REPUBLIC OF SERBIA
CENTER FOR INVESTIGATION OF ACCIDENTS IN TRANSPORT
SECTOR FOR INVESTIGATION OF ACCIDENTS IN RAILWAY TRAFFIC
Nemanjina 11, 11000 Belgrade

No.: ŽS - 02/21

No.: 340-01-1/2021-02-2-42

Date: 01.06.2022.

FINAL REPORT ON SERIOUS ACCIDENT INVESTIGATION

Accident type:	Overtaking of the pushed shunting composition on the railway worker
Shunting composition:	Locomotive 443-06 and 2 (two) wagons of type Arbel, series Faboo
Accident location:	Obrenovac, TENT Obrenovac, area of the station Obrenovac
Date:	12.07.2021.
Time:	07:43

This Report presents the results of investigation of a serious accident, overtaking of the shunting composition (locomotive 443-06 and 2 (two) wagons of type Arbel series Faboo), owned by JP "EPS" Branch TENT from Obrenovac, on the railway worker of "Pro Tent"d.o.o. from Obrenovac, which occurred on 12.07.2021. at 07:43 in the area of the industrial railway JP "EPS" Branch TENT from Obrenovac at the station Obrenovac, at the second platform on the switch No. 17. In this serious accident a railway worker of "Pro Tent"d.o.o. from Obrenovac was fatally injured.

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. 340-01-1/2021-02-2-5 of 15.07.2021.

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 Republic of Serbia and the holder of founding rights is the Government of the Republic of Serbia.

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
ZJŽ	.....	Community of Yugoslav Railways
RS	.....	Republic of Serbia
SRS	.....	Socialist Republic of Serbia
MUP	.....	Ministry of Interior
PS	.....	Police station
OJT	.....	Basic Public Prosecutor
JP	.....	Public Enterprise
d.o.o.	.....	Limited company
EPS	.....	Electrical Power Industry of Serbia
TENT	.....	Thermo Power Plant “Nikola Tesla”
ŽT	.....	Railway transport
OB1	.....	Unloading point Obrenovac 1
OB2	.....	Unloading point Obrenovac 2
TK	.....	Telecommand
SS	.....	Signalling-safety device
TT	.....	Telephone-telegraph
PTT	.....	Mail telegraph telephone
BZR	.....	Health and safety at work
ZOP	.....	Fire protection
ŽTO	.....	Railway transport organization

C O N T E N T:

1. Summary

1.1. Short description of the serious accident

On 12.07.2021. at 07:43 in the area of the industrial railway JP "EPS" Branch TENT from Obrenovac, in the station Obrenovac, during the shunting work, on the second station track, there occurred an overtaking of the pushed shunting composition (locomotive 443-06 and 2 (two) wagons of type Arbel series Faboo), owned by JP "EPS" Branch TENT from Obrenovac, on a railway worker employed in "Pro Tent"d.o.o. from Obrenovac. The railway worker was in the area of the switch block No. 17 in the profile of the second track of the Obrenovac station, when he was hit by a pushed shunting composition, which was moving on the second track from the direction of the entrance switches towards the second turnout track. On that occasion, the railway worker suffered severe bodily injuries, from which he died on the spot.

Fatally injured worker, railway worker employed in "Pro Tent"d.o.o. from Obrenovac was in the area of switch No. 17 in the profile of the second track due to cleaning and lubrication of the switches. No material damage was caused to the railway vehicles, infrastructure and property of third parties in the serious accident in question.

1.2. The serious accident causes determined by investigation

The direct and immediate cause of the serious accident is that the railway worker, employed in "Pro Tent"d.o.o. from Obrenovac, was located on the second track of Obrenovac station in the area of switch No. 17, performing cleaning of switches at the time of the pushed shunting composition arrival, which is contrary to Article 12, paragraph 1 and Article 16, paragraph 1 under 1 of the Rulebook on special occupational safety measures in railway traffic ("Official Gazette of RS", No. 19/85), thus creating a dangerous situation related to the occurrence of this serious accident.

The pushed shunting composition (locomotive 443-06 and 2 (two) Arbel type wagons, Faboo series) was moving on a second station track towards the second turnout track. The shunting composition was occupied only with the train driver, while the shunter and the shunting operator were not on the shunting composition or next to the track near the shunting composition, so that observing the driving route of the pushed shunting composition was only performed by the train driver, which is contrary to the points 116 and 117. of the Shunting Instruction 42 ("Official Gazette ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94). Bearing in mind the position of the train driver in the driver cab of the locomotive 443-06 in the pushed shunting composition and the fact that the second track is in the direction, observation of the driving route of the pushed shunting composition only by the train driver influenced train driver not spotting the railway worker, who at the time of the shunting composition arrival, was positioned in the middle of the second track on the switch No. 17. The fact that the installation of steps and handrails for an attendant, who would observe the shunting path from the front of the pushed shunting composition, was not constructively planned on the Arbel type Faboo series wagons, could have contributed to the occurrence of the serious accident in question.

Railway worker employed in "Pro Tent"d.o.o. from Obrenovac was located in the area of switch No. 17 in the profile (inside) of the second station track immediately before the occurrence of the serious accident, ie immediately before the shunting composition arrival, performing the

tasks of cleaning of the switches, although from the employer “Pro Tent”d.o.o. from Obrenovac he was acquainted with the dangers of railway transport. Also, before going on the track, ie before starting the works on cleaning the switches No. 17, he did not receive approval for the mentioned works from the train dispatcher of the Obrenovac station, which is contrary to Article 12, paragraph 1 of the Rulebook on special occupational safety measures in railway traffic (“Official Gazette of RS”, No. 19/85).

In the Business Order of the station Obrenovac No. 32063/1 of 21.10.2010., part I, chapter B: Work organization and manner of traffic execution, item 2 Obligations of employees on the work positions, under 2.5: Obligations of the train dispatcher, for none of the three work positions of the train dispatcher at the Obrenovac station, the obligation to perform the duties of a shunting operator is not precisely stated.

Also, in item 9: Manner of communication during the formation of shunting drive routes, Chapter B: Organization of work and manner of performing traffic, Part I of the Business Order of Obrenovac station No. 32063/1 of 21.10.2010., it is defined that the shunting drive routes on the main tracks of the Obrenovac station are formed by the train dispatcher by giving commands on the electronic signal box. The role of the shunting operator during shunting is performed by the train dispatcher and he informs the shunting staff about all planned shunting drives.

Based on the above, it can be concluded that the Business Order of the station Obrenovac No. 32063/1 of 21.10.2010. does not clearly and precisely define which of the three existing train dispatchers has the obligation to perform the tasks of a shunting operator. In addition, item 9 defines in the same paragraph the obligation of the train dispatcher to form shunting routes on the electronic set and to perform the duties of the shunting operator, which indicates the conclusion that the train dispatcher is in charge of performing the duties of the train dispatcher for traffic. Due to the nature of the work of the train dispatcher for traffic (traffic regulation tasks, including the handling of electronic set) and his place of work, it is impossible to simultaneously perform the mentioned tasks in the office of the train dispatcher for traffic and to perform the duties of the shunting operator as part of shunting tasks execution.

Inaccuracy in defining which train dispatcher performs the duty of the shunting operator in the prescribed procedure in the Business Order of the Obrenovac station No. 32063/1 of 21.10.2010., could have influenced the fact that the shunting operator was not present during the execution of the shunting drive with pushed shunting composition.

1.3. Main recommendations and information on subjects to which 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_06/22, SR_07/22 and SR_08/22 are issued:

SR_06/22 JP "EPS" Branch TENT from Obrenovac, to perform extraordinary training of the shunting staff (train driver, shunting operator and the shunter) in terms of proper execution of the shunting tasks, with special reference to the conditions for safe start and movement of the shunting composition, the position of the shunter and the shunting operator when driving the shunting composition, in accordance with the items 23, 116 and 117 of the Shunting Instruction 42 ("Official Gazette ZJŽ", No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94), that is, the Article 75 of the Traffic Rulebook ("Official Gazette RS", No.34/22) (see sections 3.3.5, 3.3.9, 4.1 and 4.2.1)

SR_07/22 JP "EPS" Branch TENT from Obrenovac, to amend the Business Order of Obrenovac station, and to precisely define which employees at which work positions are obliged to perform the duties of shunting operator (such as: train dispatcher for unloading - "OB2", train dispatcher for unloading - "OB1", separate shunting operator or the shunter who performs the duties of the shunting operator) with special reference to the scope of work and in accordance with the Shunting Instruction 42 ("Official Gazette ZJŽ", No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94), that is, the Traffic Rulebook ("Official Gazette RS", No.34/22) (see sections 3.3.5, 3.3.9, 4.1, 4.2.1. and 4.2.2.).

SR_08/22 JP "EPS" Branch TENT from Obrenovac, to consider the possibility of a constructive solution for the installation of steps and handrails on the front sides of the wagon type Arbel of series Faboo, for safe stay of train attendants during shunting drives (see sections 2.2.2, 3.6.3. and 4.2.2.) or to apply other measures in order to perform shunting drives with attendants in accordance with the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94) that is, the Traffic Rulebook ("Official Gazette of RS" No. 34/22).

2. Direct facts about the serious accident

2.1. Basic serious accident data

2.1.1. Date, time and location of the serious accident

A serious accident occurred on 12.07.2021. at 07:43 in the area of the city of Belgrade, Obrenovac municipality, in the area of TENT, at the Obrenovac railway station, on the second track. The area where the serious accident in question occurred is in the industrial zone of the municipality of Obrenovac.

The appearance of the serious accident site is shown in Figure 2.1.1.1.

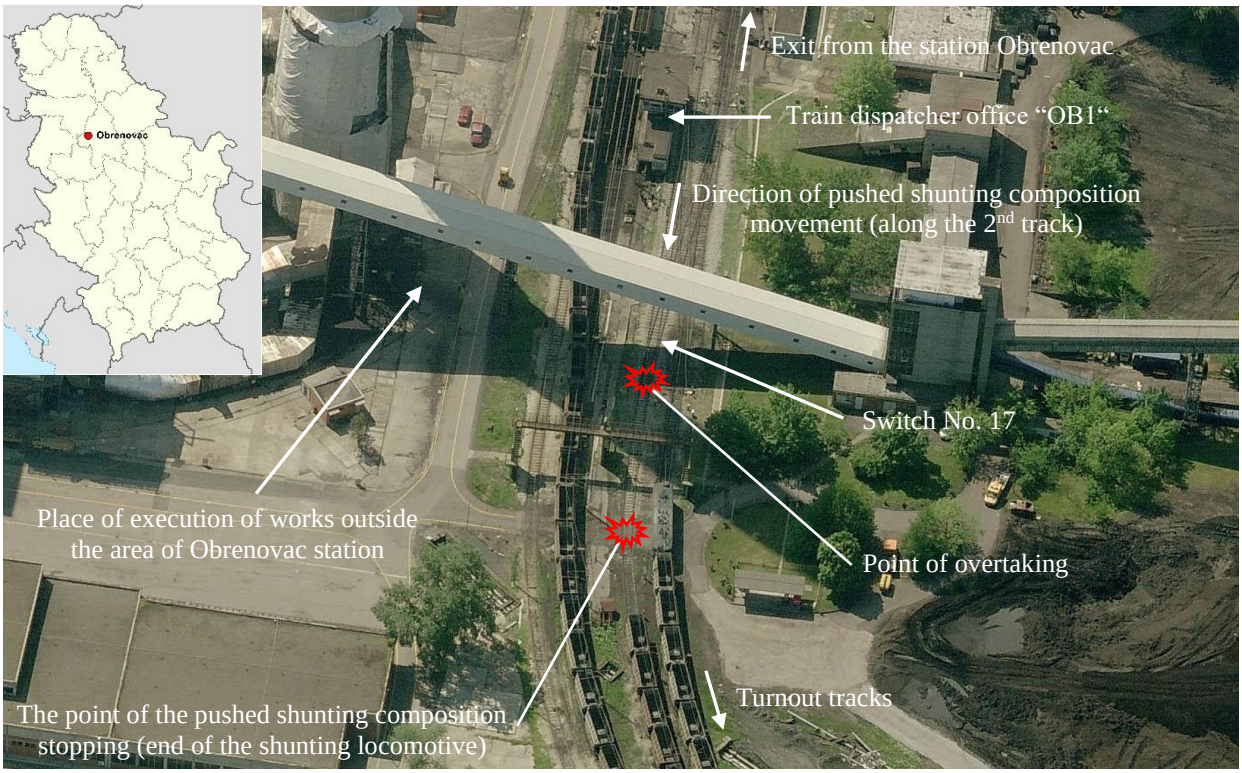

Figure 2.1.1.1: Satellite image of the serious accident site (source: Bing maps)

2.1.2. Description of the serious accident and serious accident site and work of emergency and rescue services

The place of occurrence of the serious accident in question is located on the second track of the Obrenovac station, at the switch No.17, in the immediate vicinity of the facility where the office of the unloading train dispatcher is located - "OB1".

As part of the shunting work at the Obrenovac station, in order to transfer the Arbel type Faboo series wagons from the fourth turnout track to the second turnout track, the shunting composition (locomotive 443-06 and 2 (two) Arbel type wagon, Faboo series) started driving from the station part of the railway track moving along the second station track from the direction of the entrance switches in the direction of the second turnout track. Only the train driver, employed by the

JP “EPS” Branch TENT from Obrenovac, was on the shunting composition (he was in the driver cab of the shunting locomotive 443-06).

Railway worker, employed in “Pro Tent”d.o.o. from Obrenovac, immediately before the occurrence of the serious accident, was in the area of the switch No.17 in the profile of the second station track, performing the work of cleaning the switches. While cleaning the switch No. 17, the railway worker turned his back on the oncoming pushed shunting composition.

Under these conditions, there occurred a collision of the pushed shunting composition on the railway worker. The collision occurred when the front of the shunting composition (middle of the front part of the Arbel type wagon, Faboo series individual No. 43 72 6531 314-2) hit a railway worker in the area of his back, who from the impact fell off the track, after which the entire shunting composition crossed over him. On that occasion, the railway worker suffered severe bodily injuries, from which he died on the spot.

Since the train driver on the pushed shunting train did not notice that there occurred a collision, the pushed shunting composition continued driving all the way to the second turnout track, near the place where it was planned as part of the shunting task. The train dispatcher for unloading - “OB1”, was the first to notice the occurrence of the serious accident in question, who was in his office in the facility located between the second and third track near the switch No. 17, ie near the place of occurrence of the serious accident in question.

The appearance of the place of the serious accident, after the collision of the pushed shunting composition on the railway worker, is shown in Figure 2.1.2.1.

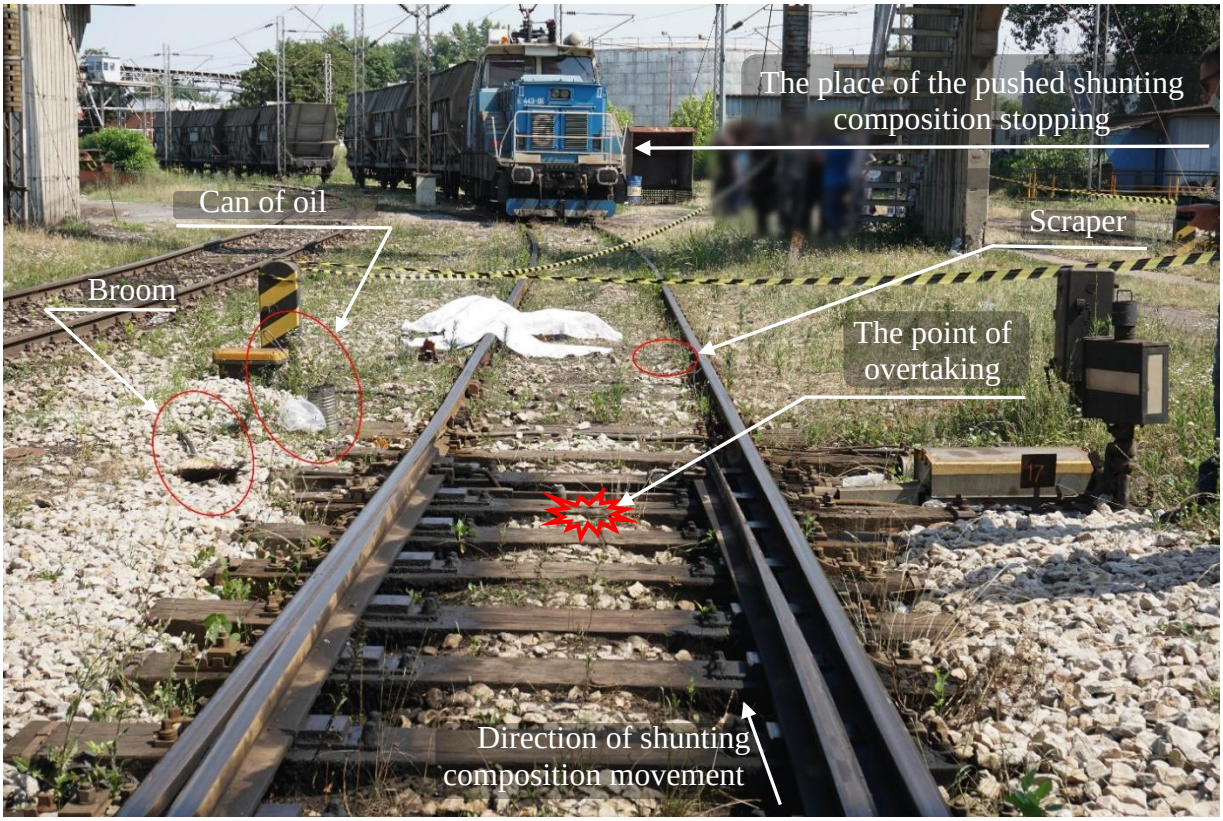

Figure 2.1.2.1: The appearance of the place of the serious accident after the collision of the pushed shunting composition on the railway worker (view from the direction of the second track to the second turnout track)

Due to this serious accident, the team of the Emergency Medical Service of the "Obrenovac" Health Center was hired.

Due to this serious accident, the traffic at the Obrenovac station was not interrupted.

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

CINS has been informed immediately upon the occurrence of the serious accident. Main Investigator for Railway Traffic received the first notification of the serious accident occurred on 12.07.2021. at 07:51 by telephone call, and then at 08:25 by additional notification via SMS by Director of Railway Transport of JP "EPS" Branch TENT from Obrenovac. Based on the information received and the facts that the investigative team of CINS determined by on-site investigation of the serious accident, CINS has launched the investigation of the serious accident in question in accordance with the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18).

Composition of the Working group for investigation of the serious accident is determined by Decision No.340-01-1/2021-02-2-5 of 15.07.2021. of the Director of CINS based on the Articles 6 and 32 of the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18).

2.2. Serious accident background

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

Employees of JP "EPS" Branch TENT and employees of "Pro Tent"d.o.o. from Obrenovac participated in this serious accident.

Among the employees in the JP "EPS" Branch TENT from Obrenovac, as directly involved railway staff, the train driver of the locomotive 443-06 and the shunter (the first shunter) participated in the serious accident.

From the employees of "Pro Tent"d.o.o. from Obrenovac, as directly involved railway staff, a railway worker participated in a serious accident.

Among the employees of JP "EPS" Branch TENT from Obrenovac who indirectly participated in a serious accident are: train dispatcher for traffic - "OB2", train dispatcher for unloading - "OB1" and a shunter (the second shunter).

Other staff did not participate in the serious accident in question, nor did other persons and witnesses.

2.2.2. Shunting composition that participated in the serious accident

Pushed shunting composition participated in the serious accident in question, consisting of locomotive 443-06 and 2 (two) wagons of type Arbel, series Faboo (one empty wagon for repair and one loaded with mud).

Table 2.2.2.1. gives a review of wagons that were part of the shunting composition.

Table 2.2.2.1: Review of wagons in a shunting composition (viewed from the shunting loc. 443-06)

Serial wagon No.	Letter marking of wagon series	Individual wagon No.	Ownership
1.	Faboo	43 72 6531 238-3	JP "EPS" Branch TENT from Obrenovac
2.	Faboo	43 72 6531 314-2	

Locomotive 443-06 is an electrified single-phase system of 25 kV/50 Hz of manufacturer "Škoda" - the Czech Republic. It was delivered in 1984 with the basic purpose of shunting operations during coal unloading. At the request of the purchaser, it was delivered with a telecontrol control device (TK). The locomotive is four-axle with two bogies of constructive characteristics Bo'-Bo', intended for traffic on a track of normal gauge (1435 mm).

Basic technical data for locomotive 443-06 are:

- length of locomotive over uncompressed bumpers 14400 mm,
- spacing between bogie centers 6800 mm,
- axle spacing in bogies 2800 mm,
- maximum height with lowered pantograph 4650 mm,
- operating height of the pantograph 5050-6300 mm,
- locomotive mass 72 t,
- locomotive power 880 kW,
- maximum locomotive speed 80 km/h.

The appearance of locomotive 443-06 is shown in Figure. 2.2.2.1.

Figure 2.2.2.1: Appearance of locomotive 443-06

The box of the locomotive 443-06 is divided into three parts lengthwise so that the driver cab is in the middle, and at the ends there are two engine rooms of equal length (one on each side of the locomotive).

In the driver cab of the locomotive 443-06 there are two control tables, placed diagonally, so that the train driver when operating the locomotive can see only one longitudinal side of the locomotive, ie the shunting composition. The view of the track directly in front of the locomotive, ie the shunting composition, is limited by the length of the part of the locomotive from the driver cab to the front part of the locomotive, ie the length of the shunting composition. The view from the driver cab of the locomotive 443-06 from the position where the train driver was at the time of this serious accident, is shown in Figures 2.2.2.2. and 2.2.2.3. On the front sides of the locomotive there are platforms with access steps and handrails. The appearance of the platform with handrails on the front side of the locomotive 443-06 is shown in Figure 2.2.2.1.

Figure 2.2.2.2: View from locomotive's 443-06 driver cab
in the direction of the pushed shunting composition driving

Figure 2.2.2.3: View from locomotive's 443-06 driver cab
in the direction opposite to the direction of the pushed shunting composition driving

Arbel type wagons, Faboo series are intended for traffic on lines of normal track gauge (1435 mm) and are used to transport coal (lignite). The wagon is composed of two two-axle part that form an indivisible assembly. Unloading is done by automatically opening the door when a fixed device acts on the wagon at the place of unloading.

Technical data (some characteristics):

- Total length over bumper 15160 mm
- Length of the lower base (one part) 6710 mm
- Distance between axles of one part 5250 mm
- Number of axles 4
- Maximum speed 80 km/h
- Own mass of the wagon 22,70 t

Schematic representation of Arbel type wagon, Faboo series (source: TENT) is shown in Figure 2.2.2.4.

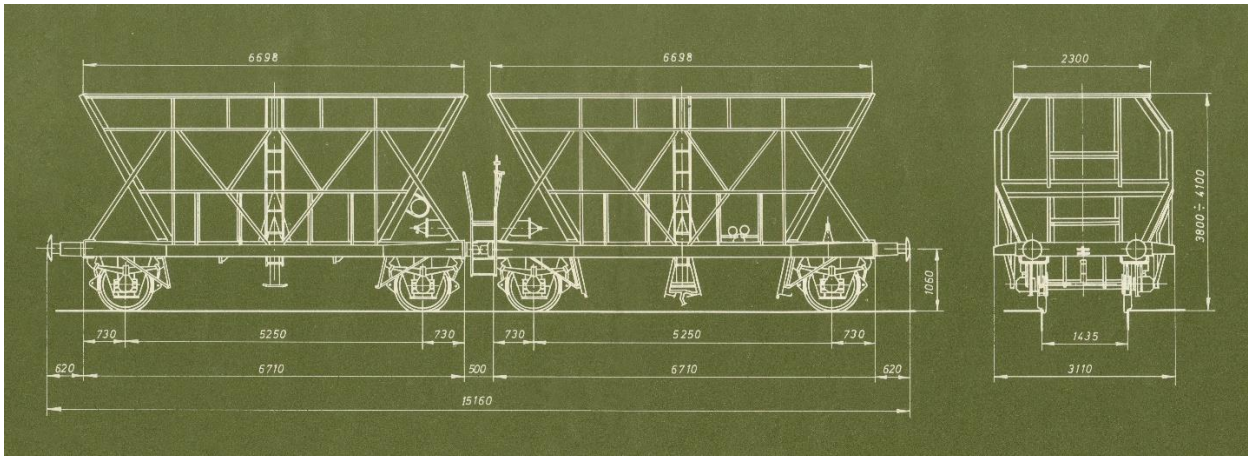

Figure 2.2.2.4: Schematic representation of Arbel type wagon, Faboo series (source: TENT)

On Arbel type wagons, the Faboo series, the installation of steps and handrails for the shunter is not structurally envisaged (see Figure 2.2.2.4).

The appearance of the tables of the Arbel type wagon, Faboo series included in the pushed shunting composition that participated in the serious accident in question is shown in Figures 2.2.2.5. and 2.2.2.6.

Figure 2.2.2.5: Tables of the Arbel type wagon, Faboo series No.43 72 6531 238-3

Figure 2.2.2.6: Tables of the Arbel type wagon, Faboo series No. 43 72 6531 314-2

Technical data for locomotive 443-06 and Arbel type wagons, series Faboo are given according to the data submitted by JP "EPS" TENT Branch from Obrenovac (attached to the letter No. 20600-E-03.01-322756/2-2021 of 09.09.2021.).

2.2.3. Infrastructure and SS system

Obrenovac station is the starting station of the Obrenovac - Vreoci railway on the TENT industrial railway. According to the type of transport work, it is an unloading station with unloading points "OB1" and "OB2". The station is intended for unloading coal, fuel oil, chemicals and other goods for the needs of TENT and other users with whom TENT has contractual obligations for the transport of goods by rail. In terms of performing the traffic service, the Obrenovac station is a distribution station.

The station plateau of the Obrenovac station was built horizontally.

The boundary of the station area in relation to the open line extends from the entrance signal from the side of the Stubline station at km 0+954 of the Obrenovac - Vreoci line, to the buffer stop at the ends of the turnout track No. I, II, III and IV on the opposite side towards the ash dump.

At the Obrenovac station, the main tracks are marked with Arabic numerals from 1 to 5, and the turnout tracks with Roman numerals from I to IV.

The Obrenovac station is secured with an SS device of the electronic signal box type ESA-11 SB, manufactured by AŽD Prague, which is operated according to the Service Manual of the station, Signalling and Safety Device Service Manual No. O 80 415/201 of 18.04.2008.

Securing covers all main tracks (1, 2, 3, 4, 5.) as well as tracks 1d and 2d, turnout tracks No. I, II, III, IV, 3a, 1da and 1db, switches from No. 1 to 20 and switches 4d, as well as ISK1 and ISK2 derailers. Other tracks and switches are not included in the SS device.

The station signal box is located in the office of the train dispatcher of the Obrenovac station - "OB2".

The switches included in the station signal box are equipped with electric switch machines and switch signals that are illuminated at night and operated remotely from the station signal box. The position of switches, main signals, shunting signals for protection of the track, border track signals, freedom/occupancy of switches and tracks, as well as crossings of switches are controlled at the station signal box.

The following road crossings were built in the area of the Obrenovac station: over the turnout track No. I, II, III and IV at km 0+041, over the HPV track at km 0+174, over the turnout track 3d in front of the sandblasting shed, over the track 2d and 3d at km 0+340, over tracks 18d and 16d (next to Block 7 towards the gate of ŽT). These road crossings in the station are used for the official needs of road vehicles and machinery, and are protected by road signs "Saltire" and "Stop".

The overview of the infrastructure and SS system is given according to the data submitted by the JP "EPS" Branch TENT from Obrenovac submitted in the attachment to the letter No. 20600-E-03.01-322756/2-2021 of 09.09.2021. (Business Order of Obrenovac station No. 32063/1 of 21.10.2010).

2.2.4. Means of communication

Obrenovac station is equipped with radio devices for mutual communication of all traffic participants. The use of radio network is performed in the manner prescribed by the Instruction on performing radio traffic on the railway network of ŽT JP TENT No. 7151 of 10.04. 2002. The entire radio traffic of the Obrenovac station is recorded with a recording device, so the radio station is a means of evidence-based communication when the recording device is correct and included in operation. The train dispatcher - TK dispatcher is responsible for controlling the operation of the registering device. The train dispatcher - TK dispatcher informs all participants in traffic about the termination of the operation of the registering device and acts in accordance with the provisions of the Instructions on the use and operation of the registering device at the Remote Control Center.

At the workplace of the train dispatcher - "OB1" there is a direct telephone connection with the operator of Coal Delivery-1, as well as a local telephone line in the automatic home exchange TENT "A" with exit via "0" to the public PTT exchange "011". At the workplace of the train dispatcher - "OB2" there is a TT desk with direct (CDS) connection with the train dispatcher - TK dispatcher in Obrenovac and Stubline station, local telephone line in the automatic home exchange TENT "A" with exit via "0" to the public PTT exchange "011", as well as a direct connection with the supervisor of locomotives at the Obrenovac station.

In addition to the TT desk, there is also a direct telephone connection with the Coal Delivery Operator-2. The registering device records telephone traffic realized by direct telephone line with train dispatcher - TK dispatcher, direct connection with locomotive supervisor at Obrenovac station and direct telephone connection with Coal Delivery-2 operator or Coal Delivery-1 operator.

An overview of the means for communication is given according to the data submitted by the JP "EPS" Branch TENT from Obrenovac submitted in the attachment to the letter No. 20600-E-03.01-322756/2-2021 of 09.09.2021. (Business Order of Obrenovac station No. 32063/1 of 21.10.2010).

2.2.5. Works executed at or near the serious accident site

In the area of the Obrenovac station works were not executed.

At the time of occurrence of the serious accident in question, works were carried out in the TENT area on the construction of the first phase of the flue gas purification plant for TENT "A" - a system for processing limestone and gypsum. The mentioned works were performed outside the station area, but near the switch No. 17, ie the place where the pushed shunting composition hit the railway worker, at a distance of approximately 40 m. These works did not directly affect the performance of work in the area of the station, but the presence of noise due to the performance of works could affect the workers who performed their work in the area of the station.

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

Immediately after the occurrence of the serious accident in question, the industrial railway JP "EPS" Belgrade, Branch TENT from Obrenovac informed the Ambulance of the Obrenovac Health Center within the TENT, Emergency Medical Service of the Obrenovac Health Center and the Obrenovac Police Station.

The Industrial Railway of JP "EPS" Belgrade, Branch TENT from Obrenovac informed CINS about the serious accident, ie. the Main Investigator in Railway Traffic.

By Decision No. 97-E.03.01-182414/1-2020 of 02.04.2020. of Director of Energy Production TENT from Obrenovac, Industrial Railway JP "EPS" Belgrade, Branch TENT from Obrenovac formed an investigation committee for accidents and incidents that conducted an investigation into the accident in accordance with applicable regulations. After the end of the investigation, the Report on the accident investigation No. 20600-E.03.01-324733/1-2021 from 12.08.2021 was made.

According to the allegations from the letter of the JP "EPS" Branch TENT from Obrenovac number 20600-E-03.01-322756/2-2021 from 09.09.2021. and on the basis of the Minutes of the hearing of the participants in the serious accident, the occurrence of this accident was first noticed by the dispatcher at the unloading - "OB1", who after crossing and releasing the switch No. 17 by the pushed shunting composition, saw a railroad worker. The train dispatcher for unloading - "OB1" informed the train driver on the shunting composition that took part in this accident and the train dispatcher for the traffic - "OB2" about the accident. He also informed the ambulance. According to the received notification, the dispatcher for the traffic of trains - "OB2" immediately informed the dispatcher of trains on TK and called the ambulance.

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

Due to this serious accident, members of the MUP RS, PS Obrenovac, members of OJT in Obrenovac and members of Emergency Medical Service of Obrenovac Health Center.

According to the allegations from the letter of the Emergency Medical Service of Obrenovac Health Center No. 1297/1 of 25.08.2021., the emergency medical service received a call at 07:55 that a worker was hit by a train on the TENT "A" railway. After receiving the call, one ambulance team from the Obrenovac Health Center was sent, consisting of: a doctor, a medical technician

and a driver. The ambulance team of the Obrenovac Health Center arrived at the scene at 08:10, where a person with polytraumatic injuries, without vital signs, was found, and the death was stated at 08:15. The fatally injured person was not moved from the scene, nor was the person transported anywhere by the Ambulance team of the Obrenovac Health Center.

According to the allegations from the letter of MUP RS, the Police Directorate, the Police Administration for the City of Belgrade, PS Obrenovac No. 3972/21/21 from 13.07.2021. the duty service of PS Obrenovac received a notification at 08:20, from the Emergency Service of Obrenovac Health Center that a fatally injured person was found at TENT "A" in Obrenovac. According to the allegations from the letter of MUP RS, the Police Directorate, the Police Administration for the City of Belgrade, PS Obrenovac No. 03.15-18-221-144/21 of 16.08.2021. on behalf of the MUP RS, the Deputy Public Prosecutor in Obrenovac was called on 12.07.2021., who led the on-site investigation in the area of TENT Obrenovac on the second track on the switch No. 17 where there occurred an overtaking of the pushed shunting composition on the railway worker of "Pro Tent"d.o.o. from Obrenovac. The investigation team of PS Obrenovac went to the scene. On that occasion, a forensic examination of the scene was performed and the same was photographed in its current state, on the basis of which the Report on the forensic examination of the scene No. KT 116-235/2021 of 12.07.2021. was made.

According to the letter from the OJT's Office in Obrenovac, KTP No. 369/21 of 22.12.2021., the Deputy Public Prosecutor in Obrenovac conducted an on-site investigation.

According to the allegations from the letter of the Ministry of Labor, Employment, Veterans and Social Affairs of the RS, the Labor Inspectorate, the First Department of the Labor Inspection for the City of Belgrade No. 163-00-2498/2021-04 of 27.08.2021., after learning about the fatal injury at work that occurred in JP "EPS", Branch TENT from Obrenovac, Unloading station Obrenovac, 2 (second) track on 12.07.2021. at 07:43, the Labor Inspector of the Department of Labor Inspection in the city of Belgrade went to the scene and issued the Minutes on the investigation of the fatal injury at work No. 163-00-2498/2021-04 of 12.07.2021.

2.3. Fatally injured, injured and material damage

2.3.1. Passengers, third parties and the railway staff including the contractors

One person was fatally injured in this serious accident. No one was injured.

Table 2.3.1.1: Overview of fatally injured and injured

	Passengers	Railway staff	Third parties	Total
Fatally injured	-	1	-	1
Seriously injured	-	-	-	-
Slightly injured	-	-	-	-

2.3.2. Goods, luggage and other assets

There was no damage to the goods in the railway vehicles and other property in this serious accident.

2.3.3. Railway vehicles, infrastructure and the environment

In the serious accident in question there is no damage done to the railway vehicles, infrastructure and third persons assets.

2.3.4. External conditions - weather conditions and geographical characteristics

The place of occurrence of the serious accident in question is located in the municipality of Obrenovac, within the circle of TENT, at the Obrenovac railway station. The area where the serious accident in question occurred is located in the industrial zone of the municipality of Obrenovac.

The area of the place of the serious accident is flat.

The part of the line on which the serious accident in question occurred (second station track) is in the direction and horizontal.

The geographical coordinates of the accident site are: 44º 40' 20.3" N and 20º 9' 29.4" E.

By the letter of the Republic Hydrometeorological Institute No. 925-1-240/2021 of 10.08.2021., data were submitted that, based on measurements and observations at the Meteorological Station Surčin, which is climatologically representative of the area of Obrenovac, on 12.07.2021. at 07:00 the air temperature was 21.4°C, there was no precipitation, the ground was dry, meteorological visibility was 20 km and the maximum wind speed in the previous hour was 4.6 m/s, and on 12.07.2021. at 08:00 the air temperature was 23.2°C, there was no precipitation, the ground was dry, meteorological visibility was 20 km and the maximum wind speed in the previous hour was 5.1 m/s.

Meteorological visibility is the horizontal transparency of the atmosphere, which is expressed with the greatest distance at which the observer of normal vision can recognize objects known to him in the environment, when observing during the day, and light sources when observing at night.

At the time of the on-site investigation (the on-site investigation started on 12.07.2021. at 09:49) of the serious accident in question by the investigative team of CINS, it was day. The weather was sunny, clear, without precipitation, fog and wind. Visibility was good. The air temperature was approximately 36°C.

3. Minutes on investigation and examination

Data, facts and evidence regarding the occurrence of the serious accident in question were collected and determined on the basis of:

- On-site investigation by the investigative team of CINS;
- materials submitted by JP “EPS” Branch TENT from Obrenovac;
- materials submitted by OJT in Obrenovac and
- material submitted by the First Department of the Labor Inspectorate for the City of Belgrade.

For the accident in question, the on-site investigation and investigation was conducted by the Investigative Committee for Accidents and Incidents of JP “EPS” Belgrade, Branch TENT from Obrenovac.

Members of PS Obrenovac, OJT in Obrenovac and the First Department of Labor Inspectorate for the city of Belgrade conducted an on-site investigation.

3.1. Summary of testimonies

The CINS working group has on 08.02. and 09.02.2022. in the premises of CINS, interrogated the employees participating in this serious accident.

From the employees of JP "EPS" Branch TENT from Obrenovac, the train dispatcher for traffic of trains - "OB2" of the station Obrenovac, the train dispatcher for unloading - "OB1", the shunter forming the shunting composition with the locomotive 443-06 that participated the serious accident in question, as well as the second shunter who, at the time of occurrence of the serious accident in question was on duty at the station Obrenovac and was in the facility "OB1", were interrogated.

From JP "EPS" Branch TENT from Obrenovac (Letter No. 20600-E-03.01/322756/2-2021 of 09.09.2021.) Minutes on hearing of the employees that participated in the serious accident in question were not submitted because the employees were not interrogated.

From the JP "EPS", Branch "TENT" from Obrenovac, Reports on irregularities were obtained during the service from 12.07, 13.07. and 14.07.2021. and amendments to these Reports from 13.07. and 22.07.2021. issued by the dispatcher for traffic of trains - "OB2" of station Obrenovac, dispatcher of trains for unloading - "OB1" of station Obrenovac, who were on duty at the time of the serious accident, the train driver who drove the locomotive 443-06 that participated in serious accident, shunters (first shunter) who formed the shunting composition with locomotive 443-06, as well as shunters (second shunter) who at the time of the serious accident was on duty at the station Obrenovac and was in the facility "OB1".

Summary of testimonies for the employees of JP "EPS", Branch "TENT" from Obrenovac, and for the dispatcher for traffic of trains - "OB2" of station Obrenovac, dispatcher of trains for unloading - "OB1" of station Obrenovac, shunter (first shunter) who formed the shunting composition with locomotive 443-06, as well as shunter (second shunter) who at the time of the serious accident was on duty at the station Obrenovac and was in the facility "OB1", are given according to the Hearing conducted by the Working Group of CINS on 08.02. and 09.02.2022. in the premises of CINS. The summary of the testimony of the train driver on the shunting locomotive 443-06 was given according to the hearing conducted by the CINS Working Group in the premises of JP "EPS", Branch "TENT" from Obrenovac after the on-site investigation of the serious accident on 12.07.2021. (at that time, the previously mentioned employees were questioned, except for the shunter (the second shunter), but due to the need to investigate the serious accident in question, the CINS Working Group conducted re-hearings on 08.02. and 09.02.2022).

3.1.1. Railway staff

The shunter who formed the shunting composition on the fourth turnout track of the Obrenovac station, which consisted of locomotive 443-06 and 2 (two) wagons of the type Arbel, series Faboo (the first shunter) stated that the train dispatcher for traffic - "OB2", by verbal order, via fixed phone, said that two wagons from the fourth turnout track should be transferred and connected with two wagons in the second turnout track, and he answered the phone and received a notification because the train dispatcher for unloading - "OB1" was not in his office at that time.

When the train dispatcher for unloading returned, he passed on the order he had received and went to couple up two wagons on the fourth turnout track. After that, he returned to the station facility, because he had an earlier agreement with a colleague shunter (the second shunter), that he would take over the further station shunting and that he would connect those wagons with the other two wagons on the second turnout track. He found out about the serious accident in the office of the train dispatcher for unloading - "OB1".

The shunter who was in the office of the train dispatcher for unloading "OB1" (the second shunter) at the time of the serious accident stated that he was in the office of the train dispatcher for unloading - "OB1" when a colleague shunter (the first shunter) had a telephone conversation with the train dispatcher for traffic - "OB2" and received an order to perform a shunting task. He stated that he did not participate in the communication and that he did not hear that conversation. The shunter (the first shunter) introduced him to the shunting task before he left the office, and they agreed that he would continue further tasks after the shunter (the first shunter) returned from the fourth turnout track after two wagons were coupled. He found out about the accident from the train dispatcher for unloading - "OB1" at the moment when he left the office to perform the shunting task.

The train dispatcher for unloading - "OB1" stated that he was in the toilet at the time of issuing the order for the station shunting, but that later, when he returned to the office the shunter (the first shunter) told him that the train dispatcher for traffic of trains - "OB2" said that the two wagons from the fourth turnout track should be transferred to the second turnout track and assembled there with the other wagons. The shunter (the first shunter) told him that he would coupled two wagons on the fourth turnout track and that the shunter (the second shunter) would assemble them on the second turnout track, which the shunters had previously agreed on. During the movement of the pushed shunting composition through the second track, he was in the office and did not accompany the shunting composition. There are two telephones and one stable radio station available at the workplace, and there are also two mobile radio stations in the office for the purpose of station shunting. He stated that he did not have any form of communication with the railway worker, nor did the railway worker inform him that he would clean the switch.

The train dispatcher for traffic - "OB2" stated that he received the order for the execution of the shunting task, ie the transfer of two wagons from the fourth turnout track to the second turnout track, from the manager. After that, he called the train dispatcher for unloading - "OB1" by phone, but it was answered by the shunter (the first shunter) to whom he issued an order for the shunting task, ie to couple two wagons from the fourth turnout track to the 443-06 locomotive and transfer to the second turnout track and couple onto the other two wagons on the second turnout track. He undertook the shunting when there was no train traffic in the station. The train dispatcher for unloading - "OB1" informed him about the accident. He noted that, in accordance with the Business Order of the Obrenovac station, it is envisaged that the train dispatcher for traffic regularly performs the duties of the shunting operator, but that he cannot act as prescribed by Rulebook 42 and take a suitable place to observe the shunting, but he can only observe from the station facility, to monitor the execution of shunting paths. He stated that he did not have any form of communication with the railway worker, nor did the railway worker inform him that he would clean the switch.

The train driver of the locomotive 443-06 on the shunting composition, stated that according to the approval of the train dispatcher for traffic - "OB2" via radio connection, he should have transferred two wagons from the fourth to the second turnout track. He performed the shunting within the signal "Limit of shunting" and gave by the locomotive siren the aspect of a signal "Watch out" several times. He did not see the railway worker, although he was at the window on

the left in the direction of travel. The shunter (the first shunter) coupled the locomotive 443-06 on the fourth turnout track and after that he was not with him on the locomotive, that is, he was not present on the pulled and later on the pushed shunting composition.

3.1.2. Other witnesses

Witnesses of this serious accident (third parties) were not questioned and no statements were obtained from them.

3.2. Safety management system

3.2.1. Organizational frame and manner of issuing and executing orders

At the time of the serious accident in question, JP "EPS", Branch TENT from Obrenovac, had a Decision on issuing a Safety Certificate for the management of the infrastructure of the industrial railway I-01-1 No. 340-359-4/2016 of 29.07.2016. passed by the Railway Directorate with a validity period of 5 (five) years.

At the time of the occurrence of the serious accident in question, JP "EPS", Branch TENT from Obrenovac, ŽT, had established the Rulebook of the Safety Management System (SMS) from 17.05.2021. (issue No. 4) and the Decision on the issuance of the Certificate of Safety for Transport - Part A and Part B No. 340-30-7/2018 of 21.08.2018. passed by the Directorate of Railways.

In accordance with the Law on Safety in Railway Traffic ("Official Gazette of RS" No. 41/2018), the Industrial Railway JP "EPS", Branch TENT from Obrenovac formed an investigation committee that conducted an investigation into the accident. Upon completion of the investigation, the Accident Investigation Report No. 20600-E.03.01-324733/1-2021 of 12.08.2021. was prepared.

3.2.2. Requirements to be fulfilled by the railway staff and the manner they are applied

JP "EPS", Branch TENT from Obrenovac has, through the Rulebook of the Safety Management System (SMS) of 17.05.2021. (issue No. 4), provided management competencies, ie processes to ensure that all employees directly involved in railway transport are trained and competent, as well as workload planning.

According to the Rulebook of the Safety Management System (SMS) of 17.05.2021. the railway workers must be professionally qualified for the jobs they perform and must be professionally trained and their professional qualifications must be regularly and extraordinarily checked, in accordance with the Rulebook on professional qualifications of railway workers.

Regarding the serious accident in question, the train driver of the locomotive 443-06 on shunting composition, the train dispatcher for traffic - "OB2", the train dispatcher for unloading - "OB1" and the shunter at Obrenovac station, employees of JP "EPS", Branch TENT from Obrenovac, all activities related to professional training, competence and working time planning were carried out in accordance with applicable regulations.

3.2.3. Procedures for internal audits and controls and their results

JP "EPS", Branch TENT from Obrenovac has, as the railway undertaking, established Rulebook of the safety management system. The general purpose of safety management system (SMS) is, to secure safe operation of its own activities in accordance with the provisions of the Law on Railway Safety.

Rolling stock be must maintained in the prescribed technical level of correctness and must follow preventive plans prepared on a monthly basis, their cycles of periodic inspections and regular repairs (RO), in order to be as reliable as possible in traffic, in accordance with the Rulebook on maintenance of railway vehicles, Instructions for maintenance of railway rolling stock (JP EPS) and others laws and bylaws.

Regarding the serious accident in question, regular maintenance of the locomotive 443-06 in the interval from 12.07.2020. to 12.07.2021. done in certain intervals, was performed in accordance with the applicable regulations.

Regarding the serious accident in question, regular maintenance of the wagons No. 43 72 6531 238-3 and No. 43 72 6531 314-2, was performed in accordance with the applicable regulations.

3.3. Relevant international and national regulations

3.3.1. Law on Railway Traffic Safety ("Official Gazette RS" No. 41/2018)

VIII TRAFFIC REGULATION AND MANAGEMENT

Business Order of the station

Article 41 (excerpt)

Technical equipment of the official position, manner of performing the service of railway workers, obligations of the manager and the railway undertaking, their mutual cooperation in performing traffic, as well as activities that precede the formation of trains, ie follow the disbandment of trains and perform other tasks to preserve safety and regularity of railway traffic, in the area of the official place, are determined by the Business Order of the station issued by the manager.

...

XI CONDITIONS TO BE MET BY RAILWAY WORKERS

1. General conditions

Article 59 (excerpt)

Railway workers must have the prescribed education, must be professionally trained for the jobs and tasks they perform in performing railway traffic, must have passed the professional exam and must meet special health and other conditions in accordance with the provisions of this Law.

...

3.3.2. Law on Safety and Health at Work ("Official Gazette of RS" No. 101/2005, 91/2015 and 113/2017 - other law)

I BASIC PROVISIONS

Article 4 (excerpt)

...

6) Workplace is a space intended for performing work with the employer (in the facility or outdoors as well as on temporary and mobile construction sites, facilities, devices, vehicles, etc.) in which the employee resides or has access during work and which is under the direct or indirect control of the employer;

7) Work environment is a space in which work is performed and which includes workplaces, working conditions, work procedures and relations in the work process;

...

III OBLIGATIONS AND RESPONSIBILITIES OF THE EMPLOYER

...

3. Employee training

Article 27 (excerpt)

The employer is obliged to train the employee for safe and healthy work when establishing an employment relationship, ie other employment, transfer to other jobs, when introducing new technology or new means of work or changing work equipment, as well as when changing work processes that may cause a change in measures for safe and healthy work.

The employer is obliged to acquaint the employee during the training for safe and healthy work with all types of risks in the jobs for which he is assigned and about specific measures for safety and health at work in accordance with the Risk Assessment Act.

...

Training for safe and healthy work of the employee must be adjusted to the specifics of his workplace and is carried out according to the program, the content of which the employer must, when necessary, renew and modify.

If the employer appoints the employee to perform work at two or more jobs at the same time, he is obliged to train the employee for safe and healthy work at each of the jobs.

Article 28 (excerpt)

...

Periodic checks of competence for safe and healthy work of an employee working at a workplace with increased risk are performed no later than one year from the day of the previous check, and at other jobs no later than four years from the day of the previous check.

Note: Article 78 states that until the enactment of regulations on preventive measures for BZR, if they are not in conflict with this Law, occupational safety measures (rules) contained in the following regulation will be applied: 2) Rulebook on special occupational safety measures in railway traffic ("Official Gazette of RS", No. 19/85).

...

IV RIGHTS AND OBLIGATIONS OF EMPLOYEES

Article 35 (excerpt)

The employee is obliged to apply the prescribed measures for safe and healthy work, to purposefully use the means of work and hazardous substances, to use the prescribed means and equipment for personal protection at work and to handle them carefully, so as not to endanger its own safety and health, and the safety and health of others.

Before starting work, the employee is obliged to inspect his/her workplace, including the means of work he/she uses, as well as the means and equipment for personal protection at work, and to inform the employer or other authorized person in case of observed deficiencies.

...

3.3.3. Rulebook on records in the field of safety and health at work ("Official Gazette of RS" 62/2007 and 102/2015)

Records of employees trained for safe and healthy work

Article 8 (excerpt)

Records on employees trained for safe and healthy work are kept on Form 6, in which data are entered, as follows:

...

3) job title;

4) job description at that job;

...

8) risks that the employee is aware of during training for safe and healthy work;

...

3.3.4. Rulebook on special occupational safety measures in railway traffic ("Official Gazette of RS", No. 19/85)

3. Cleaning and lubrication of switches

Article 12 (excerpt)

Cleaning and lubrication of switches, as well as cleaning of snow and ice in winter on switches is performed only with the prior approval of the responsible person at the station, when trains are not running and when shunting is not performed over a switch that is cleaned or lubricated.

...

Article 13

Cleaning and lubrication of switches can only be performed by workers who, in terms of sight, hearing and other health abilities, meet the conditions for their safest movement and retention on switches.

4. Shunting

Article 15

Shunting can be performed only with the obligatory presence of the worker who manages the shunting (shunting operator, train conductor, train dispatcher or other worker when appointed by the train dispatcher).

Before starting the shunting, the worker who manages the shunting checks the shunting composition and whether the workers participating in the shunting have the prescribed and correct signalling means and appropriate personal protective equipment.

Article 16 (excerpt)

...

During the shunting work, the following is not allowed:

1. staying or walking on the track or next to the track;

...

18. crossing the track directly in front of, behind or between shunting drives or shunting trains.

3.3.5. Shunting Instruction 42 ("Official Gazette ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94)

Note: at the beginning of the application of the Traffic Rulebook ("Official Gazette of RS" No. 34/22) from 01.07.2022., the Shunting Instruction 42 ("Official Gazette of the Public Procurement Agency" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94) ceases to be valid.

Shunting workers

...

12.

Shunting workers include workers of the shunting traction vehicle and workers of a certain occupation of the unit in whose territory the shunting activities are performed. These workers are grouped into a shunting team, which is a common name for the shunting operator and a number of shunters, depending on the scope and type of shunting work, local and weather conditions and other technological conditions, but not less than two workers (shunting operator and shunter).

13. (excerpt)

Shunting traction vehicle staff include shunting train driver and train driver assistant. Depending on the technical characteristics of the shunting traction vehicle, occupation can only be by a train driver or a train driver and train driver assistant, which is prescribed by a special technical instruction.

...

14. (excerpt)

...

Shunting team, upon execution of the shunting task, is managed by the shunting operator.

...

Shunters are workers of the shunting team who perform shunting tasks on the orders of the shunting operator or according to the Rulebook for performing certain works related to shunting or work with trains during their preparation, i.e., work upon their arrival.

Shunting workers equipment

...

19.

Shunting movements may be performed only under the direct guidance of the shunting operator, ie a worker who is well acquainted with shunting operations. If the latter is temporarily unable to perform his job, then the leadership is transferred to the deputy or, for minor tasks, to another suitable worker with the necessary explanations in advance. In each shunting team, it is determined in advance who can replace the shunting operator (work schedule), and a specific replacement is ordered by the train dispatcher with the shunting schedule.

Supervision and management of shunting operations

…

Shunting operators' obligations

23. (excerpt)

The shunting operator manages the shunting according to the provisions of this instruction and according to the valid special instructions for the respective station. He carries out the orders of the train dispatchers for certain shunting movements and is careful not to cause extraordinary events, not to injure workers, as well as to save funds and goods. Therefore, the shunting operator is obliged to:

- to acquaint shunting and switch staff with shunting movements, especially when special precautions are required (passengers, dangerous goods, ramp, etc.);

…

- to respect all safety measures related to shunting and driving paths, shunting area, time restrictions, etc.;
- to take such a place from which, if possible, he can monitor certain movements and agree with the shunting staff, ie, in certain cases to check and communicate by radio device;

...

- the obligations stated in the provisions of items 122 and 133 of this Instruction also apply;

...

Driving speed

29.

All shunting movements are carried out carefully, so as to avoid accidents and damage to vehicles, cargo and plants.

...

115.

Checking the driving path is the duty of the switcher and the shunting operator, as long as the view can cover the set driving path. If the switcher cannot check due to unfavourable weather, darkness or any other reason, and he cannot entrust the check to any other worker, he must inform the shunting operator.

116. (excerpt)

Monitoring the driving path is the responsibility of the shunting operator. He chooses the place of standing during the movement so that he has a good overview of the movement and can communicate orally or through aspects of signal with the train driver and other participants.

...

117. (excerpt)

...

Shunters who ride are distributed approximately evenly on wagons.

...

They are also responsible for observing the driving path, if the locomotive pulls the shunting composition, and in the case of a pushed shunting composition, the shunter at the head of the shunting composition has the basic responsibility.

...

122. (excerpt)

Before shunting, the shunting operator and the shunters make sure:

- that the track from which the shunting composition departs, from the last wagon in the composition, and the track on which it is driven are free, as well as the corresponding fouling points of that track;

…

- workers, passengers and other persons are not injured;

…

- to take on its own initiative other safety measures that are not here stated.

123. (excerpt)

The staff of the pulled shunting composition and other shunters must also ensure that the provisions of item 122 are met. If the shunters notice that the movement could cause some danger, they must immediately inform the shunting operator. In case of any danger, the train driver takes

all safety measures on his own initiative. The worker who has been explicitly acquainted with the tested driving path by the shunting operator, is responsible for this.

...

124. (excerpt)

We can shunt via the level crossings after the traffic through them has been provided beforehand.

Provision of traffic via the level crossings is performed in the manner prescribed by the Instruction for handling devices for providing traffic over level crossings, ie the Business Order of the station, part I.

...

The provision of manual aspects of signal is done during the day by a hand raised vertically with an open fist towards the oncoming vehicles, and at night by waving a red light upright on the longitudinal axis of the road. The worker, when determined by the shunting operator, in this way provides traffic across the level crossing for the entire time until the traction vehicle, ie the first wagon in the direction of pushing, encounters the level crossing. The provision of traffic with manual aspects of signal is done on both sides of the level crossing in such a way that road vehicles stop first from one direction, and then from the other. In addition, the traction vehicle must give a "Watch out" aspect of signal before encountering the level crossing. If the shunting over the level crossing will be performed for a longer time, then, in the periods prescribed by the Business Order of the station, the shunting must be stopped due to the passing of road vehicles.

In this way, traffic is provided via all level crossings, regardless of whether they are located on public transport, industrial railways and tracks, etc.

...

126.

If the shunting movement is threatened by danger from any side, the shunter who first notices that danger takes appropriate measures to prevent it (stopping by applying the parking brake, the action of the auxiliary air brake, giving the aspect of a signal "Stop", etc.). Other workers shall immediately take appropriate measures within the scope of their work and available technical devices and equipment in terms of accident prevention.

...

Issuing orders for shunting movements

135. (excerpt)

Shunters pass orders to each other and to the train driver using the aspects of signal of the shunting staff. Aspects of signal for individual movements must be given until there is a need to change the type of movement, ie, to stop the movement with the aspect of signal "Stop". Aspects of signal "Easy" and "Stop" must be given in a timely manner to avoid a strong overtaking of the vehicle. The shunting operator shall ensure that all workers employed during the shunting give correct and timely aspects of signal, in order to safely carry out the procedures according to the given announcement.

On the right track, shunters are placed on the train driver's side, and in curves on the inner side of the curve. The train driver assistant shall immediately communicate the aspects of signal given on his side to the driver.

...

137.

During shunting movements, when only the train driver is on the locomotive, who in some cases cannot stand on the side of the shunting operator, one shunter must be near the train driver or in the driver cab, in order to be able to convey orders and distances to the train driver. Such shuntings are also subject to local procedures prescribed by the station's business orders.

...

Locomotive runs

178

Locomotive runs are considered to be the movements of a locomotive, alone or with a maximum of 12 axles of attached air-braked wagons, wherein at the end there can be a maximum of two wagons without a brake. Such drives with attached wagons without an attendant are allowed only in the area of the station, ŽTO determines the stations where the traffic of locomotive runs with attached wagons is allowed, ie, locomotives without an attendant.

When a locomotive pushes a hooked wagon, it is always considered shunting, and not locomotive driving, and is therefore with an attendant.

3.3.6. Business Order of Obrenovac station No. 32063/1 of 21.10.2010.

I part

B. Organization of work and manner of performing traffic

...

2. Duties of employees in the workplace

...

2.5. Duties of the train dispatcher

...

2.5.1. Duties of the train dispatcher OB2

2.5.1.1. Duties of the train dispatcher OB2 who regulates the traffic (excerpt)

- regulates safe and regular reception and dispatch of trains, as well as safe, orderly and economical deployment of vehicles - shunting work,

...

2.7. Duties of the driver on the shunting (excerpt)

The train driver performs the following tasks during the shunting at the Obrenovac station:

…

- performs shunting on the orders of the train dispatcher on traffic OB2,

...

- in performing the tasks of this job, cooperates with other participants in traffic,

...

2.10. Duties of the shunter (excerpt)

The shunter of the Obrenovac station performs the following tasks:

- performs all shunting operations in the station,

...

- handles the switch on the spot by order of the train dispatcher,

...

- takes into account the means and measures of HSE and ZOP,

...

2.11. Duties of the switch cleaner (excerpt)

Obrenovac station switch cleaner performs:

- cleaning and lubrication of all switches and cleaning of switch signals, visually monitors the correctness and completeness of the switch during cleaning, and reports any deficiencies to the train dispatcher,

...

- if necessary, at the request of the train dispatcher, cleans and lubricates the switches and, in case of emergency, if these cannot function normally,

...

- takes into account the means and measures of HSE and ZOP,

...

- performs other tasks for which he is capable and professionally qualified, and which he received from the competent manager.

...

9. Manner of communication during the formation of shunting routes (excerpt)

Shunting routes on the main tracks of the Obrenovac station are formed by the train dispatcher by giving commands on the electronic set. The role of the shunting operator during shunting is performed by the train dispatcher and he informs the shunting staff about all intended shunting runs. The shunter must use the prescribed signalling means when performing shunting operations. After the formation of the driving routes, the train dispatcher orders the execution of the shunting run by radio.

...

13. Manner of informing the shunting staff about the need to suspend the station shunting

The train dispatcher informs the shunting staff about the need to suspend the station shunting by radio. When the shunting train is withdrawn and placed on a certain track inside the fouling points, and the train dispatcher is convinced of this personally by visual observation or through a pointer on the monitor of the command computer, then orders for entry/exit of trains and rail vehicles can be issued. The train dispatcher is responsible for the timely suspension of shunting.

...

15. The speed of drive (excerpt)

...

Since the Obrenovac station is horizontal, and braking of longer shunting compositions is performed with an extended air brake, the speed of shunting trains over the switch area of the main tracks must not exceed 30 km/h, except when there is a shunter on the front side step - then the speed must not exceed 20 km/h.

...

The driving speed of the pushed shunting compositions must not exceed 25 km/h.

3.3.7. Risk Assessment Act for all work positions in the work environment of "Pro Tent"d.o.o. No. 25635 of 28.09.2012.

I GENERAL DATA

...

CONDITIONS FOR ESTABLISHING AN EMPLOYMENT RELATIONSHIP

RM code	NAME OF JOBS BY SYSTEMATIZATION	CONDITIONS FOR ESTABLISHING AN EMPLOYMENT RELATIONSHIP			
		Professional qualification level	Work experience	HSE and ZOP training	Professional examination
612.311	Railway worker	I degree		YES	

...

II DESCRIPTION OF JOBS AND WORK TASKS

Railway worker	Job description
	auxiliary railway maintenance work;

...

X CONCLUSION

Based on the conducted procedure of recording the organization of work, applied safety and health measures at work, determining hazards and harms at the workplace and in the work environment and risk ranking, it was estimated that the position of railway worker is not a workplace with increased risk.

XI PROPOSED PROTECTION MEASURES

...

Personal protection measures: Implement according to the Proposal of personal protection means and equipment.

Table 1. Means and equipment for personal protection

Serial No.	Name of protective means	Use	Quantity	Standard		Expiration date
				SRPS	EN	
1	Helmet	Protection of head	1	Z.B1.031	EN 397	36
2	Raincoat	Protection of body	1	-	-	36
3	Work suit	Protection of body	1	-	-	9
4	Work suit-winter	Protection of body	1	-	-	24
5	Sleeveless vest	Protection of body	1	-	-	60
6	Reflective vest	Traffic safety	1	-	-	36
7	Deep shoes with protective cap	Protection of legs	1	Z.B1.300	EN 345-1	9
8	Locksmith gloves	Protection of hands	1	Z.B1.021	EN 388	4
9	Winter cap	Protection of head	1	-	-	36
10	Gumboots	Protection of legs	1			24

...

3.3.8. Service provision contract which is in the JP “EPS” Branch TENT from Obrenovac, registered under No. 12.01.12 from 17.06.2021., and in “Pro Tent”d.o.o. Obrenovac registered under No. E-78-119/2021 from 16.16.2021.

Note: The document is listed as an integral part of the contract: Annex No. 6: Health and safety at work.

3.3.9. Traffic Rulebook (“Official Gazette RS” No. 34/22)

Note: Traffic Rulebook (“Official Gazette RS” No. 34/22) is in application from 01.07.2022.

IX. SHUNTING

...

Checking and observation of the shunting drive route

Article 75 (excerpt)

The shunting drive route is checked by the switcher and the shunting operator, as long as the view covers the set driving route. If the switcher is not able to control due to unfavourable weather,

darkness or any other reasons, and he cannot entrust the check to any other worker, he informs the shunting operator.

The shunting operator, the train driver and the first (last) shunter observe the shunting path. The shunting operator chooses his/her position during the movement so that he/she has a good overview of the movement and can communicate orally or through aspects of signal with the train driver and other participants. If this is not possible for him for any reason, then on one of the front, and preferably on the first wagon, there is a shunter who observes the driving route and gives the necessary aspects of signal.

Shunters who follow the shunting composition are distributed approximately evenly on the wagons so that they can see the driving path as far as possible, notice the aspects of signal of the shunting operator, driver and switcher, and immediately apply the brakes in case of danger.

If the locomotive pushes vehicles on the track whose visibility is not possible due to curves, illumination of space, profile of pushed wagons (cargo), etc., then at a sufficient distance in front of the vehicle is a worker who gives the necessary aspects of signal in a timely manner, upon which the driving speed when pushing is not higher than the speed of human walking.

When pushing empty passenger sets and other shunting compositions when there are obstacles listed in paragraph 4 of this Article, the speed is higher than the speed of a human gait, without workers in front of the shunting composition, if there is, on the platform or on the shunting step of the head wagon, a shunter with a specially adjusted half-clutch with a manual end tap for slowing down the speed, ie stopping the shunting composition when necessary.

...

The shunting operator, shunters and the staff of the traction shunting vehicle are assured before the shunting movement:

...

4) that the bumpers of the level crossings are closed, ie that the traffic at the level crossing is secured in any way;

...

If the shunters notice that the movement could cause any danger, they immediately inform the shunting operator. The train driver takes all safety measures on his own initiative in case of any perceived danger.

If the shunting movement is threatened by danger from any side, the shunter who first notices that danger takes appropriate measures to prevent it (stopping by applying the parking brake, the action of the auxiliary air brake, giving the aspect of a signal “Stop”, etc.). Other workers shall immediately take appropriate measures within the scope of their work and available technical devices and equipment to prevent accidents.

3.4. Functioning of the railway vehicles and technical installations

3.4.1. Control, command and signalling

At the time of occurrence of the serious accident in question, the control, command and signalling devices at the Obrenovac station were in correct and functional. No faults or malfunctions were recorded on the control, command and signalling devices.

3.4.2. Infrastructure

The condition of the infrastructure (in terms of the condition of the tracks and facilities) in the area of the station Obrenovac was orderly and in that sense, there were no irregularities that could adversely affect safety of railway traffic.

3.4.3. Communication tools

At the time of occurrence of the serious accident in question, the means of communication in the area of the Obrenovac station were correct and functional. No disturbances or malfunctions were recorded on the means of communication

3.4.4. Railway vehicles

From the data on regular maintenance of locomotive 443-06 submitted by JP "EPS" Branch TENT from Obrenovac, it can be seen that regular maintenance in the period from 12.07.2020. until 12.07.2021. was done in accordance with the Instructions for the maintenance of railway rolling stock No. 20600-EOB.01-109728/1-2021 of 27.05.2021.

From the records of failures, submitted by the JP "EPS" Branch TENT from Obrenovac, it can be seen that on the locomotive 443-06 at the time of the serious accident there were no failures, malfunctions or damage that were not eliminated.

In the form Handover of traction vehicle (form SV-1) for 11/12.07.2021. no objections related to deficiencies on locomotive 443-06 were observed during the handover of the locomotive.

From the data on regular maintenance of Arbel type wagons, Faboo series individual No. 43 72 6531 238-3 and No. 43 72 6531 314-2 submitted by JP "EPS" Branch TENT from Obrenovac, it can be seen that regular maintenance in the period from 12.07.2020. until 12.07.2021. was done in accordance with the Instructions for the maintenance of railway rolling stock No. 20600-EOB.01-109728/1-2021 of 27.05.2021.

According to the data submitted by JP "EPS" Belgrade (Letter No. 20600-E-03.01/322756/2-2021 of 09.09.2021), after the serious accident, a visual inspection of the locomotive 443-06 and wagon of individual No. 43 72 6531 238-3 and No. 43 72 6531 314-2 was performed. On that occasion, no damage was noticed on the rolling stock.

In accordance with Article 51 of the Law on Railway Traffic Safety ("Official Gazette of RS" No. 41/18), the locomotive series 443-06 is equipped with a device for giving sound signals (siren).

The locomotive 443-06 is equipped with a speedometer device manufactured by the Mihailo Pupin Institute, type EB96, serial No. 20054430061.

JP "EPS" Belgrade, Branch TENT from Obrenovac has, attached to the letter No. 20600-E-03.01/322756/2-2021 of 09.09.2021., submitted data that the verification of the correctness of the electronic speedometer EB96 installed on the locomotive 443-06 was performed, upon which the Maintenance Service Report was compiled on 11.06.2021. After checking the correct operation of the electronic speedometer, no repair of the speedometer device was recorded.

Processing the data taken from the memory of the electronic speedometer records from locomotive 443-06, which was on a shunting composition, was performed in JP "EPS" Belgrade, Branch TENT from Obrenovac.

By processing the data taken from the memory of the speedometer records from locomotive 443-06, which was on a shunting composition (document: Report on the processing of data registered on the registering speedometer from 12.07.2021. submitted in the attachment to the letter No. 20600-E-03.01/322756/2-2021 from 09.09.2021.) it was determined that after the arrival of locomotive 443-06 on the fourth turnout track of the station Obrenovac at 07:33, the same started at 07:36 (locomotive ride with two wagons from the fourth turnout track to the station part of the railway track), at a speed of up to a maximum of 25 km/h, crossed 810 m and stopped at 07:39. The use of the siren was registered at 07:36 (before departure) and at 07:37 (after 50 m). Locomotive 443-06 was restarted at 07:39 (shunting drive - pushing two wagons from the station part of the railway track to the second turnout track), at a speed of up to a maximum of 17 km/h, crossed 790 m and stopped at 07:43. The use of the siren was registered at 07:39 (before departure), at 07:40 (after 190 m) and at 07:42 (after 570 m or 220 m before stopping).

The time is given according to the clock of the speedometer device.

Based on the data registered on the electronic speedometer of the locomotive 443-06, it was concluded that the speed of the shunting composition with the locomotive 443-06 was not exceeded in relation to the allowed speed of 30 km/h or 25 km/h for pushed shunting compositions, which is defined by the Business Order of the Obrenovac station No. 32063/1 from 21.10.2010.

3.5. Traffic regulation and management

3.5.1. Actions taken by the staff that manages traffic regulation, control and signalling

The shunting operations during which the serious accident in question occurred were performed in the period when there was no train traffic at the Obrenovac station. The shunting was performed for the purpose of pulling two wagons (one for repair and one loaded with mud) from the fourth turnout track and pushing it to second occupied turnout track to assemble with the other two wagons (both loaded with mud) and prepare for subsequent unloading. The shunting task was issued by the Manager of the Traffic Service to the train dispatcher for traffic- "OB2", and the train dispatcher for traffic - "OB2" gave further orders for the execution of the shunting task and formed shunting routes.

3.5.2. Exchange of voice messages in relation to the serious accident

Communication in the Obrenovac station immediately before the serious accident took place by phone and radio.

Communication (one conversation) took place by telephone over the telephone line between the work positions of the train dispatcher for unloading - "OB1" and the train dispatcher for traffic - "OB2" of the Obrenovac station, and referred to the issuance of orders regarding shunting work or execution of shunting tasks.

Via the radio connection, there was a communication between the train dispatcher for traffic - "OB2" of the station Obrenovac and the train driver of the locomotive 443-06, which performed the shunting task, regarding:

- providing a shunting route for locomotive 443-06 from 1d track to the fourth occupied turnout track;
- providing a shunting route for the pulled shunting composition (locomotive 443-06 and 2 (two) Arbel type wagons, Faboo series) from the fourth turnout track, on the fourth track, to the station part of the track (up to the aspect of signal "Limit of shunting");
- providing a shunting route for the pushed shunting composition (locomotive 443-06 and 2 (two) wagons of the Arbel type, Faboo series) from the station part of the railway track to second occupied turnout track.

Reviewing the aforementioned communication that preceded the serious accident, it can be concluded that at the order of the train dispatcher - "OB2" to perform the shunting task was given, instead of to the train dispatcher for unloading - "OB1", directly to the shunters (the first shunter), due to the current absence of the train dispatcher for unloading - "OB1", took over the telephone line in his office.

3.5.3. Measures taken to protect and secure the place of the serious accident

Considering that the pushed shunting composition stopped on the section of the track that is horizontal and that the pushed shunting composition was not decoupled, no special measures are envisaged to secure the pushed shunting composition from self-movement.

No other measures were taken until the arrival of the police and the ambulance team.

3.6. Interface between the people, machines and organization

3.6.1. Working hours of the staff involved

From JP "EPS" Belgrade, Branch TENT from Obrenovac, attached to the Letter No. 20600-E-03.01/322756/2-2021 from 09.09.2021. data were submitted that on the basis of which it was concluded that the train driver of the locomotive 443-06, which was on the shunting composition did not spend time at work longer than the maximum specified by law and that before starting work he had a legally stipulated rest.

The data were also submitted by JP "EPS" Belgrade, Branch TENT from Obrenovac, on the basis of which it can be seen that the railway worker had a stipulated rest before coming to work and that he did not spend time longer than the maximum prescribed by law.

For other participants in the serious accident, employees of the JP "EPS" Belgrade, Branch TENT from Obrenovac, data were submitted which show that they had a legally stipulated rest before starting work and that they did not spend time at work longer than the maximum prescribed by law.

3.6.2. Health-related and personal circumstances that have effects on the serious accident, including the presence of physical or mental stress

From JP "EPS" Belgrade, Branch TENT from Obrenovac, attached to the Letter No. 20600-E-03.01/322756/2-2021 from 09.09.2021. data were submitted on the basis of which it was concluded that the train driver of the locomotive 443-06 (which was in the shunting composition) was professionally trained and medically fit to perform the service. The train driver has a License to operate a traction vehicle No. RS 71 2017 0154 issued on 01.01.2017. by the Directorate of Railways with a validity period to 28.08.2022.

Also, data were submitted that show that the railway worker (fatally injured), employed by "Pro Tent"d.o.o. from Obrenovac was professionally trained and medically fit to perform the service.

For the other participants of this serious accident, employed by JP "EPS" Belgrade, Branch TENT from Obrenovac (shunters, train dispatcher for traffic - "OB2" and train dispatcher for unloading - "OB1") data were submitted that show that they were professionally trained and medically fit to perform the service.

From JP "EPS" Belgrade, Branch TENT from Obrenovac, data were submitted that upon request of the responsible person of ŽT on 12.07.2021. at 08:35, breathalyser testing of the train driver, participant in the serious accident in question was performed. The breathalyser was performed with an ethyl meter manufactured by Dräger Safety AG&Co.KgaA, Germany, model Alcotest 6820, serial No. ARNH-0150, for which the AMSS - Center for Motor Vehicles issued a Certificate of Verification of Meters No. EM 58/21-9 from 26.05.2021. The presence of alcohol was not determined at the train driver by breathalyser testing.

Attached to the letter KTR No. 369/21 of 22.12.2021. by OJT in Obrenovac data were submitted that the police officers (traffic patrol) of PS Obrenovac on 12.07.2021. at 11:00, performed breathalyzer testing of the train driver, a participant in the serious accident. The breathalyzer was performed with the breathalyzer "ALCO QUANT", factory No. A 112226 with the Certificate of correctness UV 2021-12-6. The presence of alcohol was not determined at the train driver by breathalyzer testing.

Attached to the Letter KTR No. 369/21 of 22.12.2021. to the OJT in Obrenovac the Autopsy Report and Chemical-Toxicological Analysis on the presence of alcohol and psychoactive substances in the fatally injured person were submitted, in which it was stated that the presence of ethyl alcohol and methyl alcohol, as well as acetone had not been detected.

3.6.3. Design of the equipment that has an influence on the interface between the user and the machine

The station Obrenovac is designed in such a manner that it satisfies all the criteria for safe operation of train and shunting with the speeds prescribed by the Business Order of the station Obrenovac No. 32063/1 of 21.10.2010.

According to the designed state, the Obrenovac station is equipped with an electronic signal box device of the type ESA-11 SB of the manufacturer AŽD Prague, with which from the central position (station signal box) the train dispatcher for traffic - OB2 operates. On SS devices there were no stated malfunctions or irregularities.

In the area of the Obrenovac station, communication between the staff that regulates traffic and other station staff is done by phone via the local TT connection and via radio. No objections or irregularities were registered on the means of communication.

On Arbel type wagons, Faboo series, which were included in the pushed shunting composition, the installation of steps and handrails for the shunter is not constructively envisaged (see point 2.2.2).

By on-site inspection during the investigation, it was found that on neither side at the end of the wagon of individual No. 43 72 6531 314-2, which was at the head of the pushed shunting composition, observed in the direction of movement of the shunting composition, no steps and handrails were installed (see Figure 3.6.3.1).

Also, on-site inspection during the investigation, it was found that on the wagon of individual No. 43 72 6531 238-3, which was included in the shunting composition up to the locomotive, on neither side at the ends of the wagon steps and handrails for the shunter were not installed (see Figure 3.6.3.2.).

On-site inspection during the investigation, on the shunting composition in question on the first wagon to the locomotive of individual No. 43 72 6531 238-3, it was noticed that in the middle of the wagon (between two parts) a cross-connection with steps and access handrails was installed, while on other wagon in the shunting composition of the individual No. 43 72 6531 314-2, there are no such crossings (see Figures 3.6.3.1 and 3.6.3.2).

The appearance of the wagon from the subject shunting composition is shown in Figures 3.6.3.1. and 3.6.3.2.

Figure 3.6.3.1: Appearance of wagon parts of individual No. 43 72 6531 314-2

Figure 3.6.3.2: Appearance of wagon parts of individual No. 43 72 6531 238-3

The locomotive 443-06 is controlled by the driver from the driver cab via the controls designed during the production of the locomotive, or the locomotive can be controlled via TK with the telecontrol device. During the occurrence of the serious accident in question, the locomotive 443-06 was operated by a train driver from the driver cab.

With locomotive 443-06, no objections or irregularities were registered on the control systems and devices.

3.7. Previous accidents of similar character

Based on the data obtained from JP "EPS" Branch TENT from Obrenovac (letter No. 20600-E-03.01-322756/2-2021 from 09.09.2021. and e-mail from the Director of JP "EPS" Branch TENT from Obrenovac from 08.10.2021.) for the period from 01.01.2011. to 12.07.2021., on the industrial railway TENT from Obrenovac, there were a total of 2 (two) accidents, overtakings of a railway vehicle on a worker. An overview of accidents is given in Table 3.7.1.

Table 3.7.1: An overview of accidents occurred from 01.01.2011. to 12.07.2021.

Serial No.	Date	Time	Short description	Cause
1.	20.03.2012.	10:44	At the Tamnava loading station, during the movement of the empty set on the first track, while shunting by pushing with the locomotive 443-07, the shunter was fatally injured.	Coupling of the locomotive and wagon during the movement of the pushed shunting composition.
2.	13.04.2018.	13:30	In the Obrenovac station, on the track of depot number 10d, there was an overtaking of the CEM-7 locomotive on the worker of "Inter-Mehanika" d.o.o. from Skorenovac, who on that occasion suffered severe bodily injuries, from which he died in the hospital on the same day.	No data was provided on the cause of the accident.

In the mentioned accidents, 2 (two) persons were fatally injured (the shunter and the worker of the contractor).

4. Analysis and conclusions

4.1. Final review of the course of events and making conclusion on the event based on the facts determined during investigation and examination

In accordance with the Service Agreement, in JP "EPS" Branch TENT from Obrenovac, registered under No. 12.01.12 from 17.06.2021, and in "Pro Tent"d.o.o. from Obrenovac registered under No. E-78-119/2021 dated 16.06.2021.), on 12.07.2021. the railway worker of "Pro Tent"d.o.o. from Obrenovac performed works on maintenance or cleaning and lubrication of the switch No. 17, on the second track of the Obrenovac station. According to the train dispatcher for unloading - "OB1" in the first statement taken by CINS immediately after the occurrence of the serious accident and on the basis of subsequent hearings of the train dispatcher for unloading - "OB1" and the train dispatcher for traffic - "OB2" conducted on 09.02.2022. in the premises of CINS, they had no information that before the serious accident, the railway worker went to perform work on the second track on switch No. 17 because the railway worker did not inform them.

In the communication between the traffic manager and the train dispatcher for traffic - "OB2", the traffic manager ordered that, in order to prepare for subsequent unloading, to assemble the two wagons that were on the fourth turnout track with the two wagons that were on the second turnout track. On the fourth turnout track there were two Arbel type wagons, Faboo series, individual No. 43 72 6531 238-3 (for repair - missing brake insert in 1-4) and No. 43 72 6531 314-2 (loaded with mud), which were checked with SV-52 leaflets. Two mud-laden wagons were stationed at the other turnout track. Accordingly, the train dispatcher for traffic - "OB2", said to the shunter (the first shunter), who was in the office of the train dispatcher for unloading - "OB1" (the train dispatcher was not in his office at the time), the shunting plan which predicted that the wagons be pulled by the locomotive 443-06 from the fourth turnout track and transferred to the second turnout track.

No written order or schedule of the shunting was issued for the shunting task in question, but all orders were given orally.

In order to perform the planned shunting, locomotive 443-06 was transferred from track 1d to the fourth turnout track, coupled to a gross consisting of two wagons and then a pulled shunting composition was started on the fourth track of Obrenovac station, in the direction from the fourth turnout track to the Obrenovac station exit. After the wagon was pulled out to the station part of the railway track, a pushed shunting composition was started on the second track of the Obrenovac station, in the direction from the exit switches of the Obrenovac station towards the second turnout track.

For shunting drive from the station part of the track to the second turnout track, the said shunting composition was moving as a pushed shunting composition (locomotive 443-06 and 2 (two) wagons of Arbel type, Faboo series), and in accordance with the Shunting Instruction 42 ("Official Gazette ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94), there was a necessary shunting team composed of the locomotive train driver 443-06, one shunter and shunting operator. According to the Business Order of the Obrenovac station No. 32063/1 of 21.10.2010. it has been defined that the train dispatcher is in charge of the shunting operator tasks, but it is not specified which train dispatcher. By analyzing item 9, chapter B Organization of work and manner of performing traffic, part I of the Business Order of the Obrenovac station No. 32063/1 of 21.10.2010. it can be concluded that for the tasks of the shunting operator at the Obrenovac station are regularly in charge of the train dispatcher for traffic - "OB2" who forms the shunting routes by giving commands on the electronic signal box and performs the role of shunting operator.

After the shunter (first shunter) formed the shunting composition on the fourth turnout track (coupled 2 (two) Arbel type wagons, Faboo series for locomotive 443-06), the shunting composition was started unaccompanied by the shunter, so that the complete shunting task, consisting of the driving of the pulled and then the driving of the pushed shunting composition, was performed without the presence of the shunter. Also, taking into account that the shunting route of the pulled and pushed shunting composition predicted crossing the unoccupied level crossing in the station area without traffic provision device, a worker was not hired to perform the function of providing traffic at the level crossing.

A sketch of the serious accident is shown in Figure 4.1.1.

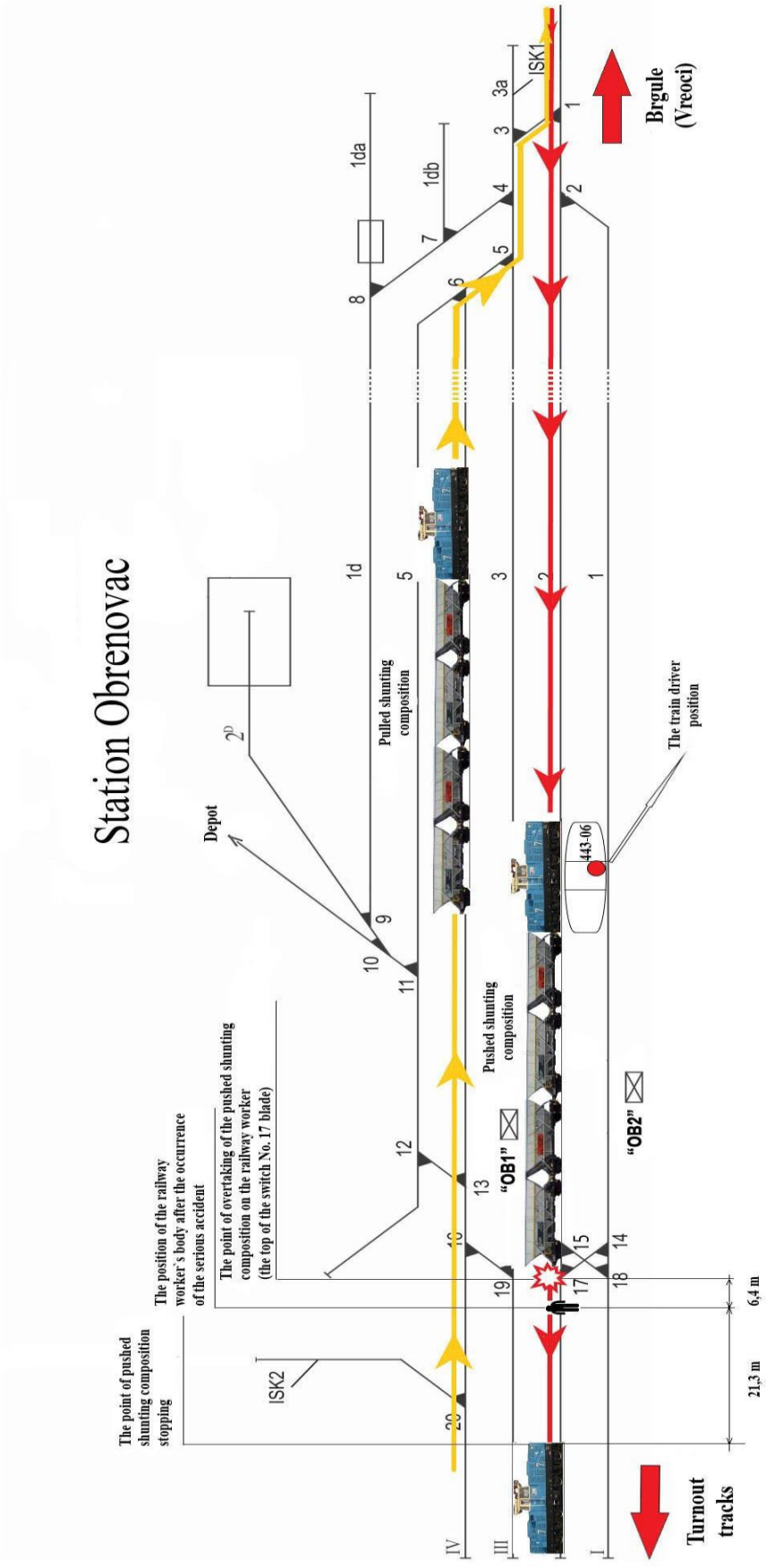

Figure 4.1.1: Sketch of the serious accident

For the execution of the shunting task (shunting drive of the pulled shunting composition and shunting drive of the pushed shunting composition), before the start of the shunting task from the fourth turnout track, by the shunting operator (train dispatcher) and locomotive train driver 443-06, it was not determined whether the conditions were fulfilled in terms of presence of the shunting team. The pulled shunting composition was moving from the direction of the fourth turnout track over the fourth track, towards the exit switches of the Obrenovac station, and for that purpose a locomotive drive was realized without the presence of the shunter, which was not necessary in this case. However, after stopping the pulled shunting composition on the station part of the railway track, due to the execution of the shunting task, it was necessary to realise a shunting drive of the pushed shunting composition over the second track. The presence of the shunter was necessary for that shunting drive, but in the mentioned case the shunter was not present. In the pushed shunting composition, the train driver was in the driver cab of the locomotive 443-06, while the shunting operator and the shunter did not participate in the performance of the shunting drive, ie they were not present at the pushed shunting composition. The shunting operator and the shunter were not even present next to the track in a convenient place from which the shunting drive route can be observed. Having in mind the fact that the shunting drive was performed on the second track, which is in the direction all the way up to the place where the overtaking of the pushed shunting composition into the railway worker occurred, it can be stated that the shunting drive was performed in conditions of limited observation of the driving route. The driving of the pushed shunting composition was performed at a speed lower than the maximum allowed in the area of the Obrenovac station. While driving the pushed shunting composition, the train driver did not notice the railway worker who was cleaning and lubricating the switch No. 17 and who was positioned in the middle of the second station track. Under these conditions, there occurred an overtaking of the pushed shunting composition on the railway worker. The pushed shunting composition, after the collision with the railway worker and crossing the switch No. 17, under the order of the train dispatcher for unloading - “OB1”, who saw the body of the injured worker on the track, stopped in the area of the level crossing near the place of the serious accident.

4.2. Discussion - analysis of the facts established during the investigation and examination with the aim of drawing conclusions regarding the causes of the serious accident and the effect of the rescue services

4.2.1. Analysis of the behaviour of participants of a serious accident

For the execution of the shunting task, ie transferring two wagons from the fourth turnout track and assembling them with the other two wagons on the second turnout track, the train dispatcher for traffic - “OB2” issued an order to the shunter (first shunter) located in the office of the train dispatcher for unloading - “OB1” and with whom he established a telephone connection because the train dispatcher for unloading - “OB1” was not in his office at that time. In addition to the shunter (the first shunter) who received the order, there was another shunter (the second shunter) in the office of the train dispatcher for unloading - “OB1”. After transferring the locomotive 443-06 from track 1d to the fourth turnout track, the first shunter coupled 2 (two) Arbel type wagons, Faboo series for locomotive 443-06, while the second shunter remained in the office of the train dispatcher for unloading - “OB1” of the station Obrenovac.

After forming the shunting composition on the fourth turnout track (coupling 2 (two) Arbel type wagons, Faboo series for locomotive 443-06) and starting it, the shunter (first shunter) returned to the office of the train dispatcher for unloading - “OB1” so that the shunting

composition was started without the attendance of a shunter, which is in accordance with paragraph 1, item 178 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94) because it was a locomotive drive. After the locomotive drive, for the purpose of performing the shunting task, the shunting composition was started from the station part of the track without the attendance of a shunter, which is contrary to paragraph 2, item 178 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94) and point 2.10. of the Business Order of the Obrenovac station No. 32063/1 of 21.10.2010. According to his own statement, the shunter (first shunter) who formed the shunting composition on the fourth turnout track, verbally agreed with the shunter (second shunter) to send the shunter (second shunter) to accompany the shunting composition and to couple the wagon, after the shunting composition arrives on the second turnout track, to the pushed shunting composition for wagons that were already on the second turnout track.

The shunting operator (train dispatcher), before starting the pushed shunting composition, did not make sure if the all conditions for safe execution of the shunting task, ie performing shunting driving of the pushed shunting composition, were met, which is contrary to item 23 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94). The shunting operator (train dispatcher) did not attend the shunting composition, ie he did not take a position from which he could constantly monitor the movement of the pushed shunting composition, which is contrary to items 23 and 116 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94). According to the own statement of the train dispatcher for traffic - "OB2", he is not able to go out of the office and follow the station shunting because due to the nature of the work he has to handle the station signal box. Only through the station signal box he can monitor the execution of shunting routes while he is not visually able because he does not have a good view and overview of the situation from his office. Also, during the shunting of the pushed shunting composition, according to the train dispatcher for unloading - "OB1" statement, he was in his office, and he saw the pushed shunting composition through the window at the moment when the shunting composition was passing by the station facility and already occupied the area of the switch No. 17, where there occurred an overtaking with a railway worker. According to the Business Order of the Obrenovac station No. 32063/1 from 21.10.2010. it was defined that for the tasks of the shunting operator the train dispatcher was in charge, but it was not specified whether it was the dispatcher for traffic - "OB2" or the train dispatcher for unloading - "OB1". By analyzing item 9, chapter B Organization of work and manner of performing traffic, part I of the Business Order of the Obrenovac station No. 32063/1 of 21.10.2010. it can be concluded that for the tasks of the shunting operator at the Obrenovac station the train dispatcher for traffic - "OB2" is in charge, who forms the shunting routes by giving commands on the electronic set and performs the role of shunting operator.

The train driver of the locomotive 443-06 of the pushed shunting composition started the shunting movement, although the conditions for observing the driving route in accordance with item 117 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94) were not provided. Also, during the shunting movement, he did not stop the pushed shunting composition, although he did not have a shunter in his field of vision, nor was the shunting movement ensured by giving aspects of signal or instructions via radio connection by the shunter, which is in contradiction with the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94).

Based on the Report on data processing registered on 12.07.2021. on the registration speedometer of the locomotive 443-06 (letter from JP "EPS" Belgrade, Branch TENT from Obrenovac No. 20600-E-03.01/322756/2-2021 from 09.09.2021), the train driver gave with the locomotive siren an aspect of a signal 67: "Watch out" four times: once, before the departure of

the pushed shunting composition, twice after 190 m and once after 570 m, that is, 220 m before the stopping position.

According to the statement of the railway and railway facilities engineer who is the immediate manager of the fatally injured railway worker (employed in "Pro Tent"d.o.o.), cleaning and lubrication of switches is one of the regular work tasks of the railway worker. Before the occurrence of the serious accident, the railway worker did not contact the immediate supervisor and inform him that he will go to clean and lubricate the switch No. 17, and the immediate supervisor did not issue him any orders or work tasks.

According to the statements of the train dispatcher for traffic - "OB2" and the train dispatcher for unloading - "OB1", on 12.07.2021. the railway worker did not inform them before going to clean and lubricate the switch No. 17 on the second track, which is contrary to Article 12 of the Rulebook on special occupational safety measures in railway traffic ("Official Gazette of SRS", No. 19/85). Also, the train dispatchers did not issue orders to the railway worker regarding the work of cleaning the switches.

At the time of overtaking of the pushed shunting composition on the railway worker, he was inside the second track at the top of the switch No. 17 blades. The fatally injured railway worker was wearing protective equipment (work suit with reflective material, protective shoes and reflective vest) in accordance with the Risk Assessment Act for all workplaces in the work environment of "Pro Tent"d.o.o. No. 25635 of 28.09.2012. The railway worker performed his duties in accordance with the employment contract.

The position and appearance of the railway worker on switch No. 17 immediately before the occurrence of a serious accident are shown in Figure 4.2.1.1.

Figure 4.2.1.1: The position and appearance of the railway worker on the switch No. 17 immediately before the occurrence of a serious accident (source: video surveillance of JP "EPS" Branch TENT from Obrenovac)

At the time of overtaking of the pushed shunting train on the railway worker, he had tools for cleaning and lubricating the switches (metal can with oil, scraper and broom).

The tools for cleaning and lubricating (metal oil can, scraper and broom) found on site after a serious accident are shown in Figure 4.2.1.2.

Figure 4.2.1.2: Tools for cleaning and lubricating the switches

The fatally injured railway worker was informed about the dangers of railway vehicles in motion, which was confirmed in the Records of employees trained for safe work - Form 6 from 15.04.2021., which was submitted in the attachment to the letter No. 20600-E-03.01/322756/2-2021 of 09.09.2021. JP "EPS" Belgrade, Branch TENT from Obrenovac.

There was not a hired worker, by the shunting operator (train dispatcher), to perform the function of providing traffic to an unoccupied level crossing in the station area without a traffic safety device at the road crossing (which is located approximately 20 m away from the place where the shunting composition collided with the railway worker at switch No. 17), which is in contradiction with item 124 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94).

A video recording (video) of the video surveillance camera installed at the Obrenovac station at the facility (station building) where the office of the train dispatcher for unloading - "OB1" is located (see Figure 2.1.1.1), was submitted by the JP "EPS" Branch TENT from Obrenovac. The camera is positioned so that the video shows the space between the facility on which it is placed and the beginning of all four turnout tracks. The direction in which the camera is turned coincides with the direction of movement of the pushed shunting composition that took part in the serious accident in question. The video shows the period from the moment of starting the shunting task on the fourth turnout track to the moment of stopping of the pushed shunting composition on the second turnout track after the occurrence of a serious accident.

The video shows that, after coupling the 443-06 locomotive for two Arbel type, Faboo series wagons on the fourth turnout track, the pulled shunting composition starts and moves to the fourth station track and gets out of the footage frame, and the shunter (first shunter) who has finished the coupling returns in the direction of the station building - "OB1" and enters the building. On the way back to the station facility, the shunter (the first shunter) was moving between the second and third station track and passed a railway worker who was in the area of the switch No. 17. According to the clock of the video, 4 (four) minutes and 54 (fifty four) seconds have passed from the exit from the frame of the pulled shunting composition (which was moving along the fourth track in the direction of exit from the Obrenovac station, ie towards the open track) to the moment of entering the frame of the pushed shunting composition (moving on the second track in the direction of the second turnout track). All the time, the video shows a railway worker who was in the area of the switch No.17 and was doing the cleaning of the switch. In the first part of the specified period of time, the railway worker was facing the place where the camera was installed, and in the second part of the specified period of time he was facing the turnout tracks, ie, with his back turned from the place where the camera was installed, ie turned with back to the oncoming pushed shunting composition. Apart from the railway worker who was always at the switch No. 17 and the shunter (the first shunter) who was returning to the station facility, the video does not show other people who could be said to have performed the duties of a shunter or shunting operator.

The video shows that in the period from the start of the pulled shunting composition from the fourth turnout track to the overtaking of the pushed shunting composition on the railway worker on the second track at the switch No. 17, the coal was unloaded on the first track. Also, in the video, in the frame on the right, you can see the place where the works on the flue gas purification on the plants are done, which is located outside the area of the station.

The layout of the video surveillance sequences is shown in Figure 4.2.1.3. The yellow arrow marks the railway worker who was cleaning the switch No.17, and the blue arrow marks the shunter (first shunter) of the Obrenovac station who coupled the 443-06 locomotive for two Arbel type wagons of Faboo series on the fourth turnout track.

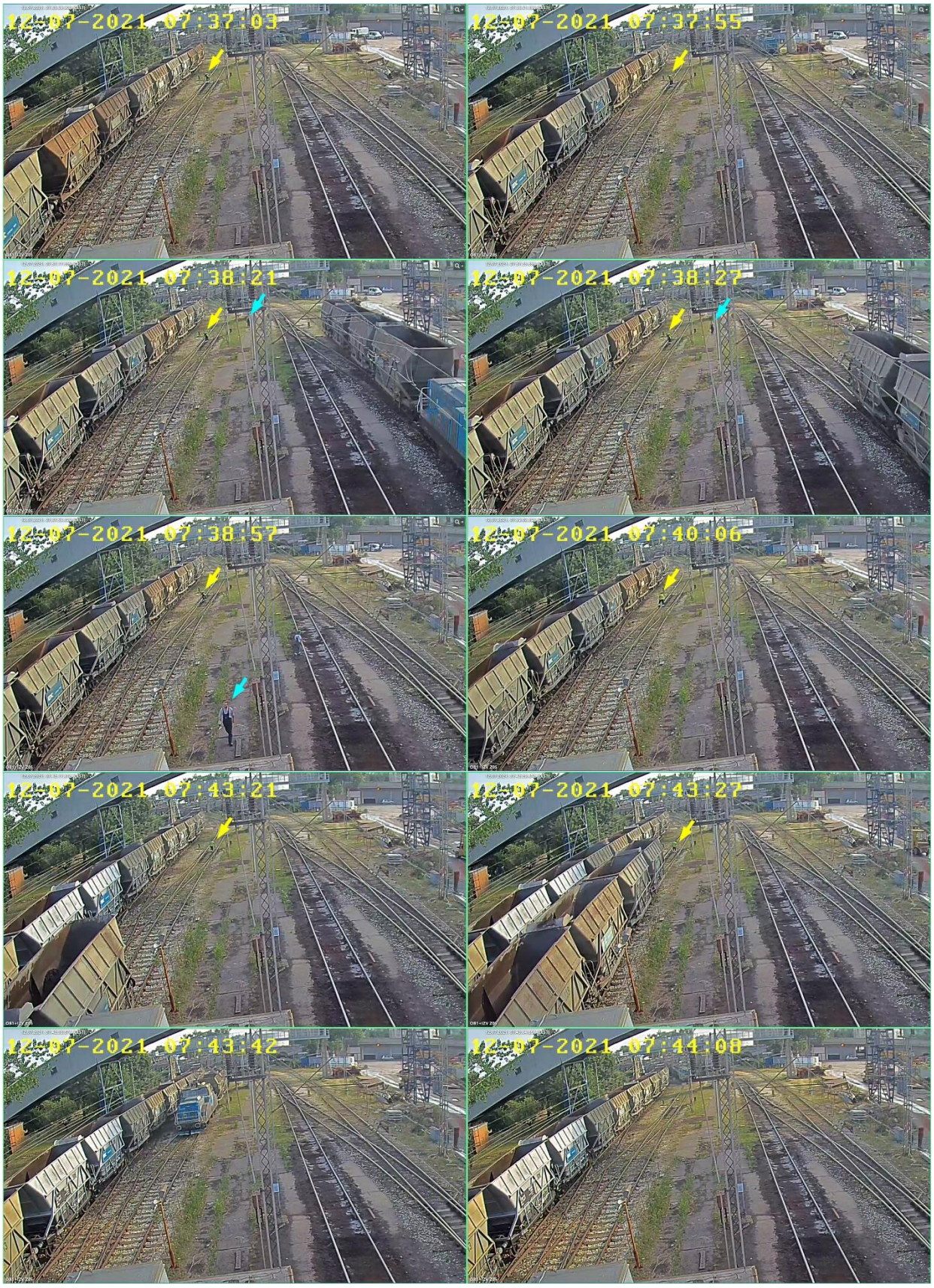

Figure 4.2.1.3: The video surveillance sequences (source: JP "EPS" Branch TENT from Obrenovac)

4.2.2. Analysis of the shunting composition movement

The shunting task during which the serious accident in question occurred at the Obrenovac station consisted of two drives. The first drive was performed by a pulled shunting composition in the direction from the fourth turnout track, through the fourth track, towards the exit switches of the Obrenovac station. Considering that the shunting composition was a pulled composition consisting of a locomotive and 8 (eight) axles of attached wagons, the drive in question can be considered as a locomotive drive, which is performed without an attendant. The second drive was performed by a pushed shunting composition in the direction from the exit switches of the Obrenovac station, through the second track, towards the second turnout track. Since the shunting composition with 8 (eight) axles of attached wagons, in this case was the pushed composition, the drive in question cannot be considered a locomotive drive but a shunting drive and must be performed with an attendant in accordance with paragraph 2, item 178 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94). In the case of occurrence of the serious accident in question, the pushed shunting composition moved without an attendant, which is in contradiction with the previously mentioned item of the bylaw. Also, analyzing the video of the surveillance camera, which is explained in detail in point 4.2.1. it can be stated that at the moment of arrival of the pushed shunting composition through the second track and further toward the second turnout track, in the area in front of the station facility where the office of the train dispatcher for unloading - "OB1" is located, there was no attendant, that is, the shunter who would further follow the movement of the shunting composition and possibly warn the railway worker of the arrival of the pushed shunting composition or the train driver about the railway worker on the track. At the time of occurrence of the serious accident, in the office of the train dispatcher for unloading - "OB1", there were shunter (the first shunter and the second shunter) and the train dispatcher for unloading - "OB1".

Based on the data registered on the registration speedometer of the locomotive 443-06, it can be stated that during the shunting of the pushed shunting composition, when the serious accident occurred, the speed of the shunting composition was, up to the maximum of 17 km/h, which is less than maximum permitted speed (see section 3.3.7).

Having in mind the technical characteristics (see point 2.2.2), of the Arbel type wagons of the Faboo series, the installation of steps and handrails for the shunter is not constructively envisaged. By on-site inspection during the investigation, it was concluded that on neither side at the end of the wagon of individual No. 43 72 6531 314-2, that were at the head of the pushed shunting composition, observed in the direction of movement of the shunting composition, no steps and handrails for the shunter were installed (see point 3.6.3), so there was no possibility for the attendant or shunter to follow the pushed shunting composition. There was a possibility for the attendant or shunter to follow the pulled shunting composition during the shunting drive from the driver cab or from the platform of the locomotive 443-06.

The appearance of the pushed shunting composition observed from the front, that is, the wagon of the individual No. 43 72 6531 314-2 towards the locomotive 443-06, is shown in Figure 4.2.2.1.

Figure 4.2.2.1: Appearance of the pushed shunting composition observed from the front ie the wagon of the individual No. 43 72 6531 314-2 towards the locomotive 443-06

Based on data obtained from JP "EPS", Branch TENT from Obrenovac, in the last five years the average volume of work is 26 376 472 tons of coal per year, and in 2021 the realized volume of work is 24 149 333 tons of coal. Out of that, only in the station Obrenovac in the last five years the average volume of work is 14 426 421 tons of coal per year, and in 2021 the realized volume of work is 14 732 628 tons of coal, which is the majority share (average 54.7% and in 2021, 61%) in the total realized volume of work. If we take into account the fact that of the total inventory of vehicles in the JP "EPS", Branch TENT from Obrenovac, the share of wagons of the Arbel type, series Faboo is 424 cars or 84.8%, we can conclude that a large amount of work in the station Obrenovac that is, shunting work with Arbel type wagons of the Faboo series. Based on the stated scope of work and the established technological process of work, it can be concluded that the realization of shunting drives at speeds up to 5 km/h is difficult.

The installation of steps and handrails for the shunter is not constructively planned on the Arbel type wagons Faboo series, so in cases where the shunting drive must be performed with an attendant and the speeds higher than 5 km/h, it is not planned to act in accordance with paragraph 2, item 178 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94).

Considering that in the JP "EPS", Branch TENT from Obrenovac, Arbel type wagons of Faboo series are mostly represented and a very large volume of work is present, the realization of the shunting drives that must be performed with an attendant is practically impossible, which indicates a threat to railway safety.

4.2.3. Review of rolling stock and rolling stock maintenance documentation

From the data on maintenance of locomotive 443-06 and Arbel type wagons of Faboo series, individual No. 43 72 6531 238-3 and No. 43 72 6531 314-2 submitted by JP "EPS" Belgrade for the period from 12.07.2020. to 12.07.2021. (Annex 2.5, 2.8 and 2.9 of Letter No. 20600-E-03.01/322756/2-2021 of 09.09.2021) it can be stated that seven inspections P1, two inspections P3 and two inspections P6 were performed on locomotive 443-06, and the rest were corrective repairs. In the case of the wagon of the individual No. 43 72 6531 238-3, one preventive and one control inspection were performed in a time interval of six months, while at the wagon of the individual No. 43 72 6531 314-2, one preventive inspection was performed.

Regarding the serious accident in question, regular maintenance of locomotive 443-06 in the period from 12.07.2020. to 12.07.2021. in certain intervals, was performed in accordance with the Instruction for the maintenance of railway rolling stock No. 20600-EOB.01-109728/1-2021 of 27.05.2021. by JP "EPS" Branch TENT. According to the submitted records, two consecutive P6 inspections were performed, on 19.11.2020. and 17.05.2021. while the annual P12 inspection in the observed period was not performed because it is not predicted by the internal act or the Instruction for maintenance of railway rolling stock.

Regular maintenance of wagons of individual No. 43 72 6531 238-3 and No. 43 72 6531 314-2 in the period from 12.07.2020. to 12.07.20201. in certain intervals, was performed in accordance with the Instructions for the maintenance of railway rolling stock No. 20600-EOB.01-109728/1-2021 of 27.05.2021.

According to the data submitted by JP "EPS" Belgrade (Letter No. 20600-E-03.01/322756/2-2021 of 09.09.2021), after the serious accident, a visual inspection of the locomotive 443-06 and wagon of individual No. 43 72 6531 238-3 and No. 43 72 6531 314-2 was performed, no damage was observed. Also, on 13.07.2021., a monthly P1 inspection of locomotive 443-06 and wagon of individual No. 43 72 6531 238-3 was performed, while on 27.07.2021. a monthly inspection of wagon of individual No. 43 72 6531 314-2 was performed. There was no material damage on the locomotive 443-06 and on both wagons.

4.2.4. Conclusion

According to the Swiss Cheese Model, accidents are not just the result of one mistake by one person, but are the result of multiple errors in the business system or organization. Cheese slices represent barriers, that is, protection or defence against the danger of occurrence of an accident, and the holes on them represent the shortcomings of the system, that is, failures in the system, the overlap of which leads to the occurrence of accidents.

Taking into account the available facts described in the analysis in section 4.2.1. and section 4.2.2., the occurrence of the serious accident in question is the result of overlapping of several irregularities in the business system or organization in JP "EPS" Branch TENT, which is shown in Figure 4.2.4.1.

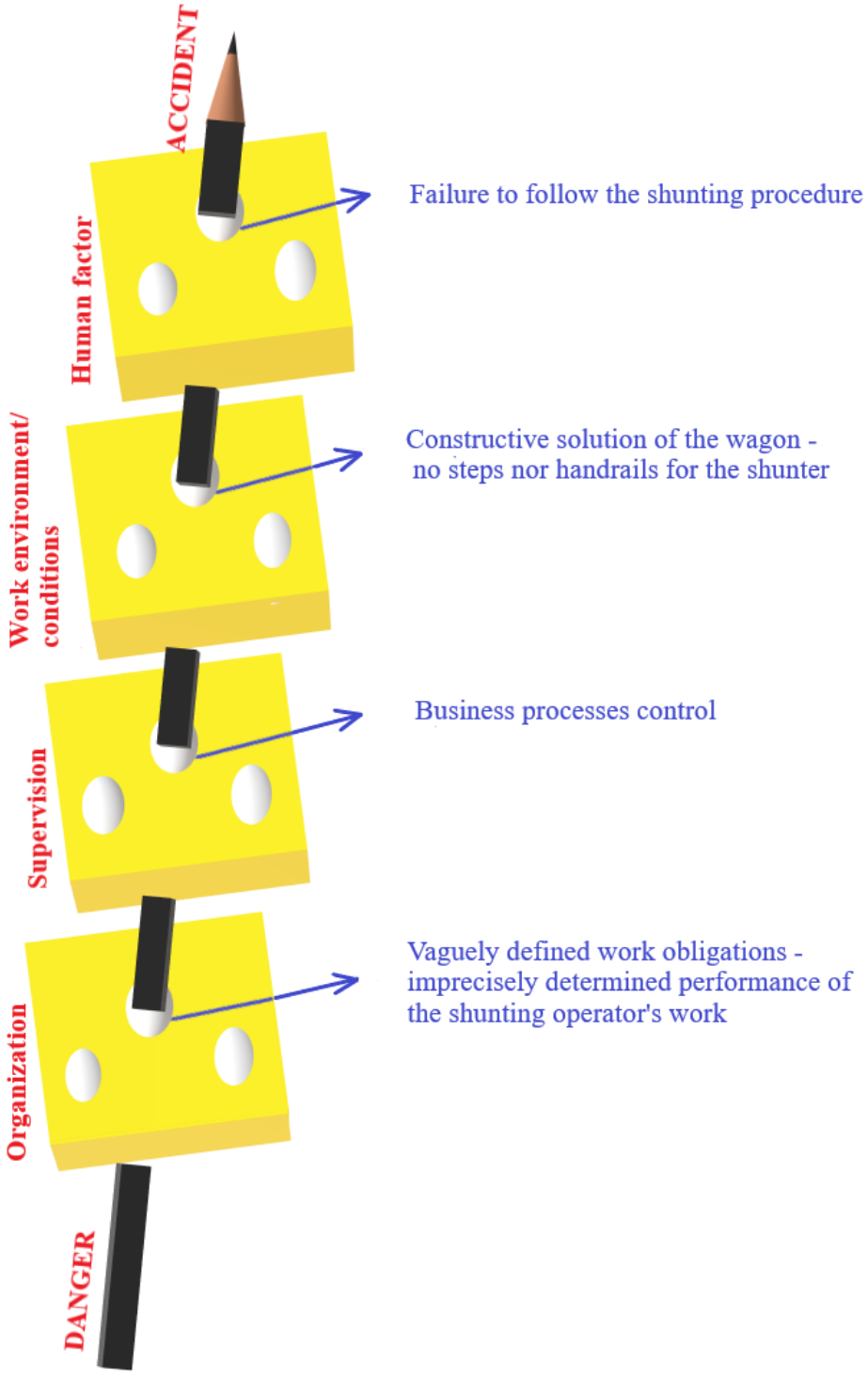

Figure 4.2.4.1: "Swiss Cheese Model" regarding the serious accident in question

4.2.5. Inspection

The Republic Inspector of Occupational Safety at the Ministry of Labor, Employment, Veterans' and Social Affairs, Department of Labor Inspection in the City of Belgrade, conducted an on-site investigation into the injury at work with a fatal outcome.

On the request of CINS No. 340-01-1/2021-02-2-10 of 02.08.2021. as attached to the Letter No. 163-00-2498/2021-04 of 27.08.2021. of the Ministry of Labor, Employment, Veterans' and Social Affairs, Labor Inspectorate, I Department of Labor Inspection in the city of Belgrade, the Record on the performed on-site investigation of the fatal injury at work, No. 163-00-2498/2021-04 of 12.07.2021. was submitted with the statements of eyewitnesses and the responsible worker. Until the conclusion of this report, CINS from the Ministry of Labor, Employment, Veterans' and Social Affairs, Labor Inspectorate in the City of Belgrade did not receive data on inspections in TENT according to the prescribed deadlines for supervision, as well as data on the type of supervision.

4.3. Conclusions on the serious accident causes

4.3.1. Direct and immediate serious accident causes

The direct and immediate cause of the serious accident is that the railway worker, employed in “Pro Tent”d.o.o. from Obrenovac was located on the second track of Obrenovac station in the area of the switch No. 17, performing cleaning of switches at the time of the pushed shunting composition arrival, which is contrary to Article 12, paragraph 1 and Article 16, paragraph 1 under 1 of the Rulebook on special occupational safety measures in railway traffic (“Official Gazette of SRS”, No. 19/85), which created a dangerous situation related to the occurrence of this serious accident.

4.3.2. Basic causes deriving from the skills, procedures and maintenance

The pushed shunting composition (locomotive 443-06 and 2 (two) Arbel type wagons of Faboo series) was moving on a second station track towards the second turnout track. The pushed shunting composition was occupied only with the train driver while the shunting operator and the shunter were not on the shunting composition nor next to the track near the shunting composition, so that the observation of driving route of the pushed shunting composition on the track in direction was done only by the train driver, which is in contradiction with the items 116 and 117 of the Shunting Instruction 42 (“Official Gazette of ZJŽ” No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94). Having in mind the position of the train driver in the driver cab of the locomotive 443-06 in the pushed shunting composition and the fact that the second track is in the direction, observation of the driving route of the pushed shunting composition done only by the train driver, influenced that the train driver does not spot the railway worker, who during the approach of the pushed shunting composition, was positioned in the middle of the second track at the switch No. 17. The fact that Arbel type wagons of the Faboo series do not constructively plan the installation of steps and handrails for an attendant to observe the shunting route from the front of the pushed shunting composition, could have contributed to the occurrence of the serious accident in question.

Railway worker employed by “Pro Tent”d.o.o. from Obrenovac was located in the area of the switch No. 17 in the profile (inside) of the second station track immediately before the occurrence

of the serious accident, that is, immediately before the shunting composition arrival, performing the task of cleaning the switches, although he was acquainted, from the employer "Pro Tent"d.o.o. from Obrenovac, with the dangers of means of railway traffic. Also, before going on the track, ie before starting the tasks on cleaning the switch No. 17, he did not receive approval for the mentioned tasks from the train dispatcher of the Obrenovac station, which is contrary to Article 12, paragraph 1 of the Rulebook on special occupational safety measures in railway traffic ("Official Gazette of RS", No. 19/85).

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

In the Business Order of the Obrenovac station No. 32063/1 of 21.10.2010., Part I, Chapter B: Organization of work and manner of performing traffic, item 2 Duties of employees at workplaces, under 2.5: Duties of train dispatchers, not for one of the three work positions of train dispatchers in Obrenovac station, the obligation of performing the duties of a shunting operator is not precisely stated.

Also, in item 9: Manner of communication during the formation of shunting routes, Chapter B: Organization of work and manner of performing traffic, Part I of the Business Order of Obrenovac station No. 32063/1 of 21.10.2010. it is defined that the shunting routes on the main tracks of the Obrenovac station are formed by the train dispatcher by giving commands on the electronic signal box. The role of the shunting operator during shunting is performed by the train dispatcher and he informs the shunting staff about all planned shunting drives.

Based on the above, it can be stated that in the Business Order of the Obrenovac station No. 32063/1 of 21.10. 2010., it is not precisely and clearly determined which of the three existing train dispatchers has the obligation to perform the duties of the shunting operator. In item 9, the same paragraph defines the obligation of the train dispatcher to form shunting routes on the electronic signal box and to perform the duties of the shunting operator, which points to the conclusion that the train dispatcher is in charge of performing the shunting operator's duties. Due to the nature of work of the train dispatcher (traffic regulation work, including the handling of electronic set) and his place of work, it is impossible to simultaneously perform the mentioned tasks in the office of the train dispatcher on traffic affairs and perform the duties of the shunting operator as part of shunting tasks.

Inaccuracy in defining which train dispatcher performs the duty of the shunting operator in the prescribed procedure in the Business Order of the Obrenovac station No. 32063/1 of 21.10.2010. could have influenced the fact that the shunting operator was not present during the shunting with the pushed shunting composition.

4.3.4. Additional remarks on the shortcomings and flaws identified during the investigation, but not relevant to the conclusions on the causes

While performing shunting drives of the pulled shunting composition through the fourth track and pushed shunting composition through the second track, the level crossing in the station area via the turnout tracks No. I, II, III and IV at km 0+041, which does not have devices to provide traffic at the level crossing, was not occupied by a worker who would provide traffic at the level crossing in question, in accordance with item 124 of the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94).

In the valid Business Order of the Obrenovac Station No. 32063/1 of 21.10.2010. part I, chapter B: Organization of work and manner of performing traffic, item 15: Speed of driving, in paragraph 4, it is stated that the speed of shunting compositions over the switch area of the main tracks must not exceed 30 km/h, except in the case when there is a shunter on the front side step - then the speed must not exceed 20 km/h. From this expression, it is not clear whether this speed applies only to the switch area or also to the main tracks. If it refers only to the switch area, then the speed of the shunting in the Obrenovac station is not fully defined in the Business Order of the station. Also, in paragraph 8 (last paragraph) it is stated that the driving speed of pushed shunting compositions must not exceed 25 km/h, which is contrary to the statements in paragraph 4. According to the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94) on each pushed shunting composition during moving at a speed higher than 5 km/h, there must be a shunter at the head of the train, on the front side step, observing the driving route.

5. Measures taken

After the occurrence of the serious accident in question, JP "EPS", Branch TENT from Obrenovac, based on the proposed measure from the Report on the investigation of the accident No.20600-E.03.01-324733/1-2021 of 12.08.2021. organized an extraordinary training of employed railway workers, hired by "Pro Tent"d.o.o. from Obrenovac, who perform the tasks on the railway maintenance and cleaning the switches. Extraordinary training was performed on 24.09.2021. on the topics of: provisions on personal safety protection on the industrial railway of TENT; Business Orders of Obrenovac, Vorbis, Stubline, Brgule, Tamnava and Vreoci stations; the duties of the switches cleaners in each station according to the station's Business Order; cleaning and checking the switches in winter conditions.

After the occurrence of the serious accident, JP "EPS", Branch TENT from Obrenovac passed the Instruction on cleaning the switches in ŽT of Branch TENT, Obrenovac No. 2460500-E.03.01-14705/1-2022 of 11.1.2022. which is an integral part of all Business Orders of stations on the industrial railway of TENT. JP "EPS", Branch TENT from Obrenovac has, in the period from 05.02.2022. to 04.03.2022, acquainted employees (train dispatchers - TK dispatchers, train dispatchers, shunters and switches cleaners) with the provisions of this Instruction.

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_06/22, SR_07/22 and SR_08/22 are issued:

SR_06/22 JP "EPS" Branch TENT from Obrenovac, to perform extraordinary training of the shunting staff (train driver, shunting operator and the shunter) in terms of proper execution of the shunting tasks, with special reference to the conditions for safe start and movement of the shunting composition, the position of the shunter and the shunting operator when driving the shunting composition, in accordance with the items 23, 116 and 117 of the Shunting Instruction 42 ("Official Gazette ZJŽ", No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94), that is, the Article 75 of the Traffic Rulebook ("Official Gazette RS", No.34/22) (see sections 3.3.5, 3.3.9, 4.1 and 4.2.1).

SR_07/22 JP "EPS" Branch TENT from Obrenovac, to amend the Business Order of Obrenovac station, and to precisely define which employees at which work positions are obliged to perform the duties of shunting operator (such as: train dispatcher for unloading - "OB2", train dispatcher for unloading - "OB1", separate shunting operator or the shunter who performs the duties of the shunting operator) with special reference to the scope of work and in accordance with the Shunting Instruction 42 ("Official Gazette ZJŽ", No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94), that is, the Traffic Rulebook ("Official Gazette RS", No.34/22) (see sections 3.3.5, 3.3.9, 4.1, 4.2.1. and 4.2.2.).

SR_08/22 JP "EPS" Branch TENT from Obrenovac, to consider the possibility of a constructive solution for the installation of steps and handrails on the front sides of the wagon type Arbel of series Faboo, for safe stay of train attendants during shunting drives (see sections 2.2.2, 3.6.3. and 4.2.2.) or to apply other measures in order to perform shunting drives with attendants in accordance with the Shunting Instruction 42 ("Official Gazette of ZJŽ" No. 3/80, 6/83, 3/87, 4/88, 6/91 and 2/94) that is, the Traffic Rulebook ("Official Gazette of RS" No. 34/22).