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FINAL REPORT ON THE INVESTIGATION OF A RAILWAY ACCIDENT – COLLISION OF FREIGHT TRAIN NO. 42083 WITH A PASSENGER VEHICLE AT PUCONCI-2 LEVEL CROSSING AT KM 44+435 BETWEEN LJUTOMER AND DANKOVCI STATIONS

Ljubljana, 1 December 2011

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1 SUMMARY

On 25 February 2010 at 11:14, freight train no. 42083 collided with a road passenger vehicle at the NPr-44+4 level crossing in Puconci between Dankovci and Murska Sobota stations at km 44+435; at the time of the collision, the passenger vehicle was driving over the level crossing after it had turned onto the incorrect or opposite lane at the junction and circumvented the lowered half-barrier.

Main railway line no. 41 from Ormož via Murska Sobota to Hodoš international border (T-69) has a single track. The junction of Šalamenci–Puconci–V Lokaj local road with the road bypassing Puconci settlement and running next to the railway line is located immediately ahead of the level crossing. At the junction, the road from the direction of Šalamenci settlement (the road bypassing Puconci settlement) and V Lokaj street runs onto the level crossing in the direction of Puconci settlement and Varoša.

Freight train no. 42083 was travelling from Hodoš international border to Koper freight station.

The driver of the passenger vehicle and his wife seated in the passenger seat were driving along the local road from Šalamenci settlement. At the aforementioned junction, he turned left onto the opposite lane of the main road running through Puconci settlement and proceeded towards the level crossing protected with two half-barriers.

The NPr-44+4 level crossing is equipped with mechanical single-leaf half-barriers and flashing or illuminated road signs. When the half-barriers are lowered across the road, they protect the lane in the travelling direction of road vehicles. If the device is in perfect working order and trains pass all the switches at the level crossing, the half-barriers are mechanically lowered when the train's first axle passes the switch from either of the two directions.

The device protecting the NPr-44+4 level crossing at km 44+435 was in perfect working order at the time of the accident; the half-barriers were lowered across the road.

The railway line from the direction of Hodoš border station runs in a straight line for 1,000m and, immediately after the level crossing, continues into a left curve that is 200 m long. For the last 110 m, the local road runs towards the level crossing from the direction of Šalamenci in a slight 'S' curve at an angle of 30°. Before the curve, the road runs parallel to the railway line for 140 m at a distance of 60 m from the track. Immediately after the junction, the road crosses the railway line in the direction of Puconci settlement at an angle of 90°, then turns towards the settlement at an angle of 40° and runs parallel to the railway line for 200 m at a distance of 100 m from the track.

The train had been catching up with the passenger vehicle travelling parallel to it for 140 m; for the last stretch of 110 m, the train was catching up with the passenger vehicle at an angle of 30°.

At the level crossing the train hit the left-hand side of the passenger vehicle, pushing it forward for 286.6 m, where it stopped with the vehicle wedged under the locomotive’s right fender.

The driver of the road vehicle and his passenger were wearing seat belts and died of the injuries sustained in the collision at the site.

Pursuant to the protocol of the post-mortem examination of the deceased driver performed by the Pathology Department of Murska Sobota Hospital, the direct cause of the accident may have been cardiac arrest, since morphological and pathological modifications of the myocardium were detected.

If the driver did not experience cardiac arrest, the indirect cause of the accident could be assigned to unsuitable protection of the level crossing; since the level crossing is located within the area of the junction, and the noise barriers significantly diminish visibility at the level crossing, the ensuing traffic conditions require drivers to process a great amount of information

within a very short period of time, which implies that the level crossing should be protected with four half-barriers closing all the lanes. It is also possible that the driver made an incorrect assessment of the given traffic situation. Perhaps he decided to drive over the level crossing because he was paying attention to the road traffic and was therefore unable to register the signalling devices at the level crossing in a split second. When driving on the opposite lane, he decided to cross the railway line, because he was not stopped by the half-barrier.

The physical and mental functions of road users diminish with age and poor physical fitness. When designing traffic arrangements, the most vulnerable groups of road users (children and the elderly) should be taken into consideration in the first place. Children are reckless and lack experience, while the elderly often react inappropriately to the given situation owing to their diminished physical and mental abilities.

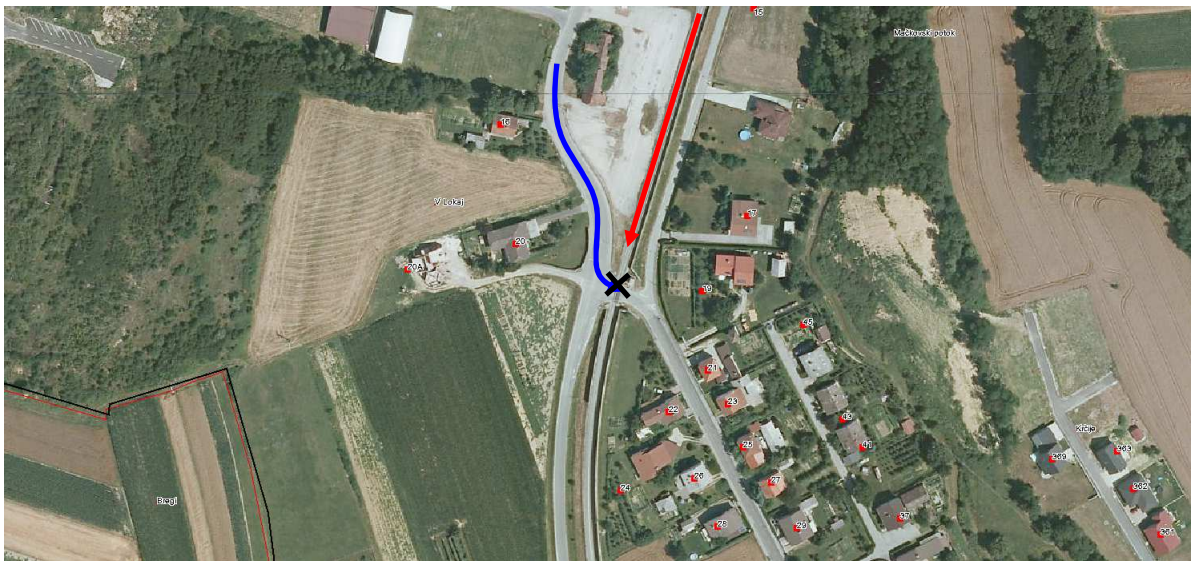

Figure 1: The red arrow shows the direction of the train, the blue arrow shows the direction of the passenger vehicle, and the black cross the site of collision

Recommendation:
Protection at Puconci 2 level crossing at km 44+435 between Murska Sobota and Dankovci stations should be upgraded with half barriers for all the lanes, owing to the micro-location of the level crossing and noise barriers (the level crossing is located within the area of the junction, and noise barriers diminish the ability to register the colour of half-barriers).

1.1. Copies of the accident report with recommendations to:

Slovenske železnice, d.o.o.
Kolodvorska 11
1506 Ljubljana

Puconci Municipality (*Občina Puconci*)
Puconci 80
9201 Puconci

Republic of Slovenia
Ministry of Transport (*Ministrstvo za promet*)
Minister Patrick Vlačič
Langusova 4
1000 Ljubljana

Public Agency of the Republic of Slovenia for Railway Transport (*Javna agencija za železniški promet RS*)
Kopitarjeva 5

2000 Maribor

Ministry of the Interior (*Ministrstvo za notranje zadeve*)
Murska Sobota Police Directorate (*Policijska uprava Murska Sobota*)
Murska Sobota Traffic Police Station (*Postaja prometne policije Murska Sobota*)
Ulica arhitekta Novaka 11
9000 Murska Sobota

ERA – European Railway Agency
160 Boulevard Harpignies
BP 20392
F-59307 VALENCIENNES Cedex

2 IMMEDIATE FACTS OF THE OCCURRENCE

The device protecting the level crossing at km 44+435 was in perfect working order at the time of the accident. The half-barriers were lowered horizontally across the road at the time of the accident. The road signs' flashing lights used to warn road users of approaching trains were in perfect working order.

At the level crossing of the single-track railway line from Hodoš international border to Murska Sobota with the junction of Šalamenci–Puconci–V Lokaj local road and the road bypassing Puconci settlement and running parallel to the railway line that is located between Dankovci and Murska Sobota stations at km 44+435 next to Puconci, freight train no. 42083 collided with the passenger vehicle that, at the junction, turned onto the incorrect or opposite lane and circumvented the lowered half-barrier by continuing along this lane.

2.1 Date, exact time and location of the occurrence

The accident – collision of freight train no. 42083 with the passenger vehicle at the level crossing of the single-track railway line with the local road running from/to Puconci that is protected with half-barriers and located at km 44+435 within the area of the junction of Šalamenci–Puconci–V Lokaj local road and the bypass running parallel to the railway line – occurred on 25 February 2011 at 11:13:30 as recorded by locomotive 664-107 of train no. 42083 on 25 February 2011.

2.2 Description of the events and the accident site

The main railway line no. 41 from Ormož via Murska Sobota to Hodoš international border (T-69) has a single track. The junction of Šalamenci–Puconci–V Lokaj local road with the road bypassing Puconci settlement and running next to the railway line is located immediately ahead of the level crossing. At the junction, the road from the direction of Šalamenci settlement (the road bypassing Puconci settlement) and V Lokaj street runs onto the level crossing in the direction of Puconci settlement and Varoša.

The railway line from the direction of Hodoš border station runs in a straight line for 1,000m, and immediately after the level crossing continues into a left curve that is 200 m long. For the last 110 m, the local road runs towards the level crossing from the direction of Šalamenci in a slight 'S' curve at an angle of 30°. Before the curve, the road runs parallel to the railway line for 140 m at a distance of 60 m from the track. Immediately after the junction, the road crosses the railway line in the direction of Puconci settlement at an angle of 90°, then turns towards the settlement at an angle of 40° and runs parallel to the railway line for 200 m at a distance of 100 m from the track.

The train had been catching up with the passenger vehicle travelling parallel to it for 140 m, and for the last stretch of 110 m, the train was catching up with the passenger vehicle at an angle of 30°.

International freight train no. 42083 was travelling from Hodoš international border to Koper freight station.

The road vehicle was occupied by the driver, who would have turned 70 in three months, and his wife aged 68 on the passenger seat. The driver of the passenger vehicle was driving along the local road from Šalamenci to Puconci. At the aforementioned junction, he turned left onto the opposite lane of the main road running through Puconci settlement and proceeded towards the level crossing protected with two half-barriers. He entered the level crossing driving along the opposite lane and thus circumvented the lowered half-barrier. The front right-hand side of the locomotive crashed into the middle of the passenger vehicle. The right-hand side fender of the locomotive pushed through the window of the driver's door and the passenger vehicle was then hooked onto the fender. The train pushed the vehicle for 286.6 m until it stopped.

Figure 2: Consequences of the train's collision with the passenger vehicle at Puconci 2 level crossing

2.3 The body that established the investigation

The investigation procedure was launched by the Chief Investigator of the Railway Accident and Incident Investigation Division, Ministry of Transport of the Republic of Slovenia. Slovenske železnice, d.o.o., conducted its investigation to establish the causes of and responsibility for the accident through an investigation commission.

Pursuant to the Minor Offences Act, an investigation was performed by Murska Sobota Traffic Police Station.

Their investigation procedures were conducted separately.

2.4 The decision to establish an investigation, the composition of the team of investigators and the conduct of the investigation

The Railway Accident and Incident Investigation Division of the Ministry of Transport of the Republic of Slovenia launched an investigation to determine all direct and indirect causes, with the purpose of collecting information important for improving safety at the level crossing.

The Chief Investigator of Railway Accidents and Incidents at the Ministry of Transport of the Republic of Slovenia conducted the investigation and brought it to a close himself.

Slovenske železnice, d.o.o., conducted its investigation through an investigation commission.

2.5 The background to the occurrence

The driver of the passenger vehicle had a valid driving licence for category B and 35 years and one month of driving experience. The locomotive driver of train no. 42083 passed the qualifying examination to operate diesel traction vehicles on 7 December 1984 and had been working as a driver of diesel traction vehicles for 25 years and two months.

The officers of Murska Sobota Traffic Police Station ordered the locomotive driver, Božo Ribič, and his assistant, Rajko Kokol, to take an electronic alcohol test, the reading of both of which was 0.00 mg/l of the breath respectively.

Pursuant to the toxicology report of the Institute for Forensic Medicine, the driver of the passenger vehicle involved in the accident had 0.09 g/kg of alcohol in his blood and 0.00 g/kg of

alcohol in his urine, which is below the prescribed limit for his driving licence category, i.e. 0.24 mg/l of alcohol in the breath or 0.5 g/kg of alcohol in the blood.

Pursuant to the protocol of the post-mortem examination of the deceased driver performed by the Pathology Department of Murska Sobota Hospital, the direct cause of the accident may have been cardiac arrest, since morphological and pathological modifications of the myocardium were detected.

There is a speed limit of 50 km/h in force for road users at the level crossing. A stop sign is erected at the junction for road users driving from Šalamenci to Puconci; vehicles travelling along this road must stop at the sign, because they are turning from a road without the right of way onto a road with the right of way.

On this section, 80 km/h is the maximum permitted speed for train no. 42083 that was travelling according to the timetable elements of train no. 42001.

Road users have an unobstructed view of the railway line in the direction of Dankovci for 350 m, but visibility can be deceptive for road users due to the colour spectrum of the high concrete noise barrier erected on the opposite side of the railway line. It should be stressed, however, that visibility does not have to be provided, since the crossing is protected by half-barriers. The barriers were lowered across the road at the time of the accident.

The level-crossing roadway is made of rubber elements that are connected to coarse asphalt concrete on both sides. The driving surface was completely dry at the time of the accident and the tyre grip for passenger vehicles was very good.

Road traffic is scarce at this level crossing, with the exception of daily peak hours when the inhabitants of Puconci commute between work and home. There is an average of 35 trains in both directions per day on workdays.

2.5.1 Persons involved

The accident involved the retired 69-year-old driver of the passenger vehicle, his 68-year-old wife, both residing in Kovačevci, and the 48-year-old locomotive driver of freight train no. 42083 and his 47-year-old assistant, both employed at Slovenske železnice, d.o.o., Traction Business Unit (*Poslovna enota Vleka*), Maribor Traction Section (*Sekcija za vleko Maribor*).

2.5.2 The trains and their composition, including the registration numbers of the items of rolling stock involved

International freight train no. 42083 was composed of diesel traction vehicle no. 92 79 2 664-107-1 and wagons for containers; total mass 1,293 t, 116 axles, total length 511 m.

2.5.3 Description of the infrastructure and signalling system (track types, switches, interlocking, signals, train protection)

On the Dankovci–Murska Sobota–Ormož section of the railway line, trains run according to the principle of one at a time on the sections between stations. Using devices for inter-station dependency, a line traffic controller of the traffic management centre in Maribor manages trains on this section. Stations are equipped with ILTIS/Simis W electronic signalling and safety devices enabling remote control by Maribor Traffic Management Centre (*Center vodenja prometa v Mariboru*) and local control by station traffic units.

If an inter-station section is not free, the device prevents the exit signal from being placed in position for trains to proceed when the electronic signalling and safety device is in perfect working order, which means that notifications by telephone are not required.

The permission for trains to proceed is given by the line traffic controller of Maribor Traffic Management Centre (*Center vodenja prometa v Mariboru*) or by station traffic controllers when

so ordered by the former. A traffic controller sets the track exit or entry signals in position for trains to proceed or sends an oral notification via telecommunication circuits.

Notification of train's departure must be sent for every train.

The NPr-44+4 level crossing between Murska Sobota and Dankovci stations is protected with the ELEKSA 93S electronic device manufactured by Siemens and composed of light signals and half-barriers. The operating status of the device protecting the level crossing is reported to Murska Sobota station and Maribor Traffic Management Centre (*Center vodenja prometa v Mariboru*) where its operation and management are supervised by means of the ILTIS integrated control and information system.

The system is remotely controlled. Murska Sobota station traffic controller or the line traffic controller from Maribor Traffic Management Centre (*Center vodenja prometa v Mariboru*) supervises the functioning and management of the device.

The device protecting the NPr-44+4 level crossing in the direction of Murska Sobota–Dankovci is switched on when the first train axle passes over the switch-on contact that is marked SK11 and located on the approaching section. The device is switched off seven seconds after a train passes over the switch-off contact marked SV11 and then SV12. Owing to direction dependency, passing over the SK12 switch-on contact on the departing section has no impact on the operation of the device protecting the level crossing.

The device protecting the NPr-44+4 level crossing in the direction of Dankovci–Murska Sobota is switched on when the first train axle passes over the switch-on contact that is marked SK12 and located on the approaching section. The device is switched off seven seconds after a train passes over the switch-off contact marked SV12 and then SV11. Owing to direction dependency, passing over the SK11 switch-on contact on the departing section has no impact on the operation of the device protecting the level crossing.

2.5.4 Means of communication

An induction telephone is installed in a box next to the barrier levers on the right-hand side of the railway line. The telephone is connected to the Murska Sobota–Dankovci guards' circuit. The SŽ 000T key is used for locking and unlocking the telephone box.

2.5.5 Building works at the scene of the accident or in the vicinity

At the time of the accident, no building works on road or railway infrastructure were in progress along the section of the railway line where the accident occurred.

2.5.6 Trigger of the railway emergency plan and its chain of events

The locomotive driver of train no. 42083 notified his superiors and the controller at Maribor Traffic Management Centre (*Center vodenja prometa v Mariboru*) of the accident by telephone, and they initiated a rescue operation for persons involved in the accident. Unfortunately, the rescue operation was not required since the physician on duty at Murska Sobota ambulance station confirmed the death of the driver and his passenger in the road vehicle at the site of the accident.

2.5.7 Trigger of the emergency plan of the public rescue services, police and medical services and its chain of events

After the notification provided by the locomotive driver of train no. 42083, the Murska Sobota station traffic controller called the notification centre.

The officer on duty at the regional notification centre dispatched staff from Murska Sobota Traffic Police Station to the scene of the accident.

After the collision, the driver and his passenger were trapped in the vehicle. Fire fighters from Murska Sobota Voluntary Fire Fighters' Association had to extricate them from the wreckage.

The fire-fighters of Murska Sobota Voluntary Fire Fighter's Association removed the wedged passenger vehicle from the front of the locomotive.

2.6 Fatalities, injuries and material damage

The 69-year-old driver of the passenger vehicle and his 68-year-old wife and passenger, both citizens of the Republic of Slovenia, were killed in the accident.

Only the right-hand step and the plough of diesel locomotive 664-107 were damaged in the accident. Maribor Traction Section (*Sekcija za vleko Maribor*) assessed damage at EUR 2,500.

The costs of repairing the safety device protecting the level crossing totalled EUR 376.11.

The passenger vehicle was completely wrecked in the accident. According to a non-expert assessment, material damage to the road vehicle amounted to EUR 3,000.

2.7 External circumstances

Weather conditions at the time of the accident: clear, +11 °C, with very good visibility.

At the time of the accident, the local road surface (of asphalt concrete) was dry and tyre grip was very good.

At the time of the accident, the surface of the rubber elements at the level crossing was also dry and tyre grip was very good.

3 RECORD OF INVESTIGATIONS AND INQUIRIES

On 25 February 2010, the Chief Investigator of Railway Accidents and Incidents of the Ministry of Transport inspected the scene of the accident.

On 3 March 2010, an Incident Registration Form No. 01/2010 dated 26 February 2010 was received from Slovenske železnice, d.o.o., Maribor Traffic Management Section (*Sekcija za vodenje prometa Maribor*), Murska Sobota Supervisory Station (*Nadzorna postaja Murska Sobota*).

On 6 April 2010, the following investigation material, no. 1.0.4./31-621/10 dated 2 April 2010, was received from Slovenske železnice, d.o.o., Internal Control Service (*Služba za notranji nadzor*):

- copy of the traffic log book of Murska Sobota station (P-4);
- original tachometer reading of locomotive 664-107;
- Incident Report of the traffic controller of Murska Sobota station (P-7);
- copy of the record of working hours of the locomotive driver of train no. 42083 for February 2010;
- copies of EV-1 and EV-50/3 of the locomotive driver of train no. 42083 of 25 February 2010;
- accompanying documents for train no. 42083 of 25 February 2010 (P-13);
- copy of the timetable of train no. 42001, the elements of which were used for train no. 42083 on 25 February 2010;
- copies of the protocol of the interview with the locomotive driver of train no. 42083, dated 1 March 2010;
- inspection protocol for the speed recorder tape of traction vehicle 664-107 of 25 February 2010;
- review of periodical examinations passed by the locomotive driver of the train involved in the accident;
- medical report of the locomotive driver of the train involved in the accident dated 9 December 2010;
- qualifying examination certificate of the locomotive driver of train no. 42083, no. 93/84 of 7 December 1984;
- Incident Report no. 217/10Mb of 26 February 2010 (EV-49).

On 26 April 2010, the Chief Investigator of Railway Accidents and Incidents of the Ministry of Transport again inspected the scene of the accident and the safety device at the level crossing.

3.1 Summary of testimonies

The locomotive driver of train no. 42083 that was involved in the accident “did not specify anything of significant relevance in the Daily Report on Incidents No. 217/10 of 26 February 2010 that would explain the direct and any potential indirect causes of the accident”. He only noted that train no. 42083 hit a passenger vehicle at km 44.5.

In the protocol of the interview with a worker who is a party to proceedings/witness, the following reply of the locomotive driver is noted: “Were the barriers at the level crossing closed at the time of the collision?”

“The barriers at the level crossing were closed at the time of the collision.”

In the Incident Report (P-7), the authorised officer of Murska Sobota station noted:

> “Train no. 42083 departed Hodoš station at 10:48 and at the NPr-44+4 level crossing at km 44+435 (Puconci) hit a passenger car and pushed it forward for about 248 m up to km 44+150. This level crossing is protected with mechanical half-barriers (remote control system) and was at the time of the accident properly protected for the passing of train no. 42083. The line traffic controller in Maribor informed me of the collision at 11:16. The scene of the accident was cleared up at 13:31 and the train continued its journey at 13:33.”

3.2 The safety management system

The road signs are for road users clear and visible from a sufficient distance. Nothing blocks the view of these road signs.

At the time of the accident, the device was in perfect working order and the level crossing was properly protected with the half-barriers lowered horizontally across the lanes of the local road immediately before the tracks. The lights on road signs were in perfect working order – flashing.

The functioning of devices protecting Puconci 2 level crossing is periodically supervised by the staff of Slovenske železnice, d.o.o., Infrastruktura, as prescribed and evident from the recorded measurements.

Figure 3: Colour spectra of half-barriers and illuminated road signs

3.3 Rules and regulations

Safety at protected level crossings of roads with railway lines is governed by Article 51 of the Safety of Railway Transport Act (official consolidated text) (*ZVZelP-UPB1*), Uradni list RS (Official Gazette of the Republic of Slovenia) No. 36/2010 of 4 May 2010, and Article 50 of the Safety of Road Transport Act (official consolidated text) (*ZVCP-1-UPB5*), Uradni list RS No. 56/2008 of 6 June 2008.

Crossings of roads and railways at level crossings are regulated in more detail in the Rules on Railway Level Crossings published in Uradni list RS, No. 85/2008, on 29 August 2008.

3.4 Operation of rolling stock, technical facilities and technical installations

Train no. 42083 that was involved in the accident was travelling from Hodoš international border to Koper freight station on 25 February 2010. The braking system of train no. 42083 was in perfect working order on 25 February 2010, because the train stopped 286.6 m from the site of collision.

The device protecting Puconci 2 level crossing between Murska Sobota and Dankovci stations at km 44+435 was in perfect working order at the time of the accident. The half-barriers were lowered horizontally across the road and the illuminated road signs were flashing at the prescribed frequency.

3.5 Documentation on the operating system

The NPr-44+4 level crossing between Murska Sobota and Dankovci stations on the Ormož–Hodoš international border railway line is protected with half barriers and illuminated road signs, and equipped with the ELEKSA 93S electronic device manufactured by Siemens. The flashing lights on road signs are switched on and off automatically and the half-barriers are also lowered or raised automatically. They are activated when the first train axle passes over the switch.

The device and its operation are described in the Manual for the Operation of NPr-44+4 on the Ormož–Hodoš railway line at km 44+420 published on 22 August 2008.

3.6 Man-machine-organisation interface

At Puconci 2 level crossing between Murska Sobota and Dankovci stations, no special safety devices are installed to assist drivers of locomotives and passenger vehicles in reducing their speed and stopping. Locomotive drivers and drivers of road vehicles operate their vehicles by pressing or releasing the accelerator and applying braking devices.

Rail vehicles are fitted with pneumatic braking systems that become effective after 3.5–4.0 seconds.

The locomotive driver of train no. 42083, who was involved in the railway accident at Puconci 2 level crossing at km 44+4 between Dankovci and Murska Sobota stations on 25 February 2010 at 11:13:30, had passed all the required qualifying examinations, and was physically and mentally fit for driving, had taken the statutory rest break between the last two working shifts and had not exceeded the prescribed working hours in the shift. He passed the examination for a driver of diesel traction vehicles on 7 December 1984.

The driver of the passenger vehicle who died of the injuries he sustained in the accident was a holder of a statutory driving licence, category B, in line with the regulations for the operation of the road vehicle involved in the accident and had 35 years and one month of driving experience.

3.7 Previous occurrences of a similar character

A similar accident has not occurred at this level crossing in the past ten years. The section of the railway line between Puconci and Hodoš international border was constructed in 2001.

4 ANALYSIS AND CONCLUSIONS

The records of measurements show that the device protecting Puconci 2 level crossing at km 44+4 was inspected regularly. Individual elements of the device are inspected every two, six or 12 months.

The following elements are inspected:

- cabinets with built-in modules and *KKS*, electricity supply unit, level crossing box – every six months;
- wheel sensors (RSR 180 and RSAR module), vehicle sensors (Zelisko, AFS module and impulse extension) – every two months and 12 months;
- batteries – every two months and 12 months;
- road signs and barrier levers – every two months and six months.

No violations of standards were detected during inspections.

In 2010, 115 barriers were broken.

The protocol of the analysis (diagnostics) of the functioning of the device protecting the NPr-44+4 level crossing at km 44+435 on the Ormož–Hodoš railway line at the time of the accident involving train no. 42083 on 25 February 2010, and the protocol of the on-the-spot test operation of the device on 1 March 2010, have shown that the safety device was in perfect working order at the time of the accident on 25 February 2010; the protection of the level crossing was switched on and the half-barriers were lowered horizontally across the local road.

The elements of the device protecting Puconci 2 level crossing were not physically damaged in the accident.

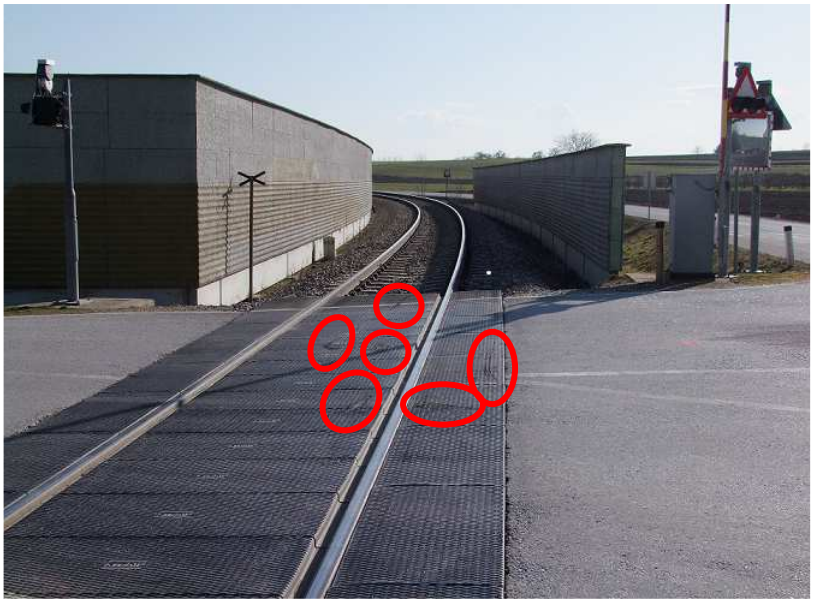

Figure 4: Traces of the collision on the rubber elements of the level crossing

4.1 Final account of the event chain

The accident – collision of freight train no. 42083 with the passenger vehicle at Puconci 2 level crossing between Dankovci and Murska Sobota stations at km 44+435 that is protected with half-barriers – on 25 February 2010 at 11:14 was directly caused by the passenger vehicle that circumvented the lowered half-barrier.

Morphological and pathological modifications of the myocardium were detected in the post-mortem examination of the deceased driver of the passenger vehicle performed by the Pathology Department of Murska Sobota Hospital; therefore, cardiac arrest cannot be completely ruled out as the cause of the accident. It is, however, not possible to define when these modifications occurred, since they could have occurred during the collision and not prior to it.

4.2 Discussion

Discussions about the cause and the consequences of the accident were held by various expert groups. Whether half-barriers are suitable protection at level crossings located at road junctions was also discussed.

Older drivers of passenger vehicles often belong to a vulnerable group of road users. Their physical and mental functions are diminished due to age and disease; hence they cannot in a given moment process as much information as the situation requires and, as a result, do not adopt the right decisions for safe manoeuvres.

It is a fact that road junctions are dangerous and full of traps, which means that road users must pay more attention to the traffic situation at road junctions. When a junction includes a railway crossing, it requires not only increased concentration but maximum concentration. It is also a fact that our physical and mental abilities differ; therefore, transport infrastructure must be designed so that it protects the most vulnerable groups of road users, especially the elderly and children.

Because of the proximity of houses to the railway line at Puconci 2 level crossing, a high noise barrier was constructed that has an additional impact on perception of facilities due to shading and colour spectra mixing.

4.3 Conclusions

Considering the findings of the investigation, level crossings located within the area of road junctions should be designed in such a manner that they are protected with barriers or half-barriers lowered across all the lanes. It may happen that a road user overlooks some key information when processing large amounts of information on the traffic situation in the shortest possible time, which can lead to hasty and wrong decisions.

Some decisions in road traffic can be corrected, but when these decisions involve rail traffic, such possibilities are rare and the consequences of wrong decisions are usually tragic.

4.4 Additional observations

The weather at Puconci 2 level crossing on 25 February 2010 at 11:14: +11 ℃ and clear; visibility was not obstructed.

The Ormož–Hodoš international border railway line is the main line. Its section from Puconci settlement to Hodoš international border was constructed in 2001. There was no railway line on the site of Hodoš 2 level crossing before 2001, and the elderly especially have not yet become accustomed to this new infrastructure.

4.5 Measures that have been taken

There is no record of any special measures having been previously taken or taken as a result of this accident collision of the train with the passenger vehicle at this level crossing.

4.6 Recommendation

Protection at Puconci 2 level crossing at km 44+435 between Murska Sobota and Dankovci stations should be upgraded – owing to the micro-location of the level crossing and noise barriers (the level crossing is located within the area of the junction and noise barriers diminish the ability to register the colour of half-barriers) – with half-barriers for all the lanes.

5 BIBLIOGRAPHY

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