028/73478 and 25412 on the Ratkovo - Odžaci route occurred within station distance.

The dispatch of train No.49028/73478 from Ratkovo station towards Odžaci was conducted by the train dispatcher of Ratkovo station. Permission was obtained from the train dispatcher of Odžaci station at 18:10, the switching order for setting the departure route was issued at 18:10, and the departure notice was given to the train dispatcher of Odžaci station at 18:13.

The dispatch of train No.25412 from Ratkovo station towards Odžaci was not conducted in accordance with regulations, specifically contrary to Articles 123, 133, 138, and 140 of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/22, 107/22). The train dispatcher of Ratkovo station dispatched train No. 25412 without previously receiving the check out from the train dispatcher of Odžaci station for the arrival of the preceding train No. 49028/73478 at Odžaci station and without obtaining permission from the train dispatcher of Odžaci station for the dispatch of train No. 25412.

The monitoring of the movement of train No. 49028/73478 on the Ratkovo - Odžaci route by the train dispatcher of Odžaci station was not timely (five minutes after the expected arrival time of the train), in accordance with Articles 141 and 175 of the Traffic Rulebook ("Official Gazette of RS" No. 34/22 and 107/22). Considering that:

- at 18:13, train No. 49028/73748 was departure noticed to Odžaci station by the train dispatcher of Ratkovo station,
- the travel time of train No. 49028/73748 was nine minutes according to the current timetable (Timetable Book 4.2 with respective amendments and supplements),
- train No. 49028/73478 had an unscheduled stop at Ratkovo station according to the timetable (which prolonged its travel time by approximately 1 minute), and
- There was restricted speed from km 52+250 to km 52+350, introduced by telegrams No. 83F and 85F dated December 9, 2022, from "IZS"a.d. (which did not impact the extension of travel time),

the estimated time of arrival of train No. 49028/73478 at Odžaci station was 18:23 h. The train dispatcher of Odžaci station informed the previous station, Ratkovo, at 18:41 that train No. 49028/73748 had not arrived. According to the statement of the train dispatcher of Odžaci station, the first attempt to establish communication with the train dispatcher of Ratkovo station was made at 18:38.

The train staff received all necessary orders and information regarding the operation of trains No. 49028/73478 and 25412 on that section of the railway through accompanying documents.

3.5.1.1. Timeline

Based on the timeline of communication by the train dispatcher of Ratkovo station over a period of three hours and nine minutes (from the opening of the track for traffic at 15:30 until the dispatch of train No. 25412 at 18:39), it can be noted that there were 45 instances of communication via radio conestion for traffic regulation involving a total of 7 trains and 12 instances of verbal communication with the switchman for track securing purposes at the station. The timeline of communication of the train dispatcher of Ratkovo station for November 17, 2023, from 15:18 to 18:57, with other personnel regulating train traffic and with the train crew, is depicted in Table 3.5.1.1.1.

Table 3.5.1.1.1.**:** Timeline of communication by the train dispatcher of Ratkovo station from 17.11.2023

Time of communication	Work position					
	Station Gajdobra train dispatcher	**Station Ratkovo train dispatcher**	Station Odžaci train dispatcher	Station Bogojevo train dispatcher	Station Ratkovo switcher	The train driver of the train No. 49028/73478
15:18:00		Gave permission for 73474				
15:28:00		Received the notuify for 73474				
15:30:00		Opened the track for traffic				
15:31:00		The train No.73474 was not notified on crossing with the 25441 in Ratkovo				
		Order to enter the 73474 into the station				
15:40:00		Gave permission for 25441				
15:47:00		Order for the travel route for 73474				
		Received the departure notice for 25441				
15:53:00		Order for travel route passing for 25441				
		Checked out for 73474				
15:54:00		Received permission for 25441				
15:55:00		Checked out for 25441				
		Gave departure notice for 25441				
15:56:00		Received the permission for 73474				
15:59:00		Order for travel route of exit for 73474				

Time of communication	Work position					
	Station Gajdobra train dispatcher	**Station Ratkovo train dispatcher**	Station Odžaci train dispatcher	Station Bogojevo train dispatcher	Station Ratkovo switcher	The train driver of the train No. 49028/73478
16:05:00		Gave departure notice for 73474				
16:15:00		Received checkout for 25441				
16:19:00		Gave permission for 25434				
16:20:00		Received the check out for 73474				
16:32:00		Received departure notice for 25434				
16:37:00		Received permission for 25434				
16:44:00		Order for travel route of passage for 25434				
16:50:00		Gave checkout for 25434				
		Gave departure notice for 25434				
17:00:00		Gave permission for 73476				
17:04:00		Received the checkout for 25434				
17:07:00		Received departure notice for 73476				
17:12:00		Established crossing 25413 with 73476 at Odžaci				
17:14:00		Established crossing 25413 with 73478 at Ratkovo				
17:18:00		Received permission for 73476				
17:19:00		To inform 73476 that should stop in Odžaci				
17:24:00		Passage route order for 73476				
17:30:00		Gave departure notice for 73476				
		Order to introduce 73478 into the station				
17:31:00		Informed 73476 to stop in Odžaci - Order				
		Gave check out for 73476				

Time of communication	Work position					
	Station Gajdobra train dispatcher	**Station Ratkovo train dispatcher**	Station Odžaci train dispatcher	Station Bogojevo train dispatcher	Station Ratkovo switcher	The train driver of the train No. 49028/73478
17:33:00		Gave permission for 73478				
17:37:00		Received departure notice for 73478				
17:38:00		Train 73478 was not informed that it should stop in Ratkovo				
17:48:00		Received a call from train driver 73478 and gave an order to enter the station				
17:49:00		Received a check-out for 73476				
17:52:00		Gave permission for 25413				
17:53:00		Entry route order for 73478				
17:59:00		Checked out for 73478				
18:00:00		Received departure notice for 25413				
18:01:00		Received permission for 25413				
18:04:00		Order for the drive route of passage for 25413				
18:10:00		Checked out for 25413				
		Received permission for 73478				
		Gave departure notice for 25413				
		Order for the route of the exit for 73478				
18:13:00		Gave departure notice for 73478, train dispatched				
18:15:00		Notify 25412 that the input signal is faulty				
		No check-out received for 73478; the train broke down at 18:24				

Time of communication	Work position					
	Station Gajdobra train dispatcher	**Station Ratkovo train dispatcher**	Station Odžaci train dispatcher	Station Bogojevo train dispatcher	Station Ratkovo switcher	The train driver of the train No. 49028/73478
18:25:00		Received check out for 25413				
		Faulty entry signal, give “Forward” for 25412				
		Gave permission for 25412				
18:25:00		Order for the driving route of the passage for 25412				
18:26:00		Received departure notice or 25412				
18:27:00		Notified 25412 that the entry signal is faulty				
		No permission received for 25412 and no preceding station reporting that train 3478 has not yet arrived in Ratkovo				
18:39:00		Checked out for 25412; train 25412 dispatched to Odžaci station				
		Call from train driver 73478 regarding a defect on the track				
18:41:00 (statement of the train dispacher)		Call from the Odžaci train dispatcher regarding the (non)arrival of 73478				
18:44:00		Call from train 73478 driver regarding passenger train collision				
18:57:00		Call from train driver 73478				

Legend							
No.	Train No.	Colour	Train No.	Colour	Train No.	Colour	Train No.
	73474		25434		73478		25412
	25441		73476		25413		Crossing

3.5.2. Exchange of the voice message related to the serious accident

Immediately before the serious accident, communication was established between the train driver of train No. 49028/73478 and the traffic control personnel, specifically the train dispatcher at Ratkovo station. The first communication occurred verbally around 18:00, during the delivery of the Crossing Order (Order number 2) by the train dispatcher at Ratkovo station. The train driver was informed that after the passenger train No. 25413 arrives at the station and the exit track is set, the train should proceed. The second communication occurred at 18:39, when the train driver used a mobile phone to call the fixed telephone line at Ratkovo station, informing the train dispatcher that the train was stopped on the track and he was unable to restart the locomotive.

Immediately before the serious accident, communication also took place between the personnel managing traffic, specifically between the train dispatcher at Odžaci station and the train dispatcher at Ratkovo station. The first communication occurred at 18:10 via radio communication, where the Odžaci station train dispatcher granted permission for train No. 49028/73478. The second communication occurred at 18:13 via radio communication, when the Ratkovo station train dispatcher issued the departure notice for train No. 49028/73478. The third communication occurred at 18:41, when the Odžaci station train dispatcher called the fixed telephone line at Ratkovo station, inquiring about train No. 49028/73478, which had not yet arrived.

After the serious accident occurred (notification of the serious accident), communication was established between the train driver of train No. 49028/73478 and the traffic control personnel, specifically the train dispatcher at Ratkovo station. The train driver used a mobile phone to call the fixed telephone line, informing the train dispatcher at Ratkovo station about the serious accident.

Immediately before the serious accident, after the departure of train No. 49028/73478 from Ratkovo station, communication also took place between the train driver of train No. 49028/73478 and the person responsible for coordinating and monitoring the maintenance of rolling stock at “Transagent Operator”d.o.o. The communication was conducted via video calls using the “Viber” application, several times between 18:16 and 18:41 (four calls were registered). The communication was related to a malfunction on locomotive 753-782. After the serious accident, another call was registered at 18:48 between the train driver and the person responsible for coordinating and monitoring the maintenance of rolling stock.

Immediately before and after the serious accident, there was no communication between the train driver of train No. 25412 and the traffic control personnel.

3.5.3. Measures undertaken to secure the serious accident site

After the serious accident, a section of the regional railway line No. 207 between stations Ratkovo and Odžaci was closed to traffic.

According to information provided by the Basic Court in Sombor (enclosed with letter No. Su VIII-42-17/24 dated March 19, 2024), members of the Odžaci PS (a team of two police officers dispatched upon the order of the duty service of the Odžaci PS) secured the accident scene until the arrival of the investigative team from the Odžaci PS.

No other measures were taken to secure the scene of the serious accident.

3.6. Interface between people, machines and organization

3.6.1. Work time of the staff involved

From the railway infrastructure manager "IŽS"a.d. and railway operators "Srbijavoz"a.d. and "Transagent Operator"d.o.o, data has been provided indicating that the train driver who operated DMV 711-077/078, the train driver who operated locomotive 753-782, as well as the train dispatchers and switch operators working at stations Ratkovo and Odžaci, all adhered to legally prescribed rest periods before commencing work and did not exceed the maximum allowable working hours as stipulated by law.

The train dispatcher at Ratkovo station began employment on April 15, 1983. From the start of employment until April 6, 2022, he held the position of train dispatcher at Zmajevo, Vrbas, Stepanovićevo, and Kisač stations (all equipped with electro-relay devices connected to the central interlocking system). From April 6, 2022, until the occurrence of the serious accident, he worked as a train dispatcher at stations Odžaci, Ratkovo, Odžaci Kalvarija, Karavukovo, and Bač.

3.6.2. Health and personal circumstances that have effect on the serious accident, including the presence of physical or psychological stress

Based on the information provided by the railway infrastructure manager "IŽS"a.d. and railway undertakings "Srbijavoz"a.d. and "Transagent Operator"d.o.o, it is evident that the train drivers who operated DMV 711-077/078 and locomotive 753-782, the train dispatchers, and switch operators working at Ratkovo and Odžaci stations during the serious accident were certified with the required professional qualifications and were medically fit for duty.

From "Srbijavoz"a.d, a photocopy of the Train Driving License No. RS 71 2019 0101 issued by the Railway Directorate on May 1, 2019, valid until May 1, 2029, was provided for the train driver operating DMV 711-077/078.

From "Transagent Operator"d.o.o, a photocopy of the Train Driving License number RS 71 2019 0214 issued by the Railway Directorate on May 1, 2019, valid until May 1, 2029, was provided for the train driver operating locomotive 753-782.

Regarding the train dispatchers, copies of their Dispatching Licenses were provided by "IŽS"a.d, attached to the e-mail dated 08.05.2024. For the train dispatcher on duty at Ratkovo station during the time of the serious accident, a copy of the Dispatching License with serial No. 0688 was issued by "IŽS"a.d. (No. 15-2018/931-688 dated August 1, 2018), valid until August 1, 2024. For the train dispatcher on duty at Odžaci station during the time of the serious accident, a copy of the Dispatching License with serial No. 0613 was issued by "IŽS"a.d. (No. 15-2018/931-613 dated August 1, 2018), valid until August 1, 2025.

The train dispatcher who was on duty at the Ratkovo station at the time of the serious accident, Annex No. 18 of the Employment Contract No. 11/2022-2/570 dated 06.04.2022 (submitted in the attachment of Letter No. 1/2023-2412 dated 27.12.2023 "IŽS"a.d.), was transferred to the duties of dispatcher of trains at Odžaci station (Ratkovo, Parage, Odžaci Kalvarija, Karavukovo and Bač). According to Letter No. 15/2024-12.13-124 dated 08.05.2024 Head of the Odžaci station and the entry in the Traffic log of the Ratkovo station (supplied by "IŽS"a.d. by e-mail dated 08.05.2024), he began his work at the Ratkovo station in the night shift on 09/10.04.2022 (he received the shift on 09.04.2022 at 19:00, and handed it over on 10.04.2022 at 07:00). Upon

inspection of the Business Order of the Ratkovo station, part I (submitted in the attachment of Letter No.1/2023-2412 dated 27.12.2023 to "IŽS"a.d. and by electronic mail to "IŽS"a.d. dated 26.04.2024), it can be stated that the dispatcher of the trains on 15.07.2022 confirmed with his signature that he is familiar with the provisions of the Business Order of the Ratkovo station part I. According to Letter No.15/2024-12.13-125 dated 08.05.2024 from Odžaci Station Head (sent by "IŽS"a.d. via e-mail dated 08.05.2024), the train dispatcher did not confirm with his signature that he was familiar with the Instruction on handling the inter-signal dependence device at Ratkovo station. Obligation of the employer, i.e. "IŽS"a.d. was to familiarize all railway workers with the Business Order of that official position and all the instructions related to the performance of the work position, which in the case of the train dispatcher, who was on duty at the Ratkovo station at the time of the serious accident, was not done.

According to the information provided by the Basic Court in Sombor (attached to letter No. Su VIII-42-17/24 dated March 19, 2024), members of the MUP RS, PS Odžaci, conducted alcohol testing of the participants involved in the serious accident on November 17, 2023, between 19:59 and 21:04. The alcohol testing, conducted using an Alco quant model 6020 breathalyzer with factory serial No. A429963, showed no presence of alcohol in the tested participants, including the train drivers of trains Nos. 25412 and 49028/73478, the train dispatcher of Ratkovo station, and the switch operator of Ratkovo station.

Additionally, all participants involved in the serious accident self-reported experiencing stress as a consequence of this event.

3.6.3. Manner of design of equipment that has an effect on the interface between the user and the machine

The regional railway line No. 207 Novi Sad - Odžaci - Bogojevo, between the stations Ratkovo and Odžaci, is designed to meet all parameters ensuring safe train traffic speeds as prescribed by the timetable regulations. Traffic on this section of the line was managed by train dispatchers at the stations Ratkovo and Odžaci. Both stations are equipped with electromechanical interlocking devices (SS devices) or inter-signal dependency device.

On the section of the track between Ratkovo and Odžaci, only pre-entry signals (out of service, deactivated) and entry signals at the stations are installed.

Regarding communication between the traffic regulation personnel on the line and the train crew, there is no specific method of communication established by the TT Service of "IŽS"a.d. In this regard, the available means are limited to mobile phone lines and fixed telephone lines at the stations.

The locomotive series 753 is operated by the train driver through controls in the driver's cabs, designed during the locomotive's manufacturing. For locomotive 753-782, on the day of the serious accident on 17th November 2023, irregularities in the blade-type fuse were recorded, leading to power supply failure and cessation of diesel engine operation.

The train driver operates the DMV series 711 through controls in the driver's cabs designed during DMV production. No objections or irregularities were registered with DMV 711-077/078 on its systems and control devices.

3.7. Previous accidents and incidents of similar character

Based on the data provided by "IŽS"a.d. (enclosed with letter No. 1/2023-176 dated 06.02.2023), for the period from January 1, 2013, to December 25, 2023, there have been no cases of train collisions or near-miss incidents involving railway vehicles on the regional line No. 207 Novi Sad - Odžaci - Bogojevo.

During the same period (from January 1st, 2013, to November 17th, 2023), across the railway network managed by "IŽS"a.d, there were a total of 55 accidents (train collisions with railway vehicles) and incidents (near-miss incidents with railway vehicles). Out of these 55 incidents, there were 12 collisions (21.82%) and 43 near-misses (78.18%).

Details of the incidents and accidents are provided in Table 3.7.1.

Table 3.7.1: Overview of Collisions and Near-Misses Occurring from January 1st, 2013, to November 17th, 2023

Serial No.	Date	Time	Description of Event	Cause of Event
1	**02.05.2013.**	**13:15**	**At km 8+073, between Tošin Bunar stop and Zemun station, on righr track, collision between train No. 2204 with locomotive 441-701 and train No. 2402 with EMV 412/416-063/064**	**Failure of train No. 2402 train driver to timely stop the train before the spatial signal indicating a stop signal**
2	13.09.2013.	06:10	At Novi Sad Rangirna station, avoiding collision between train No. 52421 with locomotive 444-010 entering 7th track and train No. 53400 with locomotive 444-022 standing on 7th track	Failure by the switchman who incorrectly set the driving route and supervising switchman
3	**16.02.2014.**	**06:39**	**At Sopot Kosmajski station, collision between train No. 44151 passing through the station and train No. 52189 standing on 3th track**	**Failure of train No. 44151 train driver to obey the entry signal of the station showing a stop aspect of a signal**
4	19.02.2014.	18:05	At Belgrade Marshalling Yard station, in the reception yard, avoiding collision of train No. 44263 entering occupied 6th track and a freight wagons that was standing on 6th track	Case not closed.
5	25.04.2014.	07:34	At Subotica station, avoiding collision between train No. 2401 with locomotive 441-703 starting from 1st track and train No. 40764 with locomotive 444-015 entering on 4th track	Failure of external train dispatcher who dispatched train No. 2401 without the required driving route being set.
6	17.07.2014.	21:33	Between Novi Beograd and Zemun stations, on the left track, avoiding collision of consecutive trains No. 6097 and 8099	Error in work of internal train dispatcher who incorrectly assumed that the occupancy indication of outgoing section was false, and occupancy indication of next space section came from train No. 6097 and allowed train No. 8099 to pass by the exit signal which displayed a stop aspect of signal

Serial No.	Date	Time	Description of Event	Cause of Event
7	**21.08.2014.**	**18:20**	**At km 92+050, between Velika Plana and Markovac stations, collision between train No. 56702 and train No. 56900.**	**Failure of train No. 56702 train driver who passed the spatial signal showing a stop aspect of a signal without permission**
8	20.03.2015.	17:26	Between Putinci and Ruma stations, on the left track, avoiding collision of opposing trains No. 2209 and No. 34200 (locomotive 441-604 itself)	Failure of train No. 34200 train driver who did not stop at Putinci station to receive General Order, and failure of train station dispatcher Putinci
9	25.03.2015.	09:30	At Trupale station, avoiding collision between train No. 48005 starting from track 4 and train No. 66910 (with locomotive 461-125) entering track 4.	Failure of train No. 66910 driver who passed the entry signal of Trupale station showing a stop signal without permission.
10	18.06.2015.	11:00	At Beli Potok station, avoiding collision between train No. 66700 starting from 3rd track and train No. 40839/59951 coming from opposite direction passing through 4th track of the station	Failure of train No. 66700 train driver who started the train without permission and passed the exit signal of Beli Potok station showing a stop aspect of a signal
11	02.08.2015.	07:45	At Belgrade station, avoiding collision between train No. 432 entering 3rd track and train No. 337 which was granted exit from 2nd track	Failure by internal train dispatcher due to slow entry of train No. 432 into station, cancellation of the entry driving route, and failure to set the signal to the position for prohibited driving, followed by authorization for train No. 337 movement
12	12.12.2015.	18:05	At Belgrade station, avoiding collision between train No. 343 entering 4th track and train No. 336 entering 3rd track	Failure of the supervising switchman and switchman to correctly position switch No. 30b for train No. 343 entry
13	08.01.2016.	02:52	At Predjane station, avoiding collision between train No. 40873 entering the station and train No. 44700 standing on 3rd track	Failure of train No. 40873 train driver who passed the entry signal of Predjane station showing a stop aspect a of signal without permission
14	10.01.2016.	19:47	At Belgrade station, avoiding collision between train No. 3902 (EMV 412/416-005/032) entering the station and train No. 729 (EMV 413/4147-001/002) standing on 8th track	Failure of the supervising switchman and switchman who did not position switch No. 9 correctly for train No. 3902 entry
15	25.03.2016.	21:30	At Dragacevo station, avoiding collision between train No. 52981 with locomotive 621-108 entering the station during shunting on 4th track	Failure of train No. 52981 train driver and assistant train driver who passed the entry signal of Dragacevo station showing a stop aspect of a signal without permission
16	03.06.2016.	19:23	At Backa Topola station, avoiding collision between train No. 1137 (locomotive 441-501) entering the station and train No. 45610 standing on 3th track	Failure in the work of the train dispatcher
17	01.08.2016.	16:48	Between stations Ovča and Pančevo Glavna, avoiding collision between train No. 53001 (locomotive 661-116) and train No. 2503 (DMV 711-031/032)	Failure in the work of the telegraph operator at Pančevo Glavna station and the train dispatcher at Ovča station
18	13.08.2016.	15:43	At Klenje station, avoiding collision between train No. 46167 entering 2nd track and train No. 52185 entering the station from the opposite direction	Failure of train No. 52185 train driver (“Serbija Kargo”a.d. undertaking), who passed the entry signal of Kleje station showing a stop aspect of a signal without permission

Serial No.	Date	Time	Description of Event	Cause of Event
19	17.08.2016.	00:42	Between stations Vodanj and Kolari, avoiding collision between train No. 40820 passing Kolari station without stopping and train No. 72613 traveling in the opposite direction	Failure of the train dispatcher at Kolari station and the TK dispatcher at the TK center Belgrade
20	01.10.2016.	01:25	Between Suva Morava and Priboj Vranjski official positions, avoiding collision between train No. 45792 and train No. 45795 from the opposite direction	Failure of the train dispatcher at Priboj Vranjski station who dispatched train No. 45792 without obtaining permission
21	**11.01.2017.**	**19:15**	**Between junction Sajlovo and Kisač station, collision between train No. 6424 (DMV 711-017/018) and train No. 47610 (locomotive 444-010), which was standing due to a defect**	**Failure of train No. 6424 driver who passed a spatial signal showing a stop aspect of a signal without permission**
22	11.02.2017.	16:55	Between Petrovaradin and Novi Sad stations, avoiding collision between train No. 752 (EMV 413/417-023/024) and train No. 40872, which was standing in front of the entry signal of Novi Sad station showing a stop aspect of a signal	Failure of train No. 752 train driver ("Srbija Voz"a.d. undertaking) who passed a spatial signal showing a stop aspect of a signal without permission
23	26.03.2017.	21:00	At km 144+420, in Kaona station, avoiding collision between train No. 52795 entering the station and a freight wagons on the 1st manipulative track	Failure of the train dispatcher who did not position switch No. 1 in the correct direction for train passage through the station
24	**04.07.2017.**	**03:30**	**At Belgrade Marshalling Yard station, collision (side impact) between train No. 42802 (locomotive 461-024) exiting from 35th track and a shunting composition (locomotive 621-109) standing on 19th track**	**Failure in the work of the internal train dispatcher, external train dispatcher, shunting operator, and train driver ("Srbija Kargo"a.d. undertaking)**
25	09.07.2017.	14:08	At Staro Trubarovo crossing, avoiding collision between train No. 1491 entering the station and train No. 52920 standing on 1st track	Inconsistency in the function of the SS device
26	30.07.2017.	04:02	At Crveni Krst station, avoiding collision between train No. 52964 departing from 5th track and train No. 71303 standing on 6th track with a formed exit driving route	Failure of train No. 52964 train driver ("Srbija Kargo"a.d. undertaking) who started the train from 3rd track without permission and throwing switch No. 5a
27	**22.08.2017.**	**01:25**	**At Subotica station, collision between train No. 45631 entering 7th track and locomotive 461-127 moving on 4th track**	**Failure of locomotive 461-127 train driver ("Srbija Kargo"a.d. undertaking)**
28	**01.08.2018.**	**05:35**	**At km 27+369, between Ripanj Tunel and Klenje official positions, collision between trains No. 2990 (EMV 413/417-033/034) and No. 70922, locomotive 661-162 itself stopped on open track**	**Train No. 2990 train driver passed a spatial signal indicating a signal for prohibited driving without permission**
29	**29.09.2018.**	**21:40**	**At km 16+565, in Pančevo Glavna station, collision between shunting locomotive 644-006 (hit at the 5th wagon of the train) and train No. 53601 exiting 6th track**	**Shunting locomotive 644-006 train driver ("Srbija Kargo"a.d. undertaking) passed without permission a shunting signal indicating "No shunting" aspect of signal**

Serial No.	Date	Time	Description of Event	Cause of Event
30	01.12.2018.	09:49	At km 149-840, at Uzići crossing, avoiding collision between train No. 45779 (locomotive 461-106 itself) which passed through crossing, and train No. 4831 (DMV 711) which stopped in front of entering signal of crossing	Failure of train No. 45779 train driver and assistant of train driver ("Srbija Kargo"a.d.) who passed an exit signal at Uzići crossing which indicating an aspect of signal for prohibited driving
31	29.03.2019.	10:35	At Vlaško Polje station, avoiding collision between train No. 40878 exiting station and train No. 40773 entering station from opposite direction	Failure of train No. 40878 train driver ("Srbija Kargo"a.d. undertaking) who passed an exit signal at Vlaško Polje station indicating an aspect of a signal for prohibited driving
32	30.03.2019.	03:31	At Džep crossing, avoiding collision between train No. 45703 exiting crossing, and train No. 4900 approaching crossing from opposite direction	Failure of train No. 45703 train driver ("Srbija Kargo"a.d. undertaking) who passed an exit signal at Džep crossing indicating an aspect of a signal for prohibited driving
33	12.04.2019.	02:50	At km 3+050, Rasputnica "B" junction avoiding collision between train No. 45023 (locomotive 461-106, "Srbija Kargo"a.d. undertaking) and train No. 52964 (locomotive 441-031, "Srbija Kargo"a.d. undertaking) from opposite direction	Failure of train dispatcher at Resnik station, Rasputnica "K" junction and Rasputnica "B" junction
34	10.06.2019.	13:40	Between Mladenovac and Kovačevac stations, avoiding collision between train No. 42001 (locomotive 441-316, "NCL"d.o.o undertaking) and train No. 53990 (locomotive 441-513, "Kombinovani prevoz"d.o.o. undertaking) from opposite direction	Failure of train dispatcher at Mladenovac station
35	27.06.2019.	14:15	At Zemun station avoiding collision between train No. 78022 and train No. 8017 from opposite direction	Failure of train No. 78022 train driver ("Srbija Voz"a.d. undertaking) who passed through Zemun station without permission
36	04.07.2019	21:02	At Zmajevo station avoiding collision between train No. 840 (DMV 711-051/052) and train No. 4407 (DMV 711-065/066) traveling in opposite directions	Failure of train No. 840 train driver ("Srbija Voz"a.d. undertaking) who passed an exit signal of Zmajevo station indicating an aspect of a signal for prohibited driving without permission
37	10.07.2019	22:55	At km 90+090, at Velika Plana avoiding collision between train No. 46872 passing through the 4th track and train No. 53971 entering the 4th track from the opposite direction	Failure of train No. 53971 train driver ("Srbija Kargo"a.d.) passed an entry signal at Velika Plana station indicating a aspect of a signal for prohibited driving without permission
38	28.10.2019.	00:40	At Banatsko Miloševo station avoiding collision between train No. 53501 (locomotive 644-017, "Srbija Kargo"a.d. undertaking) entering the 4th track and freight wagons located on the 4th track	Failure of train dispatcher at Banatsko Milosevo station who failed to provide any notice of train entry onto an occupied track
39	04.02.2020.	19:47	Ripanj Station avoiding collision between train No. 52182 ("Srbija Kargo"a.d. undertaking) entering the station and train No. 45400 ("Srbija Kargo"a.d. undertaking) standing on the 3th track	Failure of train No. 52182 train driver ("Srbija Kargo"a.d. undertaking) who passed an entry signal at Ripanj station indicating aspect of signal for prohibited driving without permission

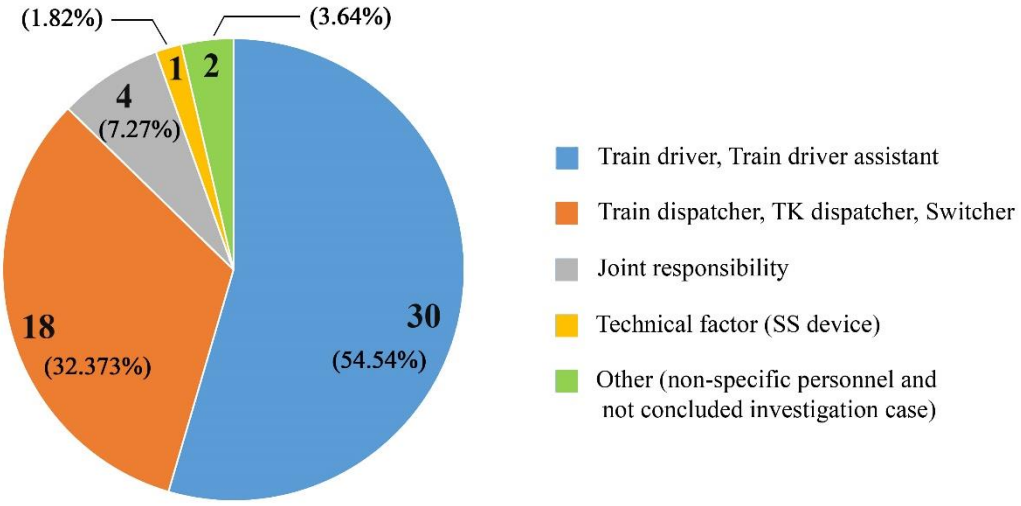
Serial No.	Date	Time	Description of Event	Cause of Event
40	06.02.2020.	15:30	Belgrade Center Station avoiding collision avoided between train No. 8022 (EMV 412/416-027/028) exiting from the 3th track and train No. 78067 (EMV 413/417-015/016) entering the 6th track from the opposite direction	Failure of external train dispatcher who dispatch train No. 8022 without order from the internal train dispatcher
41	**23.05.2020.**	**19:33**	**At Ralja station collision between train No. 46871 ("Srbija Kargo"a.d. undertaking) entering the 4th track and train No. 62185 ("Srbija Kargo"a.d. undertaking) exiting the station**	**Failure of train No. 62185 train driver ("Srbija Kargo"a.d. undertaking) who passed a boundary track signal and an exit signal at the station indicating aspect of asignal for prohibited driving without permission**
42	19.10.2020.	20:54	Between Zemunsko Polje and Zemun stations avoiding collision between train No. 8045 (EMV 412/416-064/092, "Srbija Voz"a.d. undertaking) exiting from the 3th track and train No. 8036 ("Srbija Voz"a.d. undertaking) entering the 4th track	Failure of train dispatcher at Zemunsko Polje station who gave permission for train No. 8045 to depart before setting the driving path and the arrival of train No. 8036
43	10.12.2020.	15:02	At Vlashko Polje station avoiding collision between train No. 46931 ("Srbija Kargo"a.d. undertaking) passing through the 4th track and train No. 47746 ("Srbija Kargo"a.d. undertaking) entering the station from the opposite direction	Failure of train No. 46931 train driver ("Srbija Kargo"a.d. undertaking) who passed an exit signal at Vlashko Polje station indicating aspect of a signal for prohibited driving without permission
44	26.12.2020.	08:16	At Novi Beograd Station avoiding collision between train No. 8009 (EMV 412/416-099/100) entering the station and train No. 8004 (EMV 412/416-091/096) standing on the 5th track	Failure of the switchman at block 2 of Novi Beograd station, who incorrectly set the driving path for train No. 8009
45	10.03.2020.	23:50	At Belgrade Marshalling Yard station avoiding collision between train No. 52300 ("Srbija Kargo"a.d. undertaking) with runaway wagons from industrial track "Lola"	Unauthorized handling of hand brake by non-specific personnel
46	13.09.2021.	13:00	At Ruma station avoiding collision between train No. 72210 (locomotive 647-004, "Kombinovani Prevoz"d.o.o. undertaking), entering the station, and train No. 62290 standing on the 11th track	Failure of train No. 72210 train driver and assistant train driver ("Kombinovani Prevoz"d.o.o. undertaking) who passed the entry signal at Ruma station, indicating aspect of a signal for prohibited driving, without permission
47	13.10.2021.	05:00	At Vlashko Polje Station avoiding collision between train No. 73380/52936 ("Kombinovani Prevoz"d.o.o. undertaking), entering the 3th track, and train No. 52913 (locomotive 193-917, "Srbija Kargo"a.d. undertaking), standing on the 3th track	Failure of TK dispatcher at the TK Center Belgrade, who, under interference conditions or indications of occupation on the 3th and 4th tracks, set the driving path for train No. 73380/52936 to an occupied track
48	13.04.2022.	13:50	At Zajecar station avoiding collision between locomotive train No. 70708 (locomotive 664-111, "Srbija Kargo"a.d.) exiting from the 1st track and train No. 73721 (TMD 915-105, infrastructure manager "IŽS"a.d.), entering the 2nd track	Failure of train No. 70708 train driver and assistant train driver who started the locomotive without permission, causing the switch to be throwed

Serial No.	Date	Time	Description of Event	Cause of Event
49	05.05.2022.	10:05	Between Smederevo and Radinac stations avoiding collision between train No. 6755 (DMV 711-071/072, "Srbija Voz"a.d. undertaking) moving towards Radinac station and locomotive 441-040 ("Srbija Kargo"a.d. undertaking) performing shunting work at the station	Failure of locomotive 441-040 train driver, who exited Radinac station without permission
50	**29.06.2022.**	**02:55**	**At Pančevo Glavna station collision between train No. 57601 ("Srbija Kargo"a.d. undertaking), started from the 5th track, and locomotive 441-009 ("Srbija Kargo"a.d. undertaking) stationary (not moving).**	**Failure of train No. 57601 train driver and assistant train driver ("Srbija Kargo"a.d. undertaking)**
51	**28.11.2022.**	**03:30**	**At Požega Station collision between train No. 53110 ("Srbija Kargo"a.d. undertaking), started from the 5th track, and locomotive 193-910 ("Srbija Kargo"a.d. undertaking), stationary (not moving) on the 5th trac**	**Failure of the internal and external train dispatchers of Požega station, as well as the train No. 53110 train driver**
52	**01.01.2023.**	**09:50**	**Between Resnik and Bela Reka stations collision between train No. 70111, moving from Resnik station towards defective train No. 52600**	**Failure of train No. 70111 train driver ("Srbija Kargo"a.d. undertaking)**
53	19.09.2023.	09:17	At Zemun Station avoiding collision between train No. 432, entering the 9th track of the station, and train No. 2407 (EMV 413/417-017/018), exiting from the 8th track of the station	Failure of train No. 2407 train driver ("Srbija Voz"a.d. undertaking), who started the train from the 8th track without permission and passed the exit signal at Zemun station, which indicated aspect of a signal for prohibited driving
54	12.10.2023.	01:05	Between Stalać station and Stevanac crossing avoiding collision between train No. 47842 (locomotive 1141-387, "PIMK"d.o.o. undertaking), exiting from the 2nd track of Stevanac crossing, and train No. 51331 ("Srbija Kargo"a.d. undertaking), moving towards Stevanac crossing	Failure of train No. 47842 train driver ("PIMK"d.o.o.) who started the train without permission and passed the exit signal at Stevanac crossing, which indicated aspect of a signal for prohibited driving (auto-stop device on the locomotive was disabled due to malfunction)
55	01.11.2023.	07:20	At Ovča station avoiding collision between train No. 2601 ("Srbija Voz"a.d. undertaking) for which permission was granted to enter the 3th track, at a time when the driving path for train No. 8302 ("Srbija Voz"a.d. undertaking) standing on the 3th track was already set for departure	Failure of the internal train dispatcher of Ovča station and negligence of the train No. 2601 train driver

According to the reports of the joint investigation committee of the infrastructure manager and the undertakings, the majority of these accidents and incidents (in 52 cases, or 94.55%) occurred due to personal errors of railway workers (in 30 cases involving train drivers and/or assistant train drivers; in 18 cases involving train dispatchers, TK dispatchers, telegraphers, and/or switch operators; and in 4 cases, joint responsibility was identified). In one case, the cause was

attributed to the SS device, while in another case, responsibility was attributed to non-specific personnel. One case is still pending (investigation not yet concluded).

The structure of causes of accidents and near-misses of a similar nature on the railway network of "IZS"a.d. from January 1st, 2013, to November 17th, 2023, is shown in graph 3.7.1.



Graph 3.7.1: The structure of causes of accidents and incidents of a similar nature on the railway network of "IZS"a.d. from January 1st, 2013, to November 17th, 2023

4. Analysis and conclusions

4.1. Final review of the event process and drawing conclusions about the event based on the facts established during the investigation and examination

Within the framework of the implementation of the Commercial Agreement on the modernization and reconstruction of the Hungarian-Serbian railway connection in the territory of the RS, on the day of the serious accident, works are underway to reconstruct, modernize, and build the section Novi Sad - Subotica - state border (Kelebia) under continuous closure of a section of main railway line No. 105 between stations Kisač and Naumovićevo. This necessitates the organization of train traffic via an alternative route: Novi Sad/Novi Sad Marshalling Yard - Sajlovo junction - Odžaci - Bogoevo - Sombor - Subotica. This involves significant technical, technological, and organizational changes in the way train traffic is organized, especially considering the increase in the number of trains operating on this route.

According to the data provided by "IŽS"a.d. via email dated January 16th, 2024, regarding the traffic volume before and after the start of the continuous closure of the section of main railway line No. 105 between stations Kisač and Naumovićevo, it can be noted that on the railway line No. 207 Novi Sad - Odžaci - Bogoevo, after its use as an alternative transport route began, the average number of trains during the day shift increased by 26.78%. Data for February 2022, when an average of 12.21 trains operated on the mentioned line during the day shift, and for October 2023, when an average of 15.48 trains operated on the mentioned line during the day shift, were analyzed. It can be considered that this number of trains also passed through station Ratkovo.

Upon reviewing the Traffic Diary of station Ratkovo, it can be noted that during the day shift at the time of the serious accident, 17 trains passed through the station. Due to the forestry clearance works on the section between stations Ratkovo and Odžaci, the railway was closed for train traffic 3 times and opened 4 times. During the closures, 7 motor rail vehicles were dispatched, representing a 55.04% increase in traffic volume compared to the usual average traffic volume.

Train No. 49028/73478 (locomotive 753-782 and nine wagons of series S loaded with container cargo, "Transagent Operator"d.o.o. undertaking) departed from station Ratkovo towards station Odžaci at 18:13. Permission for the traffic of train No. 49028/73478 was received from station Odžaci at 18:10, and it was departure noticed to station Odžaci at 18:13.

During the journey of train No. 49028/73478 between stations Ratkovo and Odžaci, there was an exceptional stop of train No. 49028/73478 on the open track due to a malfunction on the train, with the diesel engine of locomotive 753-782 shutting down. The train (front of locomotive 753-782) stopped at km 56+314, 6 m ahead of the activation point of the automatic level crossing at km 37+306 (Lalić level crossing).

Train No. 25412 (DMV 711-077/078, "Srbijavoz"a.d. undertaking) was dispatched from station Ratkovo towards station Odžaci at 18:39 after completing passenger handling. Permission for the traffic of train No. 25412 was not received from station Odžaci, and it was not departure noticed to Odžaci station.

Under these conditions, a collision occurred between train No. 25412 (DMV 711-077/078, railway undertaking "Srbijavoz"a.d.) and train No. 49028/73478 (locomotive 753-782 and nine wagons of series S loaded with containers, railway carrier "Transagent Operator"d.o.o.).

The collision occurred when the front of train No. 25412 (front part of DMV 711-078), which was in motion, struck the rear of train No. 49028/73478 (specifically the last wagon No. 33 68 4952 037-2), which had stopped due to the locomotive 753-782 malfunction.

After the collision, train No. 49028/73478 (which was stationary) remained in place (did not move), while train No. 25412 continued its movement for approximately 6 m. During this movement, the front part of the DMV 711-078 box climbed onto the rear end of the flat wagon No. 33 68 4952 037-2, pushing forward and deforming container No. CNEU 453486-3, which was loaded on the wagon. This led to deformation of the front part of the box in the area of the drivers' cab and container. The first bogie of DMV 711-078 (viewed in the direction of travel) shifted approximately 3 m from its position towards the end of DMV, with the wheelsets on the first axle of the bogie raised above the track (approximately 30 cm from the top edge of the rail). All other vehicle wheels in both trains remained on the tracks (did not derail). Due to the shift of the bogie, damage occurred to the drive group of DMV 711-078.

The appearance of the front part of DMV 711-078 from train No. 25412 and the rear part of the last wagon No. 33 68 4952 037-2 from train No. 49028/73478 at the site of the serious accident is depicted in images 4.1.1, 4.1.2, 4.1.3, 4.1.4, and 4.1.5.

Figure 4.1.1: Appearance of train collision No. 25412 and 49028/73478

Figure 4.1.2: The appearance of damage to the front part of the DMV 711-078 box and container No. CNEU 453486-3

Figure 4.1.3: Appearance of the damages on the wagon No. 33 68 4952 037-2

Figure 4.1.4: Appearance of the shifted bogie on the DMV 711-078

Figure 4.1.5: Appearance of the damages on the power unit DMV 711-078

On the single-track railway line No. 207 Novi Sad - Odžaci - Bogojevo, train traffic is regulated within station distance. On the section of the track where a serious accident occurred, train traffic within station distance was managed by train dispatchers from neighboring operational points Ratkovo and Odžaci. They facilitated train (track wehicles, shunting compositions) movements by issuing and giving permissions, departure notice and giving check-outs, along with receiving and transmitting phonograms through the radio communication system.

4.2. Analysis of facts determined during investigation

4.2.1. Analysis of rolling stock maintenance

4.2.1.1. Locomotive 753-782

From the railway undertaking “Transagent Operator”d.o.o. Belgrade (letter No. A969/2023 dated December 28th, 2023), data regarding regular and extraordinary maintenance of locomotive 753-782 were provided. Additionally, on April 17th, 2024, “Transagent Operator”d.o.o. Belgrade provided the Maintenance Manual for Diesel Locomotives 753.7 II. TSS via email. According to the supplied information, from February 1st, 2023, until the occurrence of the serious accident, a total of 6 routine inspections were conducted on locomotive 753-782 (comprising five operational service inspections and one minor periodic inspection). The Maintenance Manual specifies that kilometers traveled and operating hours are criteria for determining intervals for routine inspections and repairs. During the period from February 6, 2023, until the occurrence of the serious accident, a total of 15 repairs/faults were carried out on locomotive 753-782, along with one extraordinary inspection (performed after an accident on November 9, 2023, when locomotive 753-782 collided with a road vehicle at the railway crossing during shunting operations at Doljevac station). All mentioned repairs were executed in accordance with regulations.

Based on the documentation provided by “Transagent Operator”d.o.o. Belgrade, both regular and extraordinary maintenance of locomotive 753-782 were conducted in compliance with applicable regulations.

4.2.1.2. DMV 711-077/078

According to the information provided by “Srbijavoz”a.d. (attached to letter No. 1/2023-1796 dated December 27, 2023), from November 1, 2022, until the occurrence of the serious accident, a total of 36 regular control inspections were conducted. Among these, there were 26 inspections of rank Pn, 7 inspections of rank P1, one inspection each of rank P3, P6, and P24. Periodic inspections were carried out in accordance with the Maintenance Manual for Traction Vehicles of “Srbija Voz”a.d. No. 4/2016-16-4 dated February 23, 2016.

During the same period, from November 1, 2022, until the serious accident, 10 extraordinary repairs were executed. The majority of failures involved the diesel engine and braking system.

Based on the documentation provided by “Srbijavoz”a.d, both regular and extraordinary maintenance of DMV 711-077/078 were conducted in accordance with applicable regulations.

4.2.2. Analysis of the braking proces before the occurence of the serious accident

Based on the data recorded by the registering speedometer device DMV 710-077/078, diagrams on Figures 4.2.2.1. and 4.2.2.2. depict the values of main air pipe pressure (GV), brake cylinder pressure (KC), speed (v), as well as the moment of siren activation (siren) and "emergency" button (mushroom) activation in relation to the distance traveled (s) and time (t), respectively.

From the diagrams, along with the statement from the train driver of train No. 25412 (see point 3.1.1.), it can be concluded that when the train driver observed the end signal of train No. 49028/73478 which was stationary, he activated the siren and initiated emergency braking at a distance of 192 m from the stopped train, approximately 8.5 seconds before the collision. One second later, he activated the "emergency" button (mushroom). At that moment, train No. 25412 (DMV 711-077/078) was moving at a speed of 96.7 km/h. The brake cylinder pressure increased and reached a maximum value of 3.9 bar. After covering a distance of 192 m, train No. 25412 (DMV 711-077/078) collided at a speed of 60.7 km/h with the last wagon of train No. 49028/73478 which was stationary.

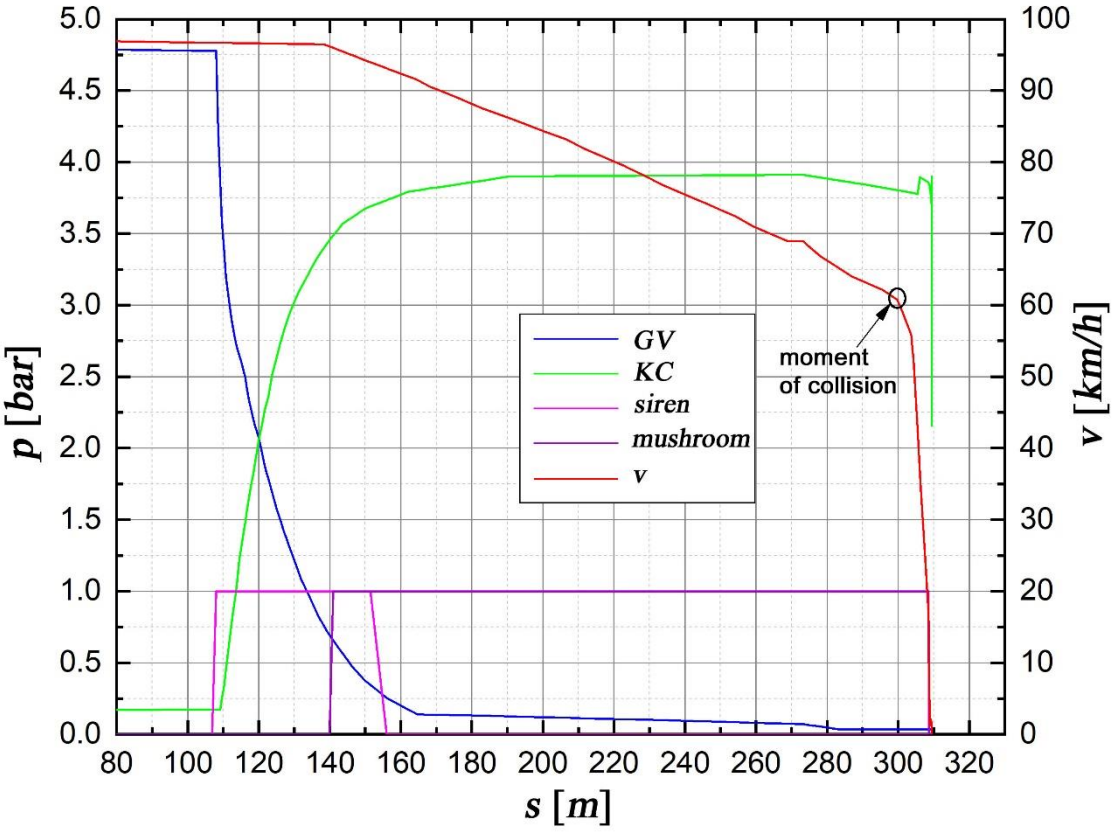


Figure 4.2.2.1: Diagram of values for main air pipe pressure (GV), brake cylinder pressure (KC), speed (v), as well as the moment of siren activation (siren) and emergency button (mushroom) activation depending on the traveled distance (s)

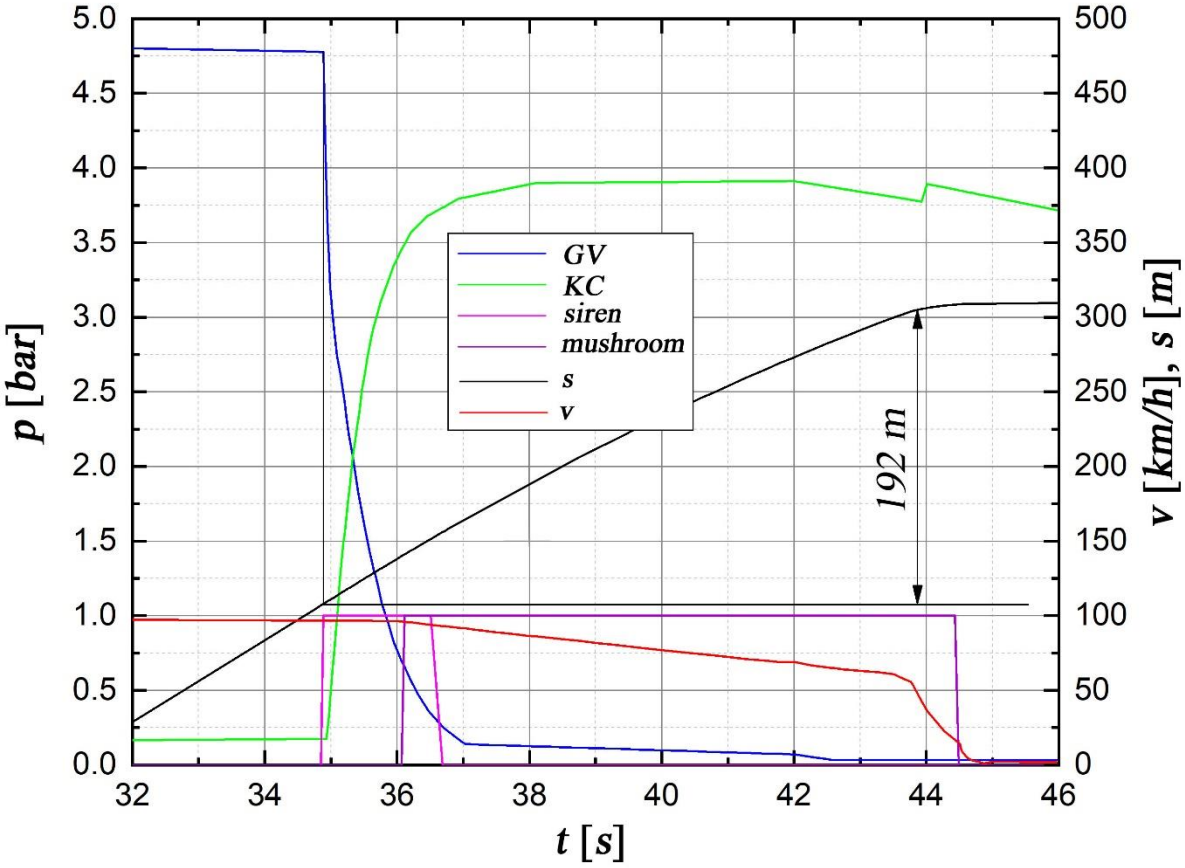


Figure 4.2.2.2: Diagram of values for main air pipe pressure (GV), brake cylinder pressure (KC), speed (v), traveled distance (s), as well as the moment of siren activation (siren) and emergency button (mushroom) activation depending on time (t).

Based on the information provided, it can be stated that the train driver of train No. 25412 (DMV 711-077/078) reacted to the sighting of the end signal of stationary train No. 49028/73478 by initiating braking, and that the brakes on train No. 25412 (DMV 711-077/078) were functioning properly at that moment.

Figure 4.2.2.3 shows a diagram depicting the values of main air pipe pressure (p_{GV}), brake cylinder pressures (p_{KC001} and p_{KC101}), and speed (v) depending on time (t). This diagram is taken from the Brake Testing Report in driving No. LIV-23-1/11 dated December 6, 2011, conducted by Institute "Kirilo Savić"a.d, Laboratory for Testing Railway Vehicles, Belgrade, during the brake testing before putting DMV series 711 into operation.

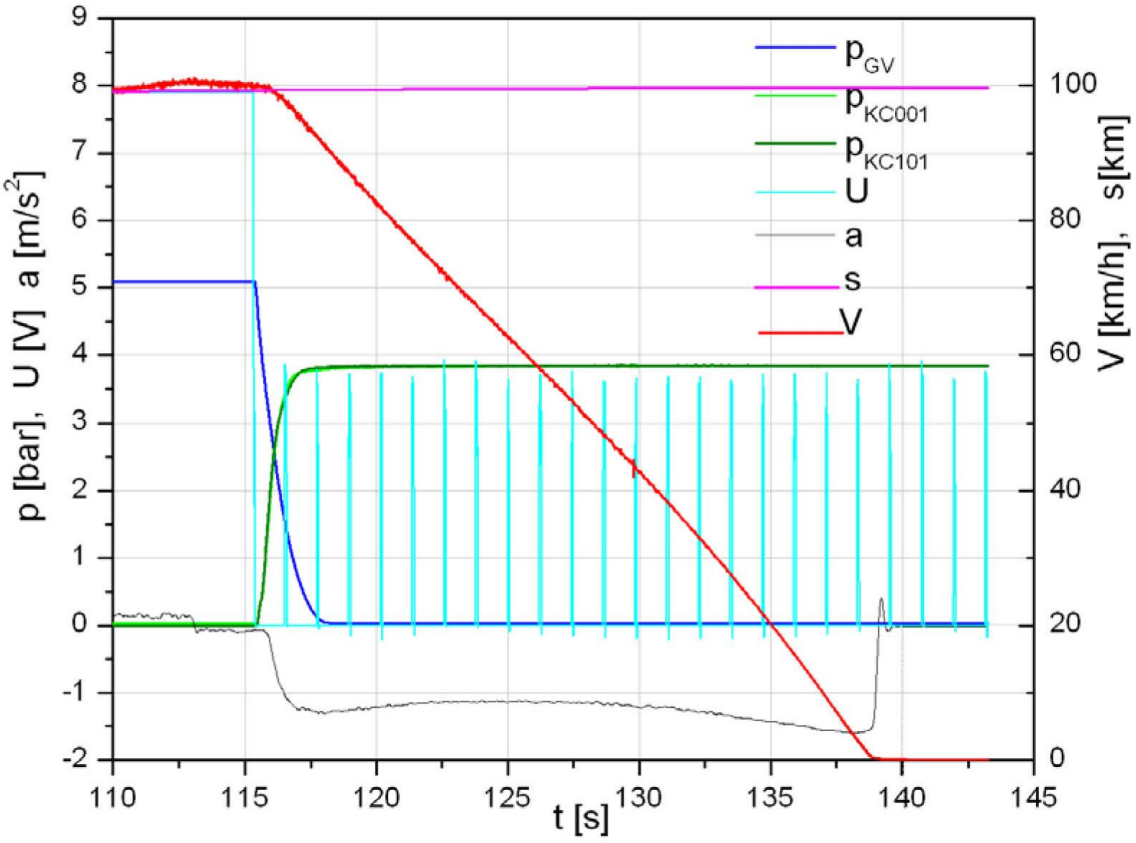


Figure 4.2.2.3: Diagram of braking from the speed 100*km/h*

From the diagrams, it can be observed that during braking (from an initial speed of 100 km/h) to reduce the speed from 96.7 km/h to 60.7 km/h, a braking time of 8.5 s was achieved.

By comparing the data recorded by the speed measuring device on train No. 25412 (DMV 711-077/078) and the data obtained during the brake testing before putting DMV series 711 into operation, it can be concluded that from the start of braking until the collision (impact with train No. 49028/73478 which was stationary ahead), there were no deviations in stopping distances. This indicates that immediately before the collision, the brakes on DMV 711-077/078 were functioning in accordance with their designed specifications.

4.2.3. Analysis of the DMV signalling devices

According to the technical description of the DMV series 711, No. 750.250000.000 РЭ-001 (delivered by "Srbijavoz"a.d. enclosed with letter No. 1/2023-1796 dated December 27, 2023), the DMV is equipped with combined signal lights in red/white colors. Additionally, there is a white reflector at the center of the upper part for illuminating the tracks (signal lights - LED diodes). Depending on the direction of movement, either white or red signal lights are activated. The reflector operates in two modes: weak and strong.

In the Technical Specifications document for the Central Upper Reflector, version A 4-Oe08046 issued on December 10, 2008 by Pintsch Bamag (Schaltbau Gruppe), under section 3.1 Light Technical Data, it is stated that the light technical data of this lighting unit in combination

with the appropriate niche and reflector glass complies with UIC standards (UIC 534, August 2002, Signal lamps and signal-lamp brackets for locomotives, railcars and all tractive and self-propelled stock). Section 8.3 concerning the malfunction of the LED card in the signal lamp function mentions that even if up to 40% of the LED diodes are malfunctioning after many years of operation, the light parameters do not fall below the requirements of the UIC standard.

European Standard EN 15153-1 from January 2013 (replacing EN 15153-1:2007) defines functional and technical requirements for lights on trains. According to this standard, head lights on trains should have luminous intensity ranging from 40,000 cd to 70,000 cd at full power and from 12,000 cd to 16,000 cd at reduced intensity. The characteristics of upper head lights may deviate from the requirements of this European standard. Regarding the luminous intensity requirements for head lights on trains, the standards from UIC 534 from August 2002 are aligned with EN 15153-1 from January 2013.

Based on maintenance activity data for DMV 711-077/078 and a statement from train driver of the train No. 25412, it can be concluded that there were no issues with the signal equipment during the analyzed period from November 1, 2022, until the occurrence of a serious accident. The reflector was confirmed to be operational and functioning correctly at the time of the serious accident.

The Rulebook on Types of Signals, Signal Marks, and Marks on the Track (“Official Gazette of RS” No. 51/20), in Section IV. Signals on Trains and Vehicles, does not define the minimum visibility distance for end signals on trains.

4.2.4. Elements of passive safety on DMV 711-077/078

The DMV series 711 do not include passive safety elements. At the time of procurement of this series of trains, the then-applicable Law on Railways (“Official Gazette of RS”, No. 18/05) and the Law on Railway Traffic Safety (“Official Gazette of SRJ”, No. 60 dated December 4, 1998, No. 36 dated May 20, 1999 - correction, “Official Gazette of RS”, No. 101 dated November 21, 2005 - other laws) did not mandate the installation of such types of elements.

4.2.5. Review of functioning of SS devices and telecommunication facilities

At the station Ratkovo, an inter-signal dependency device is installed in the train dispatcher's office. Using this device, the train dispatcher at Ratkovo station sets aspects of a signal on the light signals (entry signals and pre-signals to entry signals) installed there. At the time of a serious accident, due to a malfunction in the inter-signal dependency device at Ratkovo station, the train dispatcher was unable to set the aspect of a signal for permitted movement on the entry signals. Therefore, train entry into Ratkovo station was authorized using manual aspects of a signal provided by the switchman and the train dispatcher. According to the entry in the Fault Logbook (V-11) at Ratkovo station, the malfunction in the inter-signal dependency device occurred on November 17, 2023, at 18:10, reported at 18:15, and was resolved on the same day at 22:50 after the serious accident.

No other malfunctions in the SS devices were recorded at the time of the serious accident.

4.2.5.1. Data analysis on disturbances on SS and telecommunication devices at the station Ratkovo

By “IŽS”a.d. a scanned copy of the Fault Logbook (V-11) maintained at Ratkovo station has been provided. This Logbook regularly records breakdowns and faults related to SS and telecommunication equipment, along with their rectification and causes of the anomalies. It also documents inspections conducted by the Internal Control Sector of “IŽS”a.d.

During the period from November 1, 2022, to November 17, 2023, a total of 82 faults on SS devices were recorded. Among these, 65 faults were related to level crossings (at km 52+303 secured by automatic devices with half-barriers, traffic lights, and road signs, and at km 50+336 secured by barriers operated manually and road signs), one fault occurred on switches, and 16 faults were related to station entry signals and the inter-signal dependency device. No faults were registered on telecommunication devices during this time.

According to Section 15. SS Devices, Instruction on the Organization and Regulation of Train Traffic by Alternative Transport Route during Continuous Closure the Part of the Novi Sad - Subotica Railway Line, No. 4/2022-3524-722 dated April 1, 2022, it is noted that the pre-signals of the entry signals PAu at km 49+095 and PBu at km 52+425 were not functional. Aspect of a signal 97a: "Slow" was placed on their masts, indicating that these pre-signals have been out of operation for a prolonged period due to theft of signal equipment and related cables, as confirmed in the response from “IŽS”a.d, Sector for ETP, in Letter No. 21/2023-1603 dated December 20, 2023.

Given that the pre-signals PAu at km 49+095 and PBu at km 52+425 at Ratkovo station have not been operational for an extended period due to theft of equipment parts, thereby reducing the technological function of SS system elements, it can be concluded that maintenance of certain elements (SS and telecommunication devices) of the public railway infrastructure was not conducted in accordance with Article 55 of the Railway Law.

At the time of the serious accident, there was a malfunction in the inter-signal dependency device at Ratkovo station, preventing the acceptance of commands to set the routes for train movement, resulting in the entry signals displaying the aspect of a signal 4: “Stop”.

4.2.5.2. Data analysis on disturbances on SS and telecommunication devices at the station Odžaci

A scanned copy of the Fault Logbook (V-11), maintained at Odžaci station, has been provided by “IŽS”a.d. This Logbook regularly records incidents and faults related to SS and telecommunication equipment, along with their rectification and causes of the issues. It also documents inspections conducted by the Internal Control Sector of “IŽS”a.d.

During the period from November 1, 2022, to November 17, 2023, a total of 53 faults on SS devices were recorded. Among these, 45 faults were related to level crossings (at km 57+306 secured by automatic devices with half-barriers, traffic lights, and road signs; at km 59+303 secured by manually operated barriers and road signs; and at km 61+335 secured by barriers and road signs), and eight faults were related to station entry mechanical image signals and electromechanical permission block device. No faults were registered on telecommunication devices during this time.

According to Section 15. SS Devices, Instruction on the Organization and Regulation of Train Traffic by Alternative Transport Route during Continuous Closure the Part of the Novi Sad - Subotica Railway Line, No. 4/2022-3524-722 dated April 1, 2022, it is noted that the pre-signals to entry signals at km 57+411 and km 60+512 were not operational. They continuously displayed the aspect of a signal 13: "Expect Stop" on site, indicating these approach signals have been out of operation for a prolonged period due to equipment vandalism and theft of wiring components, as confirmed in the response from "IŽS"a.d, Sector for ETP, in Letter No. 21/2023-1603 dated December 20, 2023.

Given that the pre-signals at km 57+411 and km 60+512 at Odžaci station have not been operational for an extended period due to theft of equipment parts, thereby reducing the technological function of SS system elements, it can be concluded that maintenance of certain elements (SS and telecommunication devices) of the public railway infrastructure was not conducted in accordance with Article 55 of the Railway Law.

At the time of the serious accident at Odžaci station, there was a fault on the public fixed telecommunication network line of the operator "Telekom Srbija".

4.2.5.3. Analysis of SS devices and telecommunication equipment condition

At the time of the serious accident at Ratkovo station, there was a malfunction in the inter-signal dependency device, causing the entry signals to display the aspect of a signal 4: "Stop". This technical irregularity was not a direct cause of the serious accident. According to the Business Order of Ratkovo station, Part I, Article 6.3, procedures are prescribed for traffic regulation in conditions of faults and malfunctions. During faults on entry signals, the switch operator gives the aspect of a signal "Proceed" upon the train dispatcher's orders for trains entering the station.

At the time of the serious accident at Odžaci station, there was a fault in the public fixed telecommunication network line of the operator "Telekom Srbija". This technical irregularity was also not a direct cause of the serious accident, as the primary method of communication with traffic staff during train traffic regulation is conducted using radio communication in accordance with Article 16 of the Instruction on the Organization and Regulation of Train Traffic by Alternative Transport Route during Continuous Closure the Part of the Novi Sad - Subotica Railway Line, No. 4/2022-3524-722 dated April 1, 2022. The radio communication system was functioning properly.

4.2.6. Analysis of the serious accident participants' work

4.2.6.1. Train dispatcher of the station Ratkovo

According to the traffic situation on November 17, 2023, at Ratkovo station, the crossing of trains Nos. 49028/73478 and 25413 was established.

According to the entry in the Traffic Daily Log (S-10) of Ratkovo station, in accordance with the established crossing, the train dispatcher of Ratkovo station gave permission for train No. 49028/73478 to depart from Gajdobra station at 17:33. Train No 49028/73478 was departure noticed to depart from Gajdobra station at 17:37, after which the train dispatcher of Ratkovo station gave permission for train No. 25413 to depart from Odžaci station at 17:52. Train

No. 49028/73478 arrived at Ratkovo station at 17:58 on track four. Upon the entry of the train into Ratkovo station, the train dispatcher handed over to the train driver the order to crossing with train No. 25413. Train No. 25413 was departure noticed to depart from Odžaci station at 18:00, and the train dispatcher of Ratkovo station received permission from Gajdobra station at 18:01 for the same train. Train No. 25413 arrived at Ratkovo station on track three at 18:09. The train dispatcher dispatched train No. 25413 from Ratkovo station at 18:10 and simultaneously departure noticed Gajdobra station. Also, at 18:10, he gave check out to Odžaci station for train No. 25413 and for train No. 49028/73478 receive permission from Odžaci station. The train No. 49028/73478 departed Ratkovo station at 18:13 and was departure noticed to Odžaci station.

The train dispatcher of Ratkovo station received a check-out for train No. 25413 from Gajdobra station at 18:25 and at the same time (at 18:25) gave permission for train No. 25412 to operate at Gajdobra station. Train No. 25412 was departure noticed from Gajdobra station to Ratkovo station at 18: 26. Train No. 25412 arrived at Ratkovo station at 18:38, and from Ratkovo station it was dispatched to Odžaci station at 18:39.

The Traffic Daily Log (S-10) of Ratkovo station did not record receipt of the check out for train No. 49028/73478 from Odžaci station, nor did Odžaci station give permission for train No. 25412. Additionally, it was not recorded that Odžaci station received check out after the dispatch of train No. 25412. The train dispatcher of Ratkovo station confirmed in his statement to the CINS Working Group that he did not receive the check out for train No. 9028/73478 from Odžaci station and did not request or receive permission from Odžaci station for train No. 25412.

All communication between the train dispatchers of Ratkovo station and neighboring stations (Gajdobra and Odžaci) was conducted via radio communication by exchanging and receiving phonograms in accordance with the Instructions for the Use of Radio Communication on the Novi Sad - Odžaci - Bogojevo railway line, No. 4/2021-2458-542 dated January 15, 2021. The recordings on the registraphone, connected to the radio communication (see point 2.2.4.), match all entries in the Traffic Daily Logs (S-10) of Ratkovo and Odžaci stations, as well as the TT Daily Log (S-15) of Odžaci station. Conversations related to the departure of train No. 49028/73748 and permission for train No. 25412 between Ratkovo and Odžaci stations were not recorded on the registraphone device because they were not conducted.

4.2.6.2. Train dispatcher of the station Odžaci

According to the entry in the TT Daily Log (S-15) of Odžaci station, the train dispatcher of Odžaci station gave permission for train No. 49028/73478 to depart from Ratkovo station at 18:12. However, according to the Traffic Daily Log (S-10) of Odžaci station, the train dispatcher of Odžaci station received departure notice for train No. 49028/73478 from Ratkovo station at 18:13. There is no record in the Traffic Daily Log (S-10) of Odžaci station indicating that Ratkovo station provided a check out for train No. 49028/73478, nor is there a record that is granting permission for train No. 25412.

All recorded conversations on the registraphone, connected to radio communication (see section 2.2.4.), match the entries in the Traffic Daily Log (S-10) and TT Daily Log (S-15) of Odžaci station. Conversations related to the check out of train No. 49028/73748 and permission for train No. 25412 between Ratkovo and Odžaci stations were not recorded on the registraphone device because they were not conducted.

In the statement provided to the CINS Working Group, the train dispatcher of Odžaci station stated that the travel time for freight trains between Ratkovo and Odžaci stations is 12 minutes.

According to the current timetable (Timetable Book 4.2 with relevant amendments and supplements), the travel time for train No. 49028/73748 between Ratkovo and Odžaci stations is 9 minutes (see sections 2.2.3.1 and 3.4.2).

Considering that train No. 49028/73748 was departure noticed at 18:13 at Odžaci station and based on the expected travel time (9 minutes according to the current timetable), the expected arrival time of train No. 49028/73748 at Odžaci station would be 18:22. As per the provisions of Article 141, paragraph 10 of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/2022 and 107/2022), if five minutes have passed since the scheduled arrival (passage) time of a train (based on the departure notice) and the train has not yet arrived (18:27), the official position awaiting the train's arrival (passage) (Odžaci station) must immediately inform the previous station (Ratkovo station) that the train has not yet arrived, without waiting for the check out prompt from the previous official position. Such a conversation was not recorded on the registraphone device, indicating that the train dispatcher of Odžaci station did not communicate via radio to inform the train dispatcher of Ratkovo station that train No. 49028/73748 had not yet arrived at Odžaci station, as required by the Traffic Rulebook ("Official Gazette of RS" Nos. 34/2022 and 107/2022).

According to his statement provided to the CINS Working Group, at the expected arrival time of train No. 49028/73478, the train dispatcher of Odžaci station was in front of his office at Odžaci station. Since train No. 49028/73478 did not arrive at the station, he attempted to communicate with the train dispatcher of Ratkovo station using his mobile phone via a call through the mobile operator's network to the fixed telephone line at Ratkovo station connected to the public fixed telecommunications network operated by "Telekom Srbija". This call was made shortly before a serious accident occurred.

4.2.6.3. The train driver of the train No. 49028/73478

According to data recorded by the registering speedometer device on locomotive 753-782 (see section 3.4.4.), train No. 49028/73478 passed through Gajdobra station without stopping at 17:38. No stops were registered between Gajdobra and Ratkovo stations. At Ratkovo station, the train driver stopped the train at 17:56. After a one-minute stop, the train was again set in motion and after moving at a speed of up to 12 km/h, the train was stopped again at 18:00. In the travel document for train No. 49028, the train driver noted that he received a Crossing Order II/38 of the Ratkovo station, had engagement for crossing with another train, arrived at Ratkovo station at 17:56, and departed from Ratkovo station at 18:10 (Travel Document (S-1) for train No. 49028 and Crossing Order II/38 of Ratkovo station were provided with the letter No. A969/2023 dated 28.12.2023 "Transagent Operator"d.o.o. Belgrade). According to data recorded by the registering speedometer device on locomotive 753-782, after a nine-minute stop at Ratkovo station, the train driver departed with train No. 49028/73478 from Ratkovo station at 18:09. After departing from Ratkovo station, the train driver drove the train, which was 5342 m long, accelerating first to a speed of 44 km/h, and then decelerating to a stop at 18:24. During the period from stopping the train until a serious accident occurred, no movement of the train was recorded. According to the statement provided to the CINS Working Group (see section 3.1.1.), the train driver stopped the train due to the activation of the audible and visual signals indicating a problem with the oil temperature in the hydraulic system and the diesel engine shutdown of locomotive 753-782. In the Travel Document (S-1), the train driver recorded stopping the train at km 56+300 at 18:20, noting the reason for stopping as "loco defect, 18:55, called Ratkovo". Based on the call logs and use of

Viber applications from the train driver's mobile device (provided with the letter No. A969/2023 dated 28.12.2023 "Transagent Operator"d.o.o. Belgrade and email dated 16.01.2024 "Transagent Operator"d.o.o. Belgrade), it can be inferred that the train driver engaged in video calls via Viber five times from 18:16 to 18:48 to communicate with technical support personnel from "Transagent Operator"d.o.o. Belgrade, for diagnosing and resolving the cause of the diesel engine shutdown. Additionally, using the mobile network, the train driver, attempted to inform the neighboring Odžaci and Ratkovo stations about the extraordinary train stop. He called Odžaci station at 18:37, 18:54, and 18:57, but the calls were not answered (investigative proceedings determined that the fixed telephone at Odžaci station was out of service due to a malfunction). He called Ratkovo station at 18:39, 18:44, and 18:57, and all three calls were answered.

The speeds recorded by the registering speedometer device on locomotive 753-782 are in accordance with the current timetable material and the restricted speeds instructions provided by General Order No. 32 dated 17.11.2023 of Novi Sad Marshalling Yard station. The time elapsed from the moment of the extraordinary train stop of train No. 49028/73478 until informing the neighboring stations did not exceed 15 minutes, as stipulated by Article 234 of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/22, 107/22). The difference in the time of the extraordinary train stop recorded by the train river in the Travel Document (S-1) and that registered by the registering speedometer device on locomotive 753-782 likely stems from the train driver's perception at the given moment, with the registered data from the registering speedometer device being deemed credible.

4.2.6.4. The train driver of the train 25412

The train driver took over the control of train No. 25412 at Gajdobra station. According to data recorded by the speed recording device on DMV 711-077/078 (see point 3.4.4.), the train driver started the train from Gajdobra station at 18:24. Between Gajdobra and Ratkovo stations, the train driver operated the train at a maximum speed of 100 km/h. On the interstation distance between Gajdobra and Ratkovo, the train driver stopped the train at Parage stop (as required by the timetable) and in front of the level crossing at km 44+303 (to secure the level crossing). The train driver stopped train No. 25412 at Ratkovo station at 18:37. After handling passenger operations, guided by the aspects of a signal given from the train conductors and the train dispatcher at Ratkovo station, the train driver restarted the train and continued further. According to the data recorded by the speed recording device, after departing from Ratkovo station, the train driver operated train No. 25412 at a maximum speed of 99 km/h. After covering a distance of 5340 m from Ratkovo station, at a speed of 93.2 km/h, the driver first initiated rapid braking using the command and immediately activated the "Emergency" button. Based on the timetable and the data recorded by the speed recording device on DMV 711-077/078, it can be affirmed that the train driver operated the train in accordance with the timetable and applicable regulations. The train driver maintained concentration and carefully observed the track ahead. Upon detecting obstacles in the form of the end signals of the previous train, the train driver initiated braking procedures.

4.2.7. Psychological analysis of the event

4.2.7.1. Human factor importance in the accidents and incidents analysis

Psychological analysis of accidents and incidents is a very important segment as it deals with the human factor, which plays a significant, practically primary role in the realization of all human activities. The manifestations and aspects of the influence of the human factor are numerous. They appear through the synthesis of various elements, which in their combined action have an impact on the results of work. By increasing the quality of the human factor, the number of human errors is significantly reduced, optimizing the symbiosis between humans and technical-technological achievements. Understanding the interaction between organizational, individual, and team work factors is crucial for establishing principles that ensure a reliable management system and reduce the risk of errors. Effectively identifying critical points on the human factor map represents a proactive approach in comprehensive preventive actions aimed at reducing accidents and incidents.

Organizations need to identify all sources of risk, events, and/or sequences of circumstances that could signal the occurrence of a risky event and their potential consequences. The goal of any analysis of accidents and incidents is to consider all combinations of possible factors of accidents and incidents in order to compile a comprehensive list of risks based on those events and circumstances that imply the reduction, prevention, or slowing down of the achievement of set goals. By identification, systems should encompass all potential hazards, regardless of whether they are under the system's control or not, and regardless of whether they are currently relevant or not. A quality identification process involves the use of relevant and up-to-date information. Accurate information about previously occurred events and the results and conclusions of their analyses are of great importance.

The consequences that arise from the realization of a risky event represent the central point of the risk management system. Specifically, the degree of uncertainty of a risky event or accident directly depends on the extent of knowledge regarding the consequences of the event itself. Understanding the effect that accidents and incidents have on organizational systemic values is essentially important in knowing how to prevent or reduce their occurrence. Preventing or mitigating the consequences of accidents is achieved by taking various measures. This means that during the activities of organizational systems, there should be continuous adjustment of planned strategies to new conditions to minimize potential risks of harmful events and possible losses due to risky events or accidents.

The control process encompasses an organized system of monitoring the implementation of activities and the occurrence of risky events, along with the permanent modification and adaptation of planned actions and strategies. This organized control process includes all subprocesses of risk identification, risk assessment, and development of alternatives, which are interconnected into an efficient and flexible system that can be quickly and effectively applied.

Considering the human factor in accidents and incidents in railway traffic is a complex issue that requires a multifaceted approach. Global scientific research has highlighted the importance of addressing human error, fatigue, and safety culture. Integration of technology and psychological aspects are key points to reduce accidents. Continuous efforts to understand and mitigate these factors are essential for improving railway safety worldwide. Implementing evidence-based strategies, fostering a strong safety culture, and using technology to support railway workers are crucial to reducing the human factor in railway accidents and incidents.

4.2.7.2. Elements of human factor influence on accidents and incidents

What can be specifically highlighted and examined in the psychological analysis of the human factor and its impact on accidents and incidents in railway traffic are the following defined elements:

1. *Lack of knowledge (experience)*, this implies unfamiliarity, inability to cope, or non-compliance with work procedures (instructions, regulations/rules, legal solutions, etc.), relying on improvisation in work;

2. *Lack of resources*, refers to performing duties without sufficient resources, leading to the inability to adequately complete assigned tasks;

3. *Disregard for norms*, represents ignoring defined rules according to which the system operates, requiring systematic work without improvisations, working from memory, and outside procedures;

4. *Lack of teamwork*, involves a low degree of mutual understanding and cooperation, ineffective joint actions, and decision-making;

5. *Lack of communication*, refers to unsuccessful communication between all participants in the activity implementation to achieve optimal information exchange;

6. *Exposure to stress*, significantly affects the psychophysical abilities and characteristics of people, leading to significant behavioral disturbances;

7. *Work pressure*, refers to performing work tasks without the right/ability to make mistakes;

8. *Routine*, involves the executor's work based on the feeling that something is correct just because there have been no problems or disruptions up to that point;

9. *Fatigue*, physical or mental, results in distraction, loss of concentration and attention, and reduced perceptual abilities;

10. *Low level of work awareness* (reduced responsibility, reliability, work discipline) and *moral awareness* (lack of moral values);

11. *Lack of motivation*, reduced motivation for work and dissatisfaction with the job and working conditions;

12. *Lack of assertiveness*, involves an environment where there is no practice of openly expressing opinions, attitudes, and needs positively and productively without endangering others;

13. *Lack of situational/event awareness*, represents a state of not recognizing the consequences of a particular action taken;

14. *Psycho-physical incapacity*, refers to mental and physical incapacity caused by various somatic diseases, personality disorders, and old age;

15. *Absence*, refers to divided attention/distraction of the executor's priorities, caused by various factors (financial, family, personal, etc.).

The human factor plays a significant role in the occurrence of accidents and incidents in railway traffic, a topic widely researched in scientific papers around the world. Understanding these factors is crucial for improving safety measures and reducing accidents and incidents in the railway sector. Here we will highlight the key aspects of the human factor in railway accidents and incidents, based on the findings of global scientific studies. Human error is often cited as the

leading cause of railway accidents and incidents. Errors can occur at various levels, including operational staff, maintenance teams, and management. *Operational errors* include mistakes by operational staff (railway workers), while *maintenance errors* can include insufficient inspection or repair. *Management errors* relate to safety culture, inadequate training, or improper resource allocation. Research indicates that improving training, implementing advanced safety systems, and fostering a strong organizational and safety culture can significantly reduce these errors. Additionally, *fatigue* among railway workers, particularly train drivers, train dispatchers and TK dispatchers, has been identified as a key risk factor for accidents. Scientific studies have shown that fatigue can impair judgment, reaction time, and decision-making abilities. Implementing work schedules that allow for adequate rest, along with monitoring and managing workload, can mitigate the risks associated with fatigue. *The organizational safety culture* within railway operations significantly influences the incidence of accidents and incidents. A positive safety culture, where safety is prioritized at all levels of the organization, can lead to lower accident rates. Research highlights the importance of leadership in promoting a safety culture, continuous safety training, and open communication about safety issues. *Safety culture is defined as a phenomenon that encompasses awareness of legal obligations, attitudes towards their execution, written and unwritten rules of conduct, a specific ethical code, and a developed mechanism for preventive and repressive action regarding the occurrences and bearers of threats to the vital values of the organization or society. The psychological state* of railway employees, including work overload, stress, anxiety, and job satisfaction, can affect the incidence of accidents and incidents. Studies have explored the relationship between employee well-being and safety performance, suggesting that improving workplace conditions and providing psychological support can enhance safety. While not strictly a human factor, the interaction between people and technology plays a significant role in railway safety. *The introduction of advanced safety systems* has been shown to reduce the likelihood of accidents caused by human error. However, the effectiveness of these technologies depends on their integration with human operators, including training and adaptation to these systems.

4.2.7.3. Psychological Assessment of the Behavior of Direct Participants in a Serious Accidenty

The assessment is made based on the interview with the participants of the serious accident held on 29.01., 30.01. and 11.03. in the CINS' premises, based on the structured questions.

4.2.7.3.1 Train dispatcher of the station Ratkovo

The train dispatcher of Ratkovo station is a railway worker with over 40 years of experience in train dispatching. During the hearing, he appeared sincere, direct, and expressed a strong sense of guilt and remorse for the serious accident that occurred. He was clearly aware of his mistake (exhibiting moral awareness), and provided concrete, detailed, and clear facts about the incident. He realistically assessed the situation and its causes. During his day shift, at the time of the serious accident, the electromechanical device at Ratkovo Station was malfunctioning. Although he reported this to the duty SS service, the fault was only fixed after the serious accident occurred. Additionally, during his day shift, the volume of train traffic at Ratkovo Station was increased by more than 50% compared to the usual number of trains due to the construction of a new railway line from Novi Sad to Subotica. According to data provided by the "IŽS"a.d, and under conditions where the Novi Sad - Subotica railway line was closed and the Novi Sad - Odžaci - Bogojevo

railway line was used as an alternative route (with an increased number of trains compared to when the Novi Sad - Subotica line was not closed), the average number of trains in the day shift was approximately 15.48. Based on the records from Ratkovo Station, it can be stated that the number of trains during the day shift was 24, representing an increase in train traffic of more than 50%. The increased train volume was also due to planned railway closures (the railway was closed and opened three times during the work, and the previously closed railway was reopened), which also added to the workload due to record-keeping and communication. As a result of all this, the dispatcher of Ratkovo Station felt tired, overburdened, and experienced a drop in concentration towards the end of his shift due to the increased workload, as well as a sense of relaxation before going on vacation and retirement. Under such conditions, at the end of his day shift, he dispatched passenger train No. 25412 towards Odžaci Station without having previously received a check out for freight train No. 49028/73478 and without obtaining permission for train No. 25412 from the dispatcher at Odžaci station, which was contrary to railway regulations. Upon learning of the serious accident, he was in a state of shock, collapsing into a chair and being paralyzed for some time. As a disciplined person who persistently and impeccably follows rules and never loses focus on what is clearly defined and specified. His behavior in the serious accident cannot characterize him as an irresponsible or careless worker, considering his established moral awareness, competence for the given job, and adherence to organizational rules.

4.2.7.3.2 Train dispatcher of the station Odžaci

The train dispatcher at Odžaci station has been a railway worker for over 28 years in train dispatching. During the hearing, he appeared stable, responsible, controlled, cooperative, clear, detailed, and concise in presenting facts. He expressed regret and concern for the serious accident. He began his night shift on November 17, 2023, at 18:00. Although he received a departure notice from the dispatcher at Ratkovo station at 18:13 for train No. 49028/73478 and was obliged to call the previous station (Ratkovo station) five minutes after the expected arrival of the train (at 18:24) to report that the train had not yet arrived, he did not do so. He stated that considering it was night and due to the type of freight, he tolerated a few more minutes, and only communicated with the train dispatcher at Ratkovo station at 18:41. Had he communicated earlier with the train dispatcher at Ratkovo Station, it is certain that he would have reminded him that freight train No. 49028/73478 was on the open track between Ratkovo and Odžaci stations. This would likely have influenced the train dispatcher at Ratkovo station not to dispatch passenger train No. 25412 (even though he should not have done so without permission), which could have prevented the serious accident. In this case, the train dispatcher at Odžaci station should have reacted immediately at the specified precise time by calling the dispatcher at Ratkovo Station to inquire about the situation, regardless of any previous experiences or routine knowledge of potential train delays on this route. A disciplined person persistently and impeccably follows rules and never loses focus on what is clearly defined and specified.

4.2.7.3.3 The train driver of the train No. 49028/73478

The train driver of train No. 49028/73478 has been a railway worker for over 40 years in the role of a train driver. During the hearing, he appeared very confident in his presentation, focused on the questions, providing a logical sequence of events with clear, precise, and valid facts. He conveyed the impression of a competent and experienced person, stable, composed, with developed capacities for stressful situations and working under pressure, controlled in stressful

conditions. He is described as professional, disciplined, and responsible, with established habits for necessary rest to remain mentally focused, productive, and efficient in his job. He is a focused individual who takes his duties seriously, which implies his conscientious attitude towards the organizational system, rules, norms of behavior, and values. In performing all his duties, he acted thoughtfully and professionally. During the phase of troubleshooting the train malfunction that occurred at 18:24, he tried in every way to resolve the ongoing issue, that is, to repair the malfunction, and to inform the station dispatchers about the defect within the stipulated time frame.

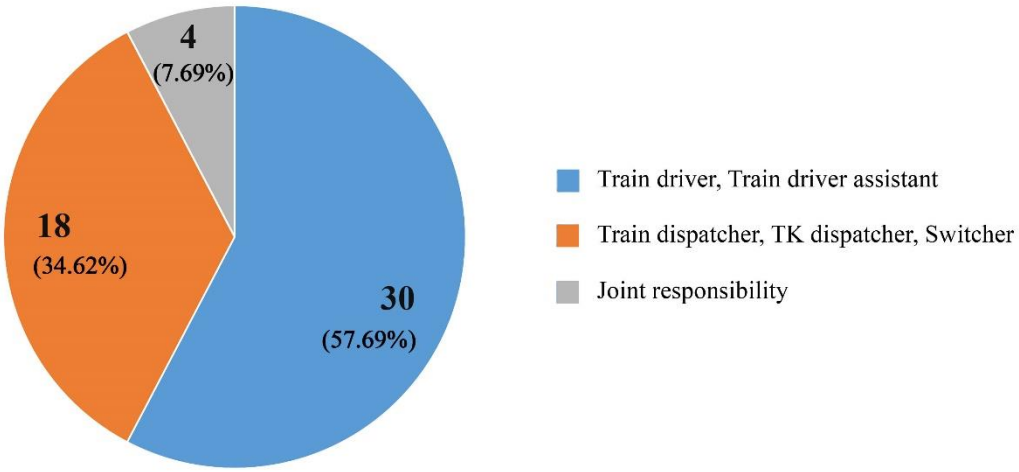
4.2.7.3.4 The train driver of the train No. 25412

The train driver of the train No. 25412 has been a railway worker for over 23 years, having worked as a train driver for eight years and previously for 15 years as a conductor. During the hearing, he very consciously and in detail described the situation and provided valid data about the event, assessing the situation very rationally and presenting the factual state clearly and precisely. In the given situation, immediately before the occurrence of the serious accident, he behaved in a controlled, pragmatic, responsible, and conscientious manner, with an altruistic concern for the participants in the serious accident. A professional attitude towards all aspects was observed. Despite experiencing a highly stressful reaction, he exhibited self-awareness, rational reasoning, concern for others, and a readiness to help others, showing a sense of responsibility for the lives of others. He demonstrated foresight regarding the causal events following the serious accident, thinking quickly and efficiently about the dangers of the train catching fire, which could have caused much more serious consequences. It can also be noted that immediately after the serious accident, he experienced significant stress, which particularly affected him a few days after the event. This can be characterized as a completely normal post-stress reaction following the shock, with symptoms of acute stress, which may manifest through anxiety, insomnia, reliving traumatic images, and certain somatic reactions.

4.2.7.4. Analysis of accident and incident causes up to date

From the analysis of data obtained from “IŽS”a.d. regarding accidents - train collisions with railway vehicles and incidents - avoided train collisions with railway vehicles occurring on the “IZS”d.o.o. railway network from January 1, 2013, to November 17, 2023 (see point 3.7.), it can be concluded that out of a total of 55 cases, in 52 cases (94.54%), the cause of the events was human factor (negligence of railway workers). In the remaining cases (3 cases, or 5.46%), the causes were technical factors (SS device malfunction), responsibility of unidentified individuals, and one case remains unresolved (investigation not concluded). Railway workers responsible for these accidents and incidents (52 cases) were: worker who operated the traction vehicles (train drivers/assistant train drivers, in 30 cases that is, 57.69%), traffic controllers (train dispatchers, TK dispatchers, telegraphers, switchers, in 18 cases that is, 32.73%) and joint responsibility of workers (in 4 cases that is, 7.27%).

The structure of accidents and incidents (collisions and avoided collisions) caused by railway workers from January 1, 2013, to November 17, 2023, on the “IŽS”a.d. railway network is shown in Graph 4.2.7.4.1.



Graph 4.2.7.4.1: The structure of accidents and incidents caused by the railway workers in the period from 2013- 2023. on the railway network of "IŽS"a.d.

The provided overview of accidents and incidents in railway traffic lacks elements regarding the influence of human factors because specific data on these aspects unfortunately do not exist (e.g., fatigue, decreased responsibility, poor communication, routine, stress impact, etc.). It is certain that accurate information about events and the results and conclusions of their analysis are of great importance. Therefore, the use of relevant and updated information is necessary for a quality process of identification. This includes identifying all sources of risk, events, and/or a series of circumstances that may signal the occurrence of a risky event, accident factors, incidents, and their potential consequences.

Considering the above, it is necessary to conduct analyses of accidents and incidents prioritizing the assessment of the impact of human factors based on the elements mentioned above (point 4.2.7.2.). To develop a model of critical elements, it is essential to classify them according to importance and rank their prevalence. The formation of a model of critical elements related to human factors serves as the basis for effectively structuring preventive measures and predicting human behavior in crisis situations.

4.2.7.5. Similar accidents that CINS investigated

According to the Law on Investigation of Accidents in Air, Railway, and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18), CINS conducts investigations following serious accidents in the railway system with the aim of enhancing railway safety and preventing new accidents caused by the same or similar causes.

Although CINS is obliged to conduct investigations following serious accidents in the railway system, it also performs investigations aimed at improving railway safety and preventing the occurrence of new accidents caused by the same or similar factors. Among other cases, CINS conducted an investigation into a train collision, specifically:

1. On August 1, 2018, at 05:35 at km 27+369 of the main railway line E70/E85: Belgrade - Mladenovac - Lapovo - Nis - Preševo - state border - (Tabanovce), between the stations Klenje and Ripanj Tunnel, there was a meeting and collision of train No. 2990 (EMV 413/417-033/034) and 70922 (only locomotive 661-162) (ŽS - 03/18, Final investigation report of accident No.: 340-00-2/2018-02-3-51 dated June 27, 2019).

CINS, with the aim of improving safety in the railway system and preventing new accidents caused by the same or similar factors, issued the following safety recommendations, among others:

1. To the Directorate for Railways, regarding "IŽS"a.d: SR_20/19 and regarding "Srbijavoz"a.d: SR_22/19.

Note: SR_20/19 and SR_22/19 are identical and state:

SR_20/19 "IŽS"a.d. to form a Human Factor Assessment Team for the Accidental and Incidental Cases in order to make Critical Elements Models (see point 4.2.6.2.), by classifying them according to the importance and ranking list of representation (identification of all risks) in order to work on the prudent structuring of preventive measures and anticipation of human behavior in crises situations in order to reduce the impact on the emergence of new accidents and incidents.

SR_22/19 "Srbija Voz" a.d. to form a Human Factor Assessment Team for the Accidental and Incidental Cases in order to make Critical Elements Models (see point 4.2.6.2.), by classifying them according to the importance and ranking list of representation (identification of all risks) in order to work on the prudent structuring of preventive measures and anticipation of human behavior in crises situations in order to reduce the impact on the emergence of new accidents and incidents.

The Directorate for Railways has delivered report - letter I-01 No. 340-380/2020 dated 13.03.2020, and report - letter I-01 No. 340-805/2020 dated 30.7.2020. Safety recommendation SR_20/19 was not accepted by "IŽS"a.d. Considering the significant impact of human factors on the occurrence of accidents and incidents, it can be noted that this crucial aspect has been neglected by the infrastructure manager "IŽS"a.d.

The Directorate for Railways has delivered report - letter I-01 No. 340-1164/2019 dated 21.8.2019, report - letter I-01 No. 340-805/2020 dated 30.7.2020, and report - letter I-01 No. 340-834/2021 dated 27.7.2021. Safety recommendation SR_22/19 was accepted and implemented by "Srbija Voz"a.d. By Resolution No. 1/2020-108 dated 23.1.2020, the General Director of "Srbija Voz"a.d. formed a team to assess human factor elements contributing to accidents and incidents. By letter No. 1/2023-1796 dated 27.12. 2023, "Srbijavoz"a.d. delivered the Report on Activities and Work of the Team for Assessing Human Factor Elements Contributing to Accidents and Incidents. The implementation of activities of the Safety Management System Monitoring Plan in "Srbijavoz"a.d. commenced in 2022 with interviews conducted with train drivers and conductors in Novi Sad, Belgrade, Lapovo, and Niš. A model of critical elements was formed for conducting psychological analysis of accidents and incidents and determining aspects of the human factor. Interviews with selected employees focused on each of the 15 defined categories of human errors (see point 4.2.7.2). In 2023, implementation is planned in Subotica, Vršac, Zaječar, and Kraljevo. Subotica has been completed, Vršac is scheduled for completion by the end of 2023, and the rest will be transferred to the following year (for remaining and new nodes). By the end of 2024, all collected data will be systematized, and in 2025, external experts will be engaged to define preventive and potentially corrective measures aimed at enhancing the safety of railway passenger transport.

4.3. Conclusions on the serious accident causes

4.3.1. Direct cause of the serious accident

The direct cause of the serious accident is that two trains were at the same time at one distance between the stations, where one train was stationary (train No. 49028/73478), while the other train was moving (train No. 25412), which is contrary to the provision of paragraph 3 of Article 122 of the Traffic Rulebook ("Official Gazette of RS" No. 34/22 and 107/22). The train dispatcher of the Ratkovo station dispatched train No. 25412 in the direction of the Odžaci station without the previously requested permission for the train No. 25412 from the train dispatcher of the Odžaci station, which is contrary to paragraphs 1 and 2 of Article 121 and paragraph 1 of Article 133 of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/22 and 107/22).

4.3.2. Basic causes that derive from skills, procedures and maintenance

Workers of the railway infrastructure manager and railway undertakings who perform their duties at the station confirm by their signature that they are familiar with the provisions of the station's Business Order in accordance with paragraph 5 of Article 27 of the Traffic Rulebook ("Official Gazette of the RS" Nos. 34/22 and 107/22). In the specific case, the train dispatcher at Ratkovo station who was involved in a serious accident was primarily required to be familiar with the Ratkovo Station Business Order Part I and Appendix IV of the Station Business Order (Instructions for Handling the Inter-Signal Dependency Device) by the employer "IŽS"a.d. before starting work at Ratkovo station, which was not done. An examination of the submitted investigation material shows that the train dispatcher at Ratkovo station who was involved in the serious accident started working at Ratkovo station on the night shift of April 9/10, 2022, while he was only made familiar with the Ratkovo Station Business Order Part I after more than three months of work at Ratkovo station, which he confirmed by his signature on July 15, 2022. According to the Letter No. 15/2024-12.13-125 dated May 8, 2024, from the Station Manager of Odžaci (submitted by "IŽS"a.d. via email on May 8, 2024), the train dispatcher did not confirm by his signature that he was familiar with the Instructions for Handling the Inter-Signal Dependency Device at Ratkovo station (see point 3.6.2.).

4.3.3. The main causes arising from the conditions established by the legal framework and the application of the safety management system

N/A.

4.3.4. Additional remarks on deficiencies and defects found during the investigation, but not relevant to the conclusions about the causes

The train dispatcher at Odžaci station was obligated, according to the provisions of paragraph 10 of Article 141 of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/2022 and 107/2022), to inform the previous station (Ratkovo station) immediately after five minutes from the estimated time of arrival (passing) of train No. 49028/73478 at Odžaci station that the train had not yet arrived, without waiting for a request check out from Ratkovo station, which he failed to do. He informed Ratkovo station shortly before the occurrence of a serious accident (see point 4.2.6.2.). If the train dispatcher at Odžaci station had acted in accordance with the aforementioned provision of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/2022 and 107/2022), there would have been a possibility that the train dispatcher at Ratkovo station would not dispatch train No. 25412 to the inter-station distance where train No. 49028/73748 was stationary, thus potentially avoiding the serious accident. However, this does not diminish the obligation of the train dispatcher at Ratkovo station to have sought and obtained permission from the dispatcher at Odžaci station before dispatching train No. 25412.

During the investigation of the serious accident, it was determined that the official positions on the regional railway line No. 207 Novi Sad - Odžaci - Bogojevo are equipped with SS and telecommunication devices that are technically outdated. The regular maintenance and operation of such devices after a long period of use are greatly hindered due to the wear and tear of certain parts and the limited availability of spare parts.

The SS devices at Ratkovo and Odžaci stations lack forced technical dependencies between switch positions and entry signals, as well as output signals that would be technically dependent on permission for train dispatch to the next station. Stations with such types of SS devices pose a higher risk of accidents and incidents in railway traffic due to increased human factor influence on train traffic regulation compared to devices with higher levels of forced technical dependencies.

The telecommunication devices of the proof of understanding system (radio communication system) at Ratkovo and Odžaci stations enable conference calls among all official positions on the railway line 207 Novi Sad - Odžaci - Bogojevo, allowing transmission of only one message at a time that is broadcast to all official positions. This type of communication, due to its limited technical capabilities compared to modern commercially available telecommunication devices, also carries an increased risk of human factor influence on train traffic regulation. This is due to additional workload on traffic staff from messages not intended for their official position, as well as the inability to send a message to the neighboring official position when another position is transmitting a message.

In the Instructions on the Organization and Operation of the Operational Service in the Area of "Infrastruktura Železnice Srbije"a.d. ("Official Gazette of the ŽS" Nos. 21/17, 21/18, 37/18, and 28/23), the railway infrastructure manager "IŽS"a.d. in Chapter I, Introductory Provisions, Article 3, defined the concept of "traction vehicle breakdown", and in Chapter V, Operational Measures to Ensure Smooth Train Traffic, Article 34, part (b), point 4, defined the deadline for informing about the type of traction vehicle breakdown by the train driver, which must be given within no longer than 10 minutes on main lines or 30 minutes on regional and local lines (see point 3.3.7.). Given that a locomotive breakdown can represent a disturbance that may cause exceptional train stops, this defined time for informing by the train driver about the type of traction vehicle breakdown is not in accordance with Article 234 of the Traffic Rulebook ("Official Gazette of RS" Nos. 34/22, 107/22), which defines the obligation that if the train driver anticipates that the

train will be delayed for more than 15 minutes, both neighboring stations or the TK dispatcher must be informed and assistance requested if necessary (see point 3.3.3.). The Instructions on the Organization and Operation of the Operational Service in the Area of "Infrastruktura Železnice Srbije"a.d. ("Official Gazette of the ŽS" Nos. 21/17, 21/18, 37/18, and 28/23) was adopted during the period when Rulebook 2, Traffic Rulebook ("Official Gazette of the ZJŽ" Nos. 3/94, 4/94, 5/94, 4/96, and 6/03) was in force, in which the provision regarding the defined time for informing for all lines was identical to the provision in the current Traffic Rulebook (see point 3.3.4.).

The Instructions on the Organization and Operation of the Operational Service in the Area of "Infrastruktura Železnice Srbije"a.d. ("Official Gazette of the ŽS" Nos. 21/17, 21/18, 37/18, and 28/23) does not contain provisions on the obligation to apply and acquaint railway undertakings with the content of the Instructions. In the mentioned Instruction, provisions are prescribed regarding informing traffic staff about traction vehcile defects, which pertain to train drivers, considering transitional and final provisions. Railway undertakings "Transagent operator"d.o.o. and "Srbijavoz"a.d. have not adopted and do not have the aforementioned Instruction in their regulations.

5. Measures taken

"IŽS"a.d. took the measure of temporarily suspending the train dispatcher of Ratkovo station who was on duty at the time of the serious accident, by Decision No. 15/2023-12-1295/1 dated 20.11.2023 from the Section for Traffic Safety in Novi Sad.

"Srbijavoz"a.d. informed through Letter No. 1/2023-1796 dated 27.12.2023 that following the conclusion of the investigation by the Joint Investigation Committee of infrastructure manager and railway undertaking, appropriate measures will be taken to enhance railway safety depending on the investigation results. By email dated 17.05.2024, "Srbijavoz"a.d. provided information that the Investigation Report compiled by the Joint Investigation Committee of infrastructure manager and railway undertaking identified the direct cause of the serious accident, responsibility for the event, and specific observations regarding the actions of all participants in the serious accident. They also stated that "Srbijavoz"a.d. will not undertake specific measures to enhance railway safety.

"Transagent operator"d.o.o. informed via email dated 21.05.2024 that it has not taken any measures following the occurrence of the serious accident.

6. Safety recommendations

Aiming to improve safety on the railway line and to prevent occurrence of the new accidents, CINS has issued the following safety recommendations:

To the Directorate for Railways:

SR_01/24 The Directorate for Railways, in accordance with Article 37 of the Law on Safety in Railway Traffic ("Official Gazette of the RS", No. 41/18), should amend and supplement the Rulebook on Technical Conditions and Maintenance of the Railway Telecommunication Network ("Official Gazette of the RS", No. 68/21), in part II. Technical conditions for the railway telecommunication network, where the minimum technical requirements for the equipment of railways with telecommunication devices should be unambiguously and precisely defined depending on the speed of train movement, railway categorization, volume of railway traffic, and similar factors (see points: 2.2.4. and 3.3.6.).

SR_02/24 "IŽS"a.d. should, in terms of maintaining public railway infrastructure related to the elements of the control, management, and signaling subsystem, replace and supplement the missing and technically faulty elements of the SS devices and installations on the regional railway line 207 Novi Sad - Odžaci - Bogojevo, so as not to compromise the designed technical functionality of the elements of the control, management, and signalling subsystem, in accordance with the provisions of Articles 55 and 56 of the Law on Railways ("Official Gazette of the RS", Nos. 41/18 and 62/23) (see points: 2.2.3.2.1, 3.2.3, 3.3.1, 3.4.1, 4.2.5.1, and 4.2.5.2.).

SR_03/24 "IŽS"a.d., in terms of maintaining the public railway infrastructure in relation to the elements of the control, management and signaling subsystem, to replace and supplement the missing telecommunications devices and facilities on the regional railway line 207 Novi Sad - Odžaci - Bogojevo, which are missing and have been switched off due to technical malfunctions, as the designed technical functionality of the elements of the control, management and signaling subsystem would not be impaired, in the sense of the provisions of Art. 55 and 56 of the Law on Railways ("Official Gazette of RS", Nos. 41/18 and 62/23) (see points: 2.2.4, 2.2.4.1, 2.2.4.2. and 3.3.1.)

SR_04/24 "IŽS"a.d. should consider the possibility of replacing the SS devices, on the railway line 207 Novi Sad - Odžaci - Bogojevo, that lack enforced technical dependencies between the positions of switches and entry signals, as well as the absence of exit signals with technical dependencies, and telecommunication devices with limited technical capabilities by installing SS devices with a higher level of enforced technical dependencies and more modern commercially available telecommunication devices. This is aimed at reducing the risk of human factor influence on train traffic regulation and increasing railway traffic safety (see points: 2.2.3.2, 2.2.4, 3.4.1, 3.4.3, and 4.3.4.).

SR_05/24 "IŽS"a.d. to form a Team for the assessment of the elements of the human factor in the occurrence of accidents and incidents in order to create a critical elements model, making a classification of them according to their importance and a ranking list of representation (identification of all risks) in order to work on the expedient structuring of preventive measures and the prediction of human behavior in crisis situations in order to reduce the impact on the occurrence of new accidents and incidents (see points 3.7, 4.2.7.2, 4.2.7.4. and 4.2.7.5.).

SR_06/24 **"**IŽS"a.d. should conduct professional training for the staff responsible for regulating traffic (train dispatchers) on the railway line 207 Novi Sad - Odžaci - Bogojevo regarding the regulation of train traffic in accordance with the provisions of Articles 121, 122, 133, and 141 of the Traffic Rulebook ("Official Gazette of the RS" Nos. 34/22, 107/22) (see points 3.3.3, 4.2.6.1, 4.2.6.2, 4.3.1, and 4.3.4.).

SR_07/24 "IŽS"a.d. should make changes and additions to the Instructions on the Organization and Work of the Operational Service in the area of "Infrastructure of Railways of Serbia"a.d. ("Official Gazette of Railways" Nos. 21/17, 21/18, 37/18, and 28/23) and harmonize, in Articles 3 and 34, the deadline within which the train driver is obliged to inform the traffic staff about the type of fault of the traction vehicle, regardless of the category of the railway line, with the provision from Article 234 of the Traffic Rulebook ("Official Gazette of the RS" Nos. 34/22, 107/22) (see points: 3.3.3, 3.3.4, 3.3.7. and 4.3.4.).

SR_08/24 "IŽS"a.d. should, considering that the provisions regarding informing the traffic staff about the fault of the traction vehicle relate to train drivers, who can be railway workers of railway undertakings, make changes and additions to the Instructions on the Organization and Work of the Operational Service in the area of "Infrastructure of Railways of Serbia"a.d. ("Official Gazette of Railways" No. 21/17, 21/18, 37/18, and 28/23), by providing provisions that railway undertakings should be familiar with the mentioned instructions (see points: 3.3.8 and 4.3.4.).