



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

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FINAL REPORT ON SERIOUS ACCIDENT INVESTIGATION

Type of accident: Serious accident at level crossing
Train No: 4905
Place: Brestovac, area of the swith block of station Brestovac
Date: 21 August 2017
Time: 19:38



This report presents the results of investigation of serious accident, overtaking of the train No. 4905 on the passenger vehicle, occurred on 21 August 2017 at 19:38 at the main arterial route E70/E85 Belgrade- Mladenovac-Lapovo-Niš-Preševo-state border -Tabnovce, on level crossing PBE 1, ensured by the automatic devices on the crossings (road half-barriers and the light and sound signals), which is located in the area of the switch unit 2 for the unmanned TK station Brestovac.

Director of the Center for Investigation of Accidents in Transport of the Republic of Serbia established the Working Group for the investigation of this accident by the Decision 33 No. 340-8226/2017-8 of 5 September 2017.

In accordance with the Article 33 of the Law on Investigation of Air, Rail and Water Traffic Accidents (*“Official Gazette of the RS” No. 66/15*) and the Article 23 of the Directive 2004/49/EC of the European Parliament and of the Council, Center for Investigation of Accidents in Transport drafted and published the Final Report.

In this report, all sizes and measurements are expressed in accordance with 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 Air, Rail and Water Traffic Accidents (*“Official Gazette of the 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.

Department for investigations of railway traffic accidents and international cooperation carries out tasks within the competence of the Centre for investigation of accidents in traffic in relation to rail traffic with the aim of possible improvement of safety on the railways by issuing safety recommendations. The investigation procedure in the field of railway traffic is conducted on the basis of the provisions of the Law on Investigation of Air, Rail and Water Traffic Accidents (*“Official Gazette of the RS” No. 66/15*).

CINS conducts investigations after 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	.....	Centre for Investigation of Accidents in Transport
IŽS	.....	Serbian Railways Infrastructure
RS	.....	Republic of Serbia
a.d.	.....	Join Stock Company
OJ	.....	Organisational Unit
SS	.....	Signalling System
APB	.....	Automatic Block
TT	.....	Telephone-Telegraph
TK	.....	Tele-command
RDV	.....	Ground-train radio link
MUP	.....	Ministry of Interior
OJT	.....	Basic Public Prosecutor
ETP	.....	Electro-technical affairs
US	.....	The Constitutional Court



CONTENTS:

1. SUMMARY.....	7
1.1. Short description of the accident.....	7
1.1. The causes of the accident determined by the investigation	7
1.2. Main recommendations and information on subjects to which the report is submitted.....	7
2. DIRECT FACTS ABOUT THE ACCIDENT	8
2.1. Basic accident data.....	8
2.1.1. Date, time and place of the accident	8
2.1.2. Description of the accident and the accident site and work of rescue and emergency services	8
2.1.3. Decision to launch the investigation, composition of the investigation team and conducting of the investigation	9
2.2. Accident background	9
2.2.1. Involved railway staff, contractors, other persons and witnesses	9
2.2.2. Train and road vehicle involved in the accident and train composition.....	10
2.2.3. Infrastructure and signalling system	10
2.2.4. Communication tools	12
2.2.5. Works at or near the accident site	12
2.2.6. Activation of the emergency plan for railways and the sequence of events	12
2.2.7. Activation of the emergency plans of public rescue services, police and medical services and sequence of events.....	13
2.3. Dead, injured and material damage.....	13
2.3.1. Passengers, third parties and railway staff, including contractors	13
2.3.2. Goods, luggage and other assets	14
2.3.3. Railway cars, infrastructure and environment.....	14
2.3.4. External conditions – weather conditions and geographic characteristics	14
3. MINUTES ON THE INVESTIGATION AND INTERVIEWS	15
3.1. Summary of the testimonies.....	15
3.1.1. Railway staff	15
3.1.2. Other witnesses	16
3.2. Safety Management System.....	16
3.2.1. Organisational frame and manner of issuing and executing orders	16
3.2.2. Requirements that must be fulfilled by railway staff and the way they are applied	17
3.2.3. Procedures for internal audits and controls and their results.....	17
3.3. Relevant international and national regulations	17
3.3.1. Law on Railway Safety on the Roads (“Official Gazette RS“ No 41/2009, 53/2010, 101/2011, 32/2013 - decision of US, 55/2014, 96/2015 - other law and 9/2016 - decision of US).....	17
3.3.2. Law on Railway Safety and Interoperability („Official Gazette of RS“ No. 104/2013, 66/2015 – other laws and 92/2015)	18



3.3.3. Rulebook on the manner of crossing the railway and road, pedestrian or bicycle path, the point where the intersection can be done and the measures to secure the safe traffic („Official Gazette of RS“ No. 89/2016).....	18
3.4. Functioning of railway vehicles and technical installations.....	19
3.4.1. Control, command and signalling	19
3.4.2. Infrastructure	20
3.4.3. Means of communication	20
3.4.4. Railway vehicles	20
3.5. Traffic operation and management	21
3.5.1. Actions taken by the staff that manages traffic regulation, control and signaling	21
3.5.2. Exchange of voice messages in relation to the accident	21
3.5.3. Measures taken to protect and secure the place of accident.....	21
3.6. Interface between man, machine and organisation	22
3.6.1. Working hours of the staff involved	22
3.6.2. Health-related and personal circumstances that have effects on the accident, including the presence of physical or mental stress	22
3.6.3. Design of the equipment that has influence on the interface between user and machine	22
3.7. Previous accidents of similar nature	23
4. ANALYSIS AND CONCLUSIONS.....	23
4.1. Final review of the course of events and adoption of conclusions about the occurrence based on facts determined during the investigation and interviews	23
4.2. Discussion - Analysis of facts determined during the investigation with the purpose of drawing conclusions about the accident causes and the effect of the Emergency services.....	24
4.2.1. Analyses of moving of train and road vehicle.....	24
4.2.2. Analysis of the level crossing device	24
4.2.3. Analysis of the effect of work of Emergency Service.....	25
4.3. Conclusions.....	26
4.3.1. Direct and immediate causes of serious accident.....	26
4.3.2. Basic causes resulting from skills, procedures and maintenance	26
4.3.3. Main causes based on the requirements defined in the legal framework and the application of the safety management systems	26
There are no main causes.	26
5. MEASURES TAKEN	26
6. SAFETY RECOMMENDATIONS	26



1. Summary

1.1. Short description of the accident

On 21 August 2017 at 19:38 at the *km 268+318* of the main arterial route *E 70/E 85*: Belgrade - Mladenovac -Lapovo - Niš - Preševo - state border - (Tabanovce), at level crossing PBE 1, secured with automatic devices on the crossings (half-barriers and road light and sound signaling), which is located in the area of the switch block 2 of unmanned TK station Brestovac (between entrance signal from the direction of crossing Pečenjevce and first entrance switch), there was an overtaking of the train No. 4905 on the road vehicle brand Ford type Galaxy, registration number NI 161-CL.

1.1. The causes of the accident determined by the investigation

The immediate cause of the serious accident is that the road vehicle entered on the track immediately before the arrival of the train, which caused very dangerous situation related to the creation of this serious accident. The hazardous situation occurred due to the fact that the road vehicle toured half-barriers which have been suspended. The main cause is non-compliance with the Law on Traffic Safety on the roads (*“Official Gazette RS“ No 41/2009, 53/2010, 101/2011, 32/2013 - decision of US, 55/2014, 96/2015 - other law and 9/2016 - decision of US*) by the driver of the road vehicle.

1.2. Main recommendations and information on subjects to which the report is submitted

Aiming to achieve the possible improvement of railway safety and to prevent occurrence of new accidents, CINS issued the following safety recommendations:

Road Traffic Safety Agency RS:

SR_08/18 Considering that the inadequate behaviour of the drivers of road vehicles became very common during the transition over tracks in the sense of non-compliance with the Law on Traffic Safety on the roads (*“Official Gazette RS“ No 41/2009, 53/2010, 101/2011, 32/2013 - decision of US, 55/2014, 96/2015 - other law and 9/2016 - decision of US*), it is necessary that the Road Traffic Safety Agency investigates in detail various forms of behaviour, the causes of this behaviour and suggests measures that would contribute to rising the level of safety.

2. Direct facts about the accident

2.1. Basic accident data

2.1.1. Date, time and place of the accident

The serious accident occurred on 21 August 2017 at 19:38 on the area of populated place Brestovac, on the main arterial route *E 70/E 85*: Belgrade - Mladenovac - Niš - Preševo - state border - (Tabanovce), in unmanned TK station Brestovac, at *km 268+318*, on the level crossing secured with automatic devices on the crossings.

Perspective of the place of the accident is shown in the Fig. 2.1.1.1.



Fig. 2.1.1.1: Map of the accident site area (Google maps)

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

Crossing PBE 1 is located in the area of the switch block 2 of unmanned TK station Brestovac, between the last switch and entrance signal from the direction of crossing Pečenjevce. It is secured with automatic devices on the crossings (crossing half-barriers and road light and sound signaling).

Road passenger vehicle of the brand Ford type Galaxy, registration number NI 161-CL was moving the state road IIA order mark 225: Gadžin han - Brestovac - Bojnik - Lebane in the direction to centre of Brestovac and in the area of crossing has entered the profile of the track just before the arrival of the train.

Train No. 4905 was moving towards the arterial route *E 70/E 85*: Belgrade - Mladenovac - Niš - Preševo - state - border (Tabanovce), from the direction of station Doljevac to the direction of crossing Pečenjevce. The train operated regularly on the route Niš - Preševo. Viewed from the direction of movement, the train consisted of: locomotive 441-707 and two wagons of series Bt (wagon No. 50 72 2076 008-0 and No. 50 72 2076 010-6). After being at the station Brestovac because of the needs of the passengers, train No. 4905 was launched from 3rd main running track in the direction towards the junction Pečenjevce. After the transition of the train to the



output of the switch region, on encounter of the crossing PBE 1, there has been an overtaking of the train on the road passenger vehicle, that immediately prior to the arrival of the train has entered into the profile of the railroad. Overtaking occurred so that the right part of the forehead of train locomotive struck the left port side of the road vehicle (as seen in the direction of the train or road vehicle movement).

After overtaking, the train continued moving at length of 66m, after which it stopped, so that the forehead of locomotive was found at *km* 268+384. On that occasion, the train was pushing the road vehicle ahead at a distance of about 10 m, after which the vehicle is rejected outside track to the right, as viewed in the direction of the train movement.

At the moment of serious accident there were about 40 passengers in the train.

In this accident, one person is killed, and four are injured (two seriously, and two lightly). All the persons were inside the road vehicle.

On site of the accident came out members of Police from the Police Administration Leskovac, duty prosecutor of OJT Leskovac and Emergency Medical Service Team of the Health Center Leskovac.

Due to the aforementioned serious accident, there was an interruption of traffic between station Brestovac and crossing Pečenjevce. The interruption of traffic lasted until 23:30, when it was normalized.

2.1.3. Decision to launch the investigation, composition of the investigation team and conducting of the investigation

The main investigator for railway traffic received the first notification on the serious accident at 19:59 by phone from Assistant Director of the Sector for operations of "IŽS" a.d. Additional notification on the accident, with data on dead and injured, the main investigator for railway traffic received at 21:27. Based on the information and facts received, the main investigator concluded by additional visit to the place of the serious accident, CINS launched the investigation of the serious accident in accordance with the Law on Investigation of Air, Rail and Water Traffic Accidents (*"Official Gazette of the RS" No. 66/15*).

Composition of the working group for the serious accident investigation was determined by the Decision 33 No. 340-8226/2017-8 of the Director of CINS, from 5 September 2017 and according to articles 6 and 32 of the Law on Investigation of Air, Rail and Water Traffic Accidents (*"Official Gazette of the RS" No. 66/15*).

2.2. Accident background

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

Train driver and conductor of the train No. 4905, employed at railway undertaking "Srbija Voz" a.d., train driver at the Section for Traction Niš, OJ for Traction Niš and conductors at Section for Traffic-commercial affairs Niš are involved in the serious accident.

Five other persons were involved at the accident, driver of the road vehicle of brand Ford type Galaxy, registration number NI 161-CL, person who was the co-driver and three persons who were at the back seat of the road passenger vehicle.



Staff of the railway infrastructure manager “IŽS” a.d. were not involved in the respective accident.

2.2.2. Train and road vehicle involved in the accident and train composition

The train No. 4095 and road passenger vehicle brand Ford type Galaxy, registration number NI 161-CL participated in the accident.

The train, viewed from the direction of movement, consisted of: locomotive 441-707 and two wagons of series Bt (wagon No. 50 72 2076 008-0 and No. 50 72 2076 010-6).

Road passenger vehicle of brand Ford type Galaxy is multipurpose passenger vehicle with flexible interior (multi purpose vehicle - MPV) for transport of persons and goods, of approximate dimensions: length 4,6 m, width 1,8 m and height 1,7 m.

2.2.3. Infrastructure and signalling system

Arterial route *E 70/E 85*: Belgrade - Mladenovac- Niš - Preševo - state border - (Tabanovce) between stations Niš and Preševo is a onetrack line. The speed at the section between station Niš and crossing Vinarci, according to the timetable booklet 9.3, is 70 km/h. At the area of station Brestovac, over crossing area the straight line speed is 50 km/h, and in turn is 40 km/h.

Part of the section between stations Medurovo and Preševo is equipped with APB devices, which is set on the devices TK at TK centre Niš at which the traffic of the trains is regulated in block sections.

For the purpose of the traffic regulation, on the section of the railway line between the station Medjurovo and Preševo, spatial and protective signals that show two-way signs were installed.

Road crossing at the level PBE 1 at the km 268+318 (mileage according to the data provided by the service of construction activity) represents the point of crossing of arterial route *E 70/E 85* and state road IIA order mark 225. (mark for the line is taken from the Regulation on the categorization of lines, mark of the path is taken from the Regulation of the categorization of State Road).

Crossing of state road and railway is built at the level, at the angle of 90°.

Near the crossing PBE 1, viewed from the settlement Kutleš to the centre of Brestovac, on the left side, uncategorized road joins the state road, which at length is laid 150 m parallel to the railway.

Near the crossing, roads at the state and uncategorized road were asphalted. The state of the road is neat, without damages. On the crossing on the road, wooden sleepers have been installed. The state of the wooden sleepers is neat, without damages.

At the crossing over the railway, on the road, at both sides of the railway half-barriers have been installed. The length of half-barrier is 3,77 m, which equals half of the width of the road at the aforementioned state road.

At the state road, from the direction of Brestovac, before coming across the road crossing, traffic signs have been placed I-35: “Coming near the point of crossing of the road and the

railway“, I-32: “Crossing of the road and railway with barriers and half-barriers“, II-2: “Obligation of stopping“, I-34: “Andreja’s cross“ and one traffic light for regulating the crossing of the road over the railway at the same level (VI-9).

From the direction of the settlement Kutleš, before coming to the crossing, the traffic signs have been placed II-2: “Obligation of stopping“, I-34: “Andreja’s cross“ and the two traffic lights for regulating the crossing of the road over the railway at the same level (VI-9), one was placed so that it is visible from the state road, and the other is visible from the unactegorized road. Before coming to the crossing from the direction Kuttleš, there haven't been noticed traffic signs I-35: „Coming near the point of crossing of the road and the railway“ and I-32: „Crossing of the road and railway with barriers and half-barriers“.

On the aforementioned road, at the both sides of the railway, at the middle of the road there exists partial unbroken line. There aren't any other signs on the road (longitudinal, transversal and other).

The view of the crossing is given in the fig. 2.2.3.1. и 2.2.3.2.



Fig. 2.2.3.1: The view of the crossing (from the direction Brestovac)



Fig. 2.2.3.2: The view of the crossing (from the direction Kutleš)

According to the data of Section for ETP Niš, „IZS“a.d., crossing PBE 1 at km 268+293 is an automatic crossing equipped with the device of the brand „Siemens“. The device was put into operation on 20 February 1980. It is located in the station area, between entrance signal and the switch area. At the crossing, half-barriers and road sound and light signalization was installed. Activation of the crossing is done by turning on and off of the train when coming to switching points. There is a possibility of turning on/off by using the push-button TUPP/TIPP. Switching on points are located at km 267+212 (HR.S K1/11E1 from the direction of the station Doljevac) and at km 269+398 (P K2/K12E1 from the direction of Pečenjevce). Switching off point K3/K13 is located at the zone of the crossing.

Mileage of the crossing PBE 1 of construction affairs (km 268+318) and ETP (km 268+293) differs for 25 m.



2.2.4. Communication tools

On the section between the station Doljevac and Pečenjevce, communication between personnel in charge of traffic regulation and the personnel in traction vehicles is performed by phone via local TT connection. The line of communication includes all official locations on the line and telephones alongside all the main signals and TK dispatch at the position TK "Jug" at TK centre Niš. Communication on this line is recorded on the register device located in the ETP Section Niš, so this type of communication is considered as evidence-based communication.

This line is equipped with RDV devices, which are working and which enables the communication between the personnel in locomotive and TK Dispatcher. Communication performed by the RDV is recorded on the register device situated in TT section Niš, so this type of communication is considered as evidence-based communication.

For communication at TT Centre Niš, at the position of Senior Dispatcher, the stable line is working, which is connected on registerphone device which is at the ETP Section Niš, so this type of communication is considered as evidence-based communication.

2.2.5. Works at or near the accident site

No works were performed near the serious accident site.

2.2.6. Activation of the emergency plan for railways and the sequence of events

All concerned parties were informed of this serious accident, according to the regulation. Infrastructure Manager "IŽS"a.d. informed CINS, i.e., the Main investigator for railway traffic. The Railway Infrastructure Manager "IŽS"a.d and railway undertaking "Srbija Voz"a.d, established a joint investigation committee that conducted an investigation of the accident in accordance with applicable regulations. Upon completion of the investigation, the Investigation Report U-377/17 was drafted.

Given the fact that at the moment of the serious accident in the train there were 40 passengers present, conductor have immediately given them information on the new occasion. Three of the passengers have decided to remain in the train while the other passengers according to the instruction of conductor have safely left the train at the back door of the last car, from the direction of train movement and headed to the near bus station.

After on-site investigation, the train No. 4905 is by means of the additional locomotive 441-710 returned to the station Brestovac at 23:40, where from the train there was an uncoupling damaged locomotive 441-707 and left on the 3th track, after which the train number 4905, by additional locomotive, was returned to the station Doljevac, where it came at 23:54. After turning the locomotive 441-710, the train No. 4905 is launched from the station Doljevac 22 August 2017 at 00:13 for the station Preševo. Given that the damaged locomotive 441-707 at the station Brestovac was left on the third track, by enabling the crossing No. 6 at the station Brestovac, the traffic of trains was enabled through the 2. track.



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

Due to this serious accident, members of the Police Station Leskovac were hired, OJT Leksovac and Emergency service of the Health Centre Leskovac.

Emergency service of the Health Centre Leskovac was informed via stable telephone line from the members of the Police Station. A minute after the given notification, two vehicles headed onsite and two teams of the Emergency Service, that consisted of a doctor, a nurse and a driver. Until arrival at the scene of the accident 18 minutes have passed (due to the distance), the vehicles were driving the maximum safe speed, with the use of light and sound alarms.

A quick triage of five injured persons was done onsite, one of which was already dead. The four of them were taken care of on site according to the protocols, two of them were transferred to Clinical Centre Niš, Clinic for Surgery, and the other two were transferred to Emergency Service of General Hospital Leskovac.

Immediately after notification from the traffic police servant of MUP of Police Station Leskovac that there has been an accident- collision of road vehicle and train at the crossing in Brestovac, Deputy Public Prosecutor OJT Leskovac came on site on 21 August 2017. He arrived on site at 20:45 when the investigation has started.

The site, before the arrival of Deputy Public Prosecutor, was secured with police officers of MUP Leskovac. The site was secured by placing cones and official patrol vehicle on which flash lights were switched on.

Present police officers, by order of the Deputy OJT Leskovac, photographed and sketched the site, which was the base for Criminal Technical documentation which will be the integral part of Record of investigation of site OJT Leskovac. Criminal Technical documentation wasn't delivered to CINS.

During the investigation, on the railway crossing the traffic was stopped. The investigation was finished at 22:00.

2.3. Dead, injured and material damage

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

In this serious accident one person was killed and four were injured (two seriously and two lightly). Dead person and injured persons were in a road passenger vehicle.

Killed person was a co-driver in a vehicle. The autopsy concluded that at the time of death the body was in a state of acute alcohol intoxication of the level of drunkenness (chemical-toxicological analysis of sample of blood proved the presence of ethil-alcohol at a concentration of 2,18‰, and in the sample of urin the presence of ethil-alcohol was 3,20‰).

Among passengers and train staff there were no injured or dead.

Table 2.3.1.1: Review of dead and injured persons

	Passangers	Railway staff	Third parties	Summary
Dead	-	-	1	1
Seriously injured	-	-	2	2
Lightly injured	-	-	2	2



2.3.2. Goods, luggage and other assets

In this serious accident there was no damage to goods, luggage and other property.

There are damages on the road vehicle. In the Record of site investigation, delivered to OJT Leskovac, it is stated that the road vehicle was completely damaged, body totally damaged, but was not given the assessment of material damage.

2.3.3. Railway cars, infrastructure and environment

In the accident the railway vehicles (locomotive 441-707) and installations on infrastructure were damaged.

The structure of the material damage is as follows:

Concerning locomotive 441-707:	500 000,00	RSD
Concerning SS devices:	338 020,56	RSD
Total direct material damage:	838 020,56	RSD

The damage is stated in the official currency of the Republic of Serbia (Dinar - RSD).

According to the official middle exchange rate of the National Bank of Serbia on 21 August 2017, which is 1 EUR (Euro) = 119,4050 RSD (Dinara), the total material damage caused in the respective serious accident amounts to 7 018,30 Euro (EUR).

The material damage in this report is stated based on advance invoices, estimates and/or documents submitted by "IŽS" a.d. and "Srbija Voz" a.d that confirm the stated damage amounts.

2.3.4. External conditions – weather conditions and geographic characteristics

The site of serious accident is located in the area of Brestovac (city Leskovac), on the section located in geographically plain terrain.

The geographic coordinates of the place of accident are: 43° 8' 55,45" N и 21° 52' 28,76" E.

Section on which there is a crossing PBE 1 is in direction and in horizontal plane.

At the time of the accident, it was a day, the sky was clear, it was sunny and without any wind. Vision was not impaired by anything. The air temperature was 27°C.



3. Minutes on the investigation and interviews

Information, facts and evidence related to the occurrence of the respective accident were collected and determined based on the following:

- Additional on site examination conducted by the Main Investigator for Railway Traffic from CINS;
- Materials delivered by the infrastructure manager “IŽS“a.d.;
- Materials delivered by the railway undertaking ”Srbija Voz“a.d.;
- Materials delivered by Emergency Service of Health Centre Leskovac;
- Materials delivered by OJT Leskovac;

Warning: requested material from the Police Station Leskovac was not delivered.

The preliminary investigation of the accident on site and the investigation were done by a joint investigation committee of the infrastructure manager “IŽS“a.d. and the railway undertaking “Srbija Voz“a.d.

Members of Police Station Leskovac and OJT Leskovac conducted the investigation on site.

3.1. Summary of the testimonies

Written statements of “Srbija Voz”a.d. were obtained as well as Reports on irregularities in the train driver’s (EV-38) and conductor’s (K-91) work in the train No.4905.

Written statements from “IŽS”a.d. and station inspectors’ reports on irregularities during operation (S-23) from the TK Dispatcher of TK Centre Niš who performed the service at the time of the accident (personnel regulating traffic on that section of the railway line) were obtained.

3.1.1. Railway staff

Train driver stated: “upon stopping at the station Brestovac and done manipulation of passengers, conductor gave me an aspect of a signal „ready to start“. I started the train, and after exiting the station Brestovac *km* 268+318 a road vehicle suddenly overtook so I hit it. When I came from the station Brestovac a couple of times I gave the aspect of a signal “watch out“. Exiting signal allowed me to continue my drive, half-barriers were lowered and on both sides there were vehicles. The vehicle that I hit circumvented the half-barriers, on my right side and on 10 metres in front of me it came out on track. Immediately I started fast braking, but I didn’t manage to stop the train, so the collision happened. Upon stopping of the train, I informed all the authorities, and they called the police and emergency services.

Conductor 1 stated: „before the accident, I heard a siren from locomotive, and sudden „twitch of the train“. The train suddenly stopped, colleague and I (the other conductor) came out from the train and saw that the train has hit the road passenger vehicle. We came to the vehicle and I saw one passenger with head in blood who was helped by the local citizens, two persons were standing next to the vehicle with no visible injuries, one was lying next to the road on the left side and one was giving the signs of life in car. Police came very quickly at the site, after 3 or 4 minutes and they didn’t allow us to provide help, especially to the person in the car, until the



Emergency service arrives, because of the belt that he had and stuck with car plate the person couldn't be drawn out, and because of the fear that we could injure him more. Emergency service arrived after 10 to 15 minutes and took care of the injured. We informed the passengers about the accident and that the train cannot continue the travel because of the investigation. Only three passengers remained in the train, and we helped the other passengers to come out of the train at the back door and directed them to the local bus station“.

Conductor 2 stated: „before the accident, I heard a siren from locomotive, and sudden „twitch of the train“. The train suddenly stopped, colleague and I (the other conductor) came out from the train and saw that the train has hit the road passenger vehicle. After short time we came to the vehicle and saw horrible picture: one person with head in blood was helped by the local citizens, two persons were standing next to the vehicle with no visible injuries, one was lying next to the road on the left side and one was giving the signs of life in car. Police came very quickly at the site, after 3 or 4 minutes and they didnt allow us to provide help. Emergency service arrives, because of the belt that he had and stuck with car plate the person couldn't be drawn out, and because of the fear that we could injure him more. Emergency service arrived after 10 to 15 minutes and took care of the injured. We informed the passengers upon arrival at the wagon about the accident and that the train cannot continue the travel because of the investigation. Only three passengers remained in the train, and we helped the other passengers to come out of the train at the back door and directed them to the local bus station“.

Report on irregularities during operation (*K-91*), that the conductor sent regarding the accident and the statement he gave after the accident coincide in all essential facts.

Reports on irregularities (*S-23*) submitted by TK Dispatcher at TK Centre Niš in relation to the accident coincide regarding all relevant facts with the statements of train driver and conductors.

3.1.2. Other witnesses

The witnesses of this accident (passengers in the train No. 4095 and third parties) were not interviewed and no statements were obtained from them.

In Minutes on the Investigation KTP No. 1951/2017 from 21 August 2017 of OJT Leskovac, it is stated that there were not any eyewitnesses of this accident on site.

3.2. Safety Management System

3.2.1. Organisational frame and manner of issuing and executing orders

According to the Safety Management System, "IŽS" a.d. informed all interested parties on the accident.

Railway infrastructure manager "IŽS" a.d. and the railway operator "Srbija Voz" a.d, according to the Law on railway safety and interoperability ("*Official Gazette RS No. 104/13, 66/15 - other law and 92/15*"), established a joint investigating committee that carried out an investigation of the event. After the investigation, they drafted a Report on investigation U-377/17.



3.2.2. Requirements that must be fulfilled by railway staff and the way they are applied

”Srbija Voz” a.d. insured through its Safety Management System (SMS) management of competencies, i.e. that all the employees participating directly in railway traffic are trained and competent, as well as the planning of the work load.

Regarding the accident, where the train driver and the conductor employed in ”Srbija Voz” a.d., all the activities related to the professional training, competencies and the planning of working time were carried out in accordance with applicable regulations.

3.2.3. Procedures for internal audits and controls and their results

”Srbija Voz” a.d. as a railway operator has established Safety Management System. The general purpose of the Safety Management System (SMS) is to ensure that ”Srbija Voz” a.d. achieve its business objectives in a safe way.

Rolling stock must maintain the prescribed technical level of accuracy and must follow the maintenance plans (*EV-62*) and its cycles of control and technical inspections and execution of regular repairs, in order to be as reliable as possible in traffic, in accordance with the Rulebook on rolling stock maintenance and other laws and by-laws being part of the Safety Management System of ”Srbija Voz” a.d.

Regarding respective accident, regular and additional maintenance, was done according to the valid regulations.

”IŽS” a.d. as an Infrastructure Manager has Safety Management Manual. It includes organization and all the procedures and activities done by ”IŽS” a.d. for the safe railway traffic.

Risk Management related to maintenance of railway infrastructure (subsystems infrastructure, energy, control, management and signalling-railway part) and railway vehicles that ”IŽS” a.d. uses for maintenance is based on application of defined activities of regular and additional maintenance and their tracking and control. Regular and additional maintenance includes regular supervision, controls, checks, repairs.

Requests, standard and activities for maintenance of ”IŽS” a.d. were based on regulation, general and individual documents, instructions of manufacturers and standards.

Maintenance of crossing devices is done according to valid regulation.

3.3. Relevant international and national regulations

3.3.1. Law on Railway Safety on the Roads (*“Official Gazette RS” No 41/2009, 53/2010, 101/2011, 32/2013 - decision of US, 55/2014, 96/2015 - other law and 9/2016 - decision of US*)

23. Traffic on the crossing over the railway

Article 100:

On crossing over the railway, the driver is obligated to pass the train vehicle move on the railway.



The driver who approaches the crossing over the railway is obligated to set the speed of the vehicle so that it can stop it in front of the device for closing of traffic on the crossing or in front of the device for giving signs to inform of the train approaching, i.e. that it can stop the vehicle before it comes on the railway.

Article 101:

Traffic participants are required to stop before crossing road over the railway, if the device for closing the traffic is down, if the device is started to be lowered or if a light or audible warning signs are given that the device is going to descend, that is, when the light traffic sign announces the approaching of a train crossing the road over the railway at the same level without barriers, trespassing is forbidden.

3.3.2. Law on Railway Safety and Interoperability („Official Gazette of RS“ No. 104/2013, 66/2015 – other laws and 92/2015)

Devices and traction vehicles gear, Article 78. (extract):

Locomotive must possess:

...

8) device for sound signalling;

...

3.3.3. Rulebook on the manner of crossing the railway and road, pedestrain or bicycle path, the point where the intersection can be done and the measures to secure the safe traffic („Official Gazette of RS“ No. 89/2016)

Article 25 Paragraph 2:

With automatic half-barriers the traffic on the right side of the road, or the right side of the road in front of the crossing, at both sides of the track, is stopped.

Article 28:

Before lowering down the automatic half-barriers, the participants in road traffic are informed on time with light signals and sound signals (if they are embedded). The time of notification that the automatic half-barriers is going to be lowered cannot be shorter than 15 seconds.

Article 29:

Automatic half-barriers and light signals are set at least 3 m from the outside rail, at both sides of the railway.



3.4. Functioning of railway vehicles and technical installations

3.4.1. Control, command and signalling

On the section between Doljevac and Pečenjevce the devices for control, management and signalization were safe and operational. During the accident, through the station Brestovac regime of transient driving was set.

The crossing is equipped with SS device on the crossing of brand „Siemens“. Switching on and off to the crossing is done by driving the train, activation of switching points, or manually, by using TUPP push-button (push-button of switching on the crossing) and TIPP (push-button of switching off the crossing) at the station signal box or at the counter at TK Centre Niš.

For the crossing, it is concluded that from the time of activation of crossing begins the time of pre-ringing (activation of light and sound signals on the traffic light during the crossing over the railway at the same level), which lasts for 18 s, after which the lowering of half-barriers begins. Consolidated values are in accordance with the Article 28 of Rulebook on the manner of crossing the railway and road, pedestrian or bicycle path, the point where the intersection can be done and the measures to secure the safe traffic („Official Gazette RS“ No. 89/2016).

Automatic half-barriers are from the exterior rail at a distance as follows: from the direction of centre of Brestovac to the settlement Kutleš 3,70 m, and in direction of Kutleš to the centre of Brestovac 3,50 m. Light signals are set for both directions in front of automatic half-barriers. Automatic half-barriers and light signals are set in accordance with the Article 29 of Rulebook on the manner of crossing the railway and road, pedestrian or bicycle path, the point where the crossing can be done and the measures to secure the safe traffic („Official Gazette RS“ No. 89/2016).

The length of half-barriers is 3,77 m, which equals to the half of the width of the railway at the state road. This condition is in accordance with Article 25 of Rulebook on the manner of crossing the railway and road, pedestrian or bicycle path, the point where the crossing can be done and the measures to secure the safe traffic („Official Gazette RS“ No. 89/2016).

After the serious accident and investigation of members of the Police Station and OJT Leskovac, joint investigation committee of the infrastructure manager „IŽS“ a.d. and the railway undertaking „Srbija Voz“ a.d. has checked the functioning of the crossing PBE 1. The check was done by driving the locomotive 441-710. On this occasion, half-barriers at the crossing PBE 1 were lowered orderly and light and sound signalization was functioning. Also, the functional check of the devices according to the measure list by Section for ETP Niš, OJ for SS Leskovac and there has not been any irregularities.

The main investigator for Rail Traffic and the president of joint investigation committee of the infrastructure manager „IŽS“ a.d. and the railway undertaking „Srbija Voz“ a.d. have done the investigation on 25 August 2017 and the check of functioning of the crossing for various forms of switching on (driving from the direction Doljevac to Pečenjevce and giving commands from TK Centre Niš at request of the Main Investigator for Rail Traffic), and on this occasion, there have not been any irregularities (device on the crossing was orderly operating).

3.4.2. Infrastructure

The condition of the infrastructure on the part of the railway line between the station Doljevac and Pečenjevce was good and in that sense there were no irregularities that could have had a negative impact on rail traffic safety.

3.4.3. Means of communication

At the time of the respective serious accident, on the section between Doljevac and Pecenjvce, the means of communication were safe and opeartional. No malfunctions or failures of communication devices were documented.

3.4.4. Railway vehicles

At the time of occurrence of the respective accident, the train No. 4095 was moving in the direction from the station Doljevac to the station Pečenjevce (from the beginning towards the end of the railway line, in the direction of increasing mileage).

The train composition was the locomotive of series 441-707 and the two wagons of series *Bt*.

The locomotive of series 441-707 is a quad-axle monophas electrical locomotive system 25kV/50Hz for traction of passenger and freight trains by lowland and mountain railways. In accordance with Article 78 of the Law on railway safety and interoperability ("*Official Gazette*" No. 104/2013, 66/2015 - other law and 92/2015) locomotive is equipped with a device for giving audible signal (siren), and in that sense there were no irregularities.

Wagons of the series *Bt* intended for the carriage of passengers, equipped with 2nd class seats arranged in the interior of the wagon in two sections in the order of 2 +2 with a passageway through the middle aisle.

The appearance of parts of the damaged locomotive 441-707 is shown in Fig. 3.4.4.1. and 3.4.4.2.



Fig 3.4.4.1: Review of the damage on EMV 441-707



Fig. 3.4.4.2: Review of the damage on EMV 441-707



In the locomotive 441-707 speed meters of the manufacturer *Hasler* are installed, registering speed meter of the type *RT12i*, serial number *6792* is installed, and indicating speed device type *A28i*, serial number *012.075*.

From registering speed device of the driving locomotive 441-707, registering lane was removed and made the processing of registered data. Treatment of the registered data, it was found that the train No. 4905 after the departure from the station Brestovac crossed 400 m moving at speeds up to 48 km/h, then stopped.

Based on data from speed tapes, it was noted that he did not exceed the maximum speed limit on this section of railway line (50 km/h).

3.5. Traffic operation and management

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

The operation of the train No. 4905 between the station Doljevac and Pečenjevce was performed at block section lengths.

At the time of the respective serious accident, through the station Brestovac the regime of transient drive was on.

The train crew received in the accompanying documents all required orders and notifications about the operation of the train on that part of the railway line.

3.5.2. Exchange of voice messages in relation to the accident

Immediately before and during the respective serious accident, there was no communication between the train driver and the staff that manages traffic operation.

Communication between the staff managing the traffic operation and the train driver took place after the respective serious accident in order to provide information that an accident occurred. The train driver of the train No. 4905 notified the train TK Dispatcher at TK Jug at TK Centre Niš.

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

After the serious accident happened, the main arterial route *E 70/E 85*: Belgrade Mladenovac - Lapovo - Niš - Preševo - state border - Tabanovce between the stations Doljevac and Pečenjevce was closed for train traffic.

The evacuation of passengers from the train No. 4905 was performed so that the passengers by instructions and under the supervision of the train conductor left the train at the back door of the last wagon of the train.

No other measures were taken to secure the place of accident.



3.6. Interface between man, machine and organisation

3.6.1. Working hours of the staff involved

For the railway staff, information was submitted based on which it is clear that the train driver and the conductor of the train No. 4905 had the legally stipulated rest before going to work and that they did not spend more time at work than the maximum working hours defined by law.

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

For the railway staff, information was submitted based on which it is clear that the train driver and the conductor of the train No. 4905 were qualified and bodily and mentally fit to perform their work. For the train driver of the train No. 4905 a certificate was issued by the Railway Directorate to confirm that his application was submitted and conditions were fulfilled that are required to issue the licence for the operation of a traction vehicle.

Joint investigation committee of the infrastructure manager “IŽS“a.d. and the railway undertaking “Srbija Voz“a.d. has not performed the alco test of the train driver No. 4905.

In Minutes on investigation of site KTP No. 1951/2017 from 21 August 2017. OJT Leskovac, it can be seen that the order was given to the General Hospital of Leskovac to take the required amount of blood of the driver of road vehicle and train driver No. 4905 for analysis of the presence of alcohol in it that would be delivered to Institute for Forensic Medicine in Niš to conduct a chemical toxicological analysis and determination of alcohol concentration. The results of requested analysis were not delivered to CINS.

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

The main arterial route *E 70/ E 85*: Belgrade – Mladenovac-Lapovo- Niš- Preševo-state border -Tabanovce- between the station Doljevac and Pečenjevce was designed such that it satisfies, with regard to all parameters, the criteria for the safe operation of trains at speeds specified in the timetable booklet.

The railway line is equipped with APB devices in TK devices in TK Centre Niš, so that traffic at this section, from the central spot is regulated by TK dispatcher at the position TK Jug at TK Centre Niš.

For the purpose of traffic management, on the part of the railway line between the station Doljevac and Pečenjevce automatic block and protective signals are installed that show binary signalling signs.

On the part of the railway line between the station Doljevac and Pečenjevce, communication between the staff managing the traffic on the railway line and the staff in the traction vehicle is done by telephone via a local TT connection.

This railway line is equipped with RDV devices that are operational and with the help of which communication between the staff of the traction vehicle and TK Dispatcher.



The locomotive is operated by a train driver by way of commands from the driver's cabs, which were designed when the locomotive was manufactured. At locomotive 441-707 all defects noticed in the locomotive on systems and operating gear were removed, so that in that sense no remarks or defects were registered.

3.7. Previous accidents of similar nature

No data were obtained from the infrastructure manager "IŽS" a.d . about any accidents from 01 January 2013. on the crossing.

4. Analysis and conclusions

4.1. Final review of the course of events and adoption of conclusions about the occurrence based on facts determined during the investigation and interviews

On 21 August 2017 at 19:38, on the crossing at the level PBE 1 that is in the area of unmanned TK station Brestovac, there has been overtaking of the train No. 4905 (locomotive 441-707 and two wagons of series Bm) on the road passenger vehicle of brand Ford type Galaxy registration number NI 161-CL.

Serious accident occurred at the crossing at km 268+318 of arterial route E 70/E 85: Belgrade - Mladenovac – Lapovo - Niš - Preševo – State Border - (Tabanovce). Crossing PBE 1 is located between the entrance signal from the direction of Preševo and first entrance switch of unmanned TK station Brestovac. The rail is onetrack and electrified. Road is one of the state roads. Road is covered with asphalt, while road at the transition from wooden sleepers, well levelized and in good condition. Crossing is secured with automatic light-acoustic signaling (set of three traffic lights to regulate access to the vehicle - "blink", one for each direction of state road that intersects with the railway and one for unclassified road parallel to the railway line and flows into the state road directly in front of the level crossing) and half-barriers and road vertical signalization. Control of the device on the road crossing is done on the TK counter in TK Dispatcher center in Niš from which device may be operated. The railway and the road intersect at an angle of 90°. With photos it can not be determined with certainty whether the triangle of transparency (transparency), which is prescribed for crossings that do not have an active signaling exists, which in this particular case, given the way of securing the crossing, it does not matter. This transparency would normally be referred to a road that intersects the track and not on the road running parallel with the railway. On the border of free profile there is a good visibility.

At the time of the serious accident, the temperature was around 27° C, visibility was good.

In this serious accident, one person died, two person were seriously injured, and two lightly. On the locomotive and SS devices (insulated section feeder head) there were some damages. The damage on the road vehicle is total.



Fig 4.1.1: The remains of the road vehicle that was a participant of the serious accident

4.2. Discussion - Analysis of facts determined during the investigation with the purpose of drawing conclusions about the accident causes and the effect of the Emergency services

4.2.1. Analyses of moving of train and road vehicle

The train No. 4905 was after dealing in TK station Brestovac, by the timetable envisaged, dispatched to TK junction Pečenjevce. For the respective train the output path from 3rd track is formed, after which the output signal Eo 3 showed aspect of a signal of allowed driving. The output signal Eo 3 can show aspect of a signal of allowable driving only if the device is operating and if half-barriers are lowered and the light and sound signals included i.e. crossing is protected for approaching of the train.

On the basis of the form EV-85, supplement 1, it can be seen that about 400 m after departure, at speed up to 48 km/h, braking occurred, and after that the stopping of the train. According to his own statement, the train driver was approaching a level crossing, saw that the half-barriers were lowered and at both of the sides stood road vehicles, and that road vehicle which he ran over toured the half-barriers to the right in the direction of the train and about ten meters in front of the forehead train the vehicle "slipped" onto the tracks.

4.2.2. Analysis of the level crossing device

As part of the investigation, after the completion of investigation of the police and OJT Leskovac, the Joint Committee checked the operation of the device of level crossing. The check was made by driving the locomotive 441-710 and it was determined that the device is properly working. In addition, the indicator device of level crossing in TK Center in Niš, it was concluded that the devices were working regularly (correct device) before the occurrence of a serious accident. The train was dispatched from a 3rd track after the output signal Eo 3 showed aspect of a signal of allowable driving. In the event of device failure of the level crossing, the output



signal Eo 3 would not be showing aspect of a signal of allowable driving. The review of the work in the Register of Work for the relevant crossing can be concluded that the level crossing just before the occurrence of a serious accident, had no registered fault or disruption (last registered device failure at the level crossing has been removed 15 August 2017 at 12:10). Based on the forementioned, it can be concluded that the device at the time of the occurrence of a serious accident has been regular, that is, light-sound signaling devices were involved and that the half-barriers were lowered.

The review of the Register of work for the relevant crossing concluded that the occurrence of fractures of spools of half-barriers by participants in road traffic are frequent. In the period from 08 October 2016 until the moment of occurrence of this serious accident, a total of 4 cases of violent fracture spools of half-barriers were registered. Review of the fractures is given in Table 4.2.2.1

Fig. 4.2.2.1: The review of the fractures of the wooden inserts of wooden half-barriers by participants of traffic

<u>date</u>	<u>description</u>
08.10.2016.	Fracture of both poles of roadcrossing half-barriers
16.10.2016.	Fracture of the right pole of roadcrossing half-barriers
23.05.2017.	Fracture of the left pole of roadcrossing half-barriers
21.07.2017.	Fracture of the right pole of roadcrossing half-barriers

From the review of the Register of work of crossing PBE 1, it can be concluded that the device on the road crossing was maintained by the Section of ETP "IŽS" a.d. in accordance with applicable regulation.

4.2.3. Analysis of the effect of work of Emergency Service

Two of the teams of Emergency Medical Service of the Health Center Leskovac arrived on site in record time. Two seriously injured persons were taken to the Clinical Center Niš, Clinic for surgery and two lightly injured persons in the Department of Emergency Medicine of the General Hospital Leskovac. There was no need for the intervention of other rescue services.



4.3. Conclusions

4.3.1. Direct and immediate causes of serious accident

The direct and immediate cause of a serious accident is that the road vehicle entered into the track just before the arrival of the train, thereby creating a dangerous situation of the occurrence of the serious accident. Hazardous situation has occurred due to the fact that the road vehicle toured half-barriers which have been suspended.

4.3.2. Basic causes resulting from skills, procedures and maintenance

The basic cause is non-compliance with the Law on Traffic Safety on the roads (*“Official Gazette RS“ No 41/2009, 53/2010, 101/2011, 32/2013 - decision of US, 55/2014, 96/2015 - other law and 9/2016 - decision of US*) by the driver of the road vehicle.

4.3.3. Main causes based on the requirements defined in the legal framework and the application of the safety management systems

There are no main causes.

5. Measures taken

There are no measures taken.

6. Safety recommendations

For potential safety improvement on the railway and prevention of new accidents, CINS issued the following safety recommendations:

Road Traffic Safety Agency RS:

SR_08/18 Considering that the inadequate behaviour of the drivers of road vehicles became very common during the transition over tracks in the sense of non-compliance with the Law on Traffic Safety on the roads (*“Official Gazette RS“ No 41/2009, 53/2010, 101/2011, 32/2013 - decision of US, 55/2014, 96/2015 - other law and 9/2016 - decision of US*), it is necessary that the Road Traffic Safety Agency investigates in detail various forms of behaviour, the causes of this behaviour and suggests measures that would contribute to rising the level of safety.