REPUBLIKA SLOVENIJA

MINISTRSTVO ZA PROMET

SEKTOR ZA PREISKOVANJE ŽELEZNIŠKIH NESREČ IN INCIDENTOV

www.mzp.gov.si, e: gp.mzp@gov.si

Langusova 4, 1535 Ljubljana, t: 01 478 88 51, f: 01 478 81 46

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FINAL REPORT ON INVESTIGATION OF A RAILWAY ACCIDENT – COLLISION OF PASSENGER TRAIN NO. 2803 WITH ROAD FREIGHT VEHICLE AT THE CONSTRUCTED LEVEL CROSSING MARKED WITH ROAD SIGNS BETWEEN BLANCA AND SEVNICA STATIONS AT KM 481+840

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1 SUMMARY

On 6 April 2009, local passenger train no. 2803 collided with a road freight vehicle at a level crossing of a public path with a double-track railway line. The passenger train left Sevnica station at 12:15 and was travelling along the correct left-hand track of the railway line towards Blanca station.

A public tarmac path, an extension of public path no. 873212, runs parallel to the main railway line Dobova state border–Sežana state border. Approaching the settlement of Gornje Brezovo from the direction of Sevnica, the public path branches off the Sevnica–Blanca municipal road (R3-679), and on the opposite side of Gornje Brezovo it connects to the road at a right angle. From the direction of Dobova state border to Sežana state border, the public path runs immediately next to the right-hand track of the double-track railway line for about 730 m between km 481+540 and 482+270. At km 481+840 of the railway line, at the crossroads the road (the public path) branches off at a right angle, crosses the railway line and continues towards the Sava river. The road freight vehicle was travelling along the road from the direction of Gornje Brezovo towards the train coming from the direction of Sevnica.

The road freight vehicle drove onto the level crossing at the precise moment when train no. 2803 approached the crossing from the direction of Sevnica. The road freight vehicle first drove onto the right-hand track, which was at the time free of trains, and then proceeded onto the left-hand track where it collided with passenger train no. 2803 at km 481+838.5 at 12:18.

When the train hit the vehicle, the latter became attached to the automatic coupler and ended up wedged under the front of electric motor unit 312-119. The train pushed the vehicle forward for 289 m up to km 481+549.5, where it stopped.

The driver of the freight vehicle and his passenger were employees of PUH, d. d., a joint stock company for the management of torrential streams, and were on that particular day returning from work at the nearby torrential stream flowing into the Sava river.

The driver and his passenger were killed instantly. No person on the train was injured.

The road freight vehicle, a Fiat Doblo, was totally wrecked while the front and the automatic coupler of electric motor unit 312-119 were damaged. When the train was pushing the vehicle forward on the left-hand track, three switches for the automatic protection of the level crossings were damaged.

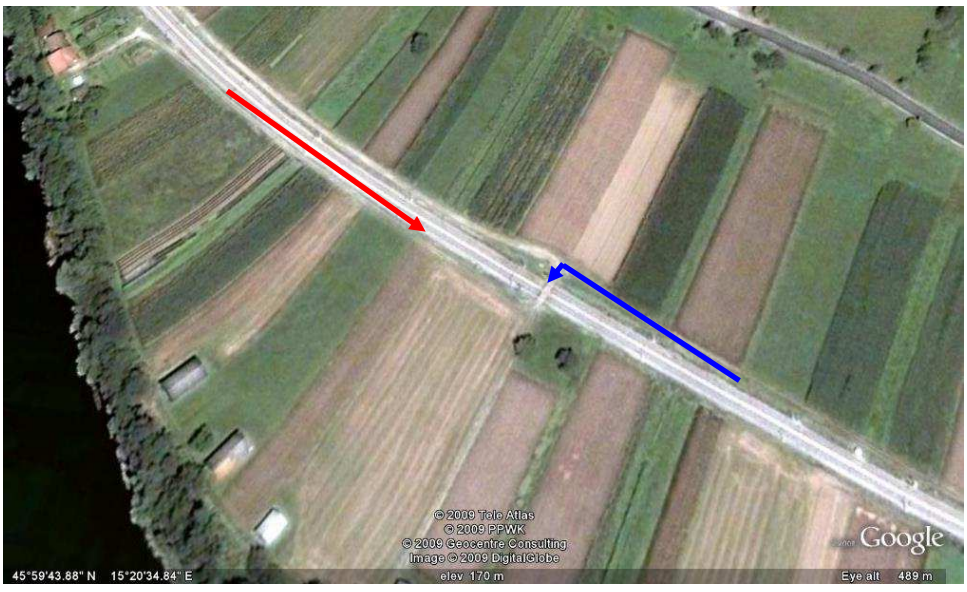

Figure 1: The blue arrow shows the direction of the road freight vehicle while the red arrow shows the direction of the local passenger train

Because of the accident, the traffic controller of Sevnica station immediately on being notified imposed an emergency closure of the left-hand track; it ended at 16:00.

The driver of the company road freight vehicle, a 43-year-old employee of PUH, d.d., citizen of the Republic of Slovenia, and Bosnia and Herzegovina, died in the accident.

The front of the trailer of electric motor unit was damaged in the accident, specifically, its air pipes, the remote cable and the coupler, and the sheet metal at the front of traction unit 312-119 was bent. Material damage, according to a non-expert assessment, amounts to EUR 2,000.

The road freight vehicle was totally wrecked in the accident. Material damage, according to a non-expert assessment, amounts to EUR 2,000.

Recommendations:

For the purposes of safety at the level crossing between Blanca and Sevnica stations at km 481+840, the maximum permitted speed of trains must be limited to 60km/h on the left-hand track from the direction of Sevnica for 370 m ahead of the crossing, and to 65 km/h on the right-hand track from the direction of Blanca for 400 m ahead of the crossing.

1.1. Copies of the accident report with recommendations to:

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

Republic of Slovenia
Ministry of Transport
Minister Patrick Vlačič
Langusova 4
1000 Ljubljana

Public Agency of the Republic of Slovenia for Railway Transport
Kopitarjeva 5
2000 Maribor

Sevnica Municipality
Glavni trg 19 A
8290 Sevnica

Ministry of the Interior
Police
Krško Police Directorate
Krško Traffic Police Station
Cesta svobode 13
8250 Brežice

ERA – European Railway Agency
120 rue Marc Lefrancq
BP 20392
F-59307 VALENCIENNES Cedex

2 IMMEDIATE FACTS OF THE OCCURRENCE

Article 51 of the Road Traffic Safety Act stipulates that:
– any crossing of a road with a railway line that is marked solely by road signs and is not protected with barriers, half-barriers or illuminated road signs warning of the approaching train is considered unprotected;
– adequate visibility must be provided to road users at unprotected crossings of roads with railway lines, taking into consideration the speed of trains along these sections; road users should also be able to easily notice an approaching train in a timely fashion; and
– road users must stop in front of crossings when a train is approaching such an unprotected crossing, must yield way to the train and can only proceed to cross the railway line after they have checked that no trains are approaching the crossing.
Since the timetable specifies that at this section the maximum permitted speed of trains is 100 km/h, the driver of the road freight vehicle should have been more alert and should have left the danger zone of the level crossing as quickly as possible.

2.1 Date, exact time and location of the occurrence

The accident – local passenger train no. 2803 colliding with the road freight vehicle at the constructed level crossing of the public road with the main double-track railway line that is marked with road signs – occurred on the left-hand track at km 481+840 on 6 April 2009 at 12:19.

2.2 Description of the events and the accident site

On 6 April 2009, a 43-year-old citizen of the Republic of Slovenia, and Bosnia and Herzegovina was driving a company road freight vehicle, a Fiat Doblo, from Gornje Brezovo to Sevnica along a public tarmac road running next to the main railway line. The driver wanted to cross the railway line at the constructed level crossing marked with road signs at km 481+840. Ahead of the crossing, he drove towards the approaching train travelling along the correct left-hand track from Sevnica station to Blanca station. When the driver of the road vehicle was approaching the level crossing, local passenger train no. 2803 was still behind the right bend (from the direction of Dobova), which on this section reduces visibility to 370 m on the left-hand track in the direction of Sevnica. At the moment the driver of the road vehicle entered the area of the level crossing, the local passenger train emerged from the right bend. When approaching the level crossing, the locomotive driver noticed that the road vehicle was driving towards the train along the road to the right of the railway line. The vehicle, without any prior warning, turned onto the crossing and crossed the right-hand track. The locomotive driver of local passenger train no. 2803 stated that he had thought the road vehicle would stop in front of the crossing but instead, the driver of the vehicle had even accelerated.

At 12:19, local passenger train no. 2803 hit the right-hand side of the road freight vehicle which became attached to the automatic coupler. The train carried and pushed the vehicle for 289 m until it stopped at km 481+555.5.

2.3 The body that established the investigation

The investigation procedure was launched by the Railway Accident and Incident Investigation Division of the Ministry of Transport of the Republic of Slovenia, Krško Traffic Police Station, Krško Police Directorate, and Slovenske železnice, d.o.o.
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 unprotected level crossings.

The Chief Investigator of the Railway Accident and Incident Investigation Division of 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.

Krško Traffic Police Station conducted an investigation in line with the Criminal Procedure Act.

2.5 The background to the occurrence

The accident involved the 43-year-old driver of the road freight vehicle, the 22-year-old passenger in this vehicle and the 38-year-old locomotive driver of train no. 2803.

There is no speed limit in force for road users on this section of the public road, but its tarmac surface does not enable high speed.

The maximum permitted speed as defined in the timetable for local passenger train no. 2803 for this section of the railway line is 100 km/h.

Road users approaching the level crossing from the direction of Gornje Brezovo have a good view of the railway line but not an adequate view for a speed of 100 km/h.

The road freight vehicle was registered and insured with the Adriatic Slovenica insurance company, insurance policy no. 9795. According to the vehicle registration certificate, the vehicle was owned by PUH, d.d., Hajdrihova ulica 28, Ljubljana Administrative Unit.

The public road, an extension of local road no. 873212, has a tarmac driving surface with a stabilised base, and was dry at the time of the accident.

Road traffic is very light at this level crossing. There is an average of sixty trains per day on workdays.

2.5.1 Staff involved

Staff involved in the accident:

The locomotive driver of local passenger train no 2803 employed with Slovenske železnice d.o.o., Business Unit Traction (*Poslovna enota Vleka*), Ljubljana Traction Section (*Sekcija za vleko Ljubljana*).

The locomotive driver passed the qualifying examination to operate diesel traction vehicles on 12 November 1992, electric traction vehicles on 16 December 2003 and electric motor unit series 312 on 15 June 2004.

The driver of the company road freight vehicle was a 43-year-old employee of PUH, d.d., and a citizen of the Republic of Slovenia and Bosnia and Herzegovina.

The driver of the road freight vehicle had a valid driving licence for categories B, G and H. It was issued by Idrija Administrative Unit on 22 April 1999 in exchange for a foreign driving licence, and was valid until 13 June 2045.

The passenger in the road vehicle was a 22-year-old citizen of Bosnia and Herzegovina, temporarily residing at [redacted]

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

Train no. 2803 was composed of a Siemens Desiro electric motor unit series 312 with traction units nos. 94 79 6312119-1 and 94 79 6312120-9, and trailer no. 94 79 6317110-5.

A category B driving licence is required to operate the road freight vehicle involved in the accident, a Fiat Doblo 1.9, registration LJ 42-6VP.

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

The main railway line from Dobova state border to Ljubljana has two tracks. Along the section between Dobova and Zidani Most stations trains travel on the right-hand track, which means that trains travel along the right-hand track from the beginning towards the end of the line. All stations from Dobova state border to Ljubljana are equipped with a Siemens SLT-30 signalling and safety device. Sections between stations are fitted with automatic line block devices (ALB). The railway line is electrified at 3 kV DC.
This section of the railway line consists of UIC-45 tracks.
The level crossing at km 481+840 is not protected and not equipped with a safety device. The crossing is 3.80 m wide and 5,670 mm long measured between the outside profiles of the two tracks. The part of the crossing used by road vehicles is constructed of sleepers. The level crossing is on both sides for the benefit of road users marked by the “St. Andrew’s Cross” road sign.

2.5.4 Means of communication

Boxes containing telephones with an internal connection to the two traffic controllers of the neighbouring stations and to the dispatcher of the relevant electric supply stations, with a construction line utilised during construction works, an emergency line utilised in case of accidents, and a line communication connection utilised during maintenance works by maintenance teams, are installed along the entire length of the railway line at every main signalling device.

2.5.5 Works carried out at or in the vicinity of the site

No construction works were being carried out at the site of the accident or in its immediate vicinity at the time of the accident.

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

The locomotive driver of train no. 2803 notified the train dispatcher of Ljubljana Transport Division (*Prometna operativa Ljubljana*) of the accident on the emergency channel of the A60 radio dispatch communication system. The train dispatcher forwarded the notification to the Sevnica station traffic controller who informed the Operation and Communication Centre of Krško Police Directorate.
A rescue team of Sevnica Health Centre and a police patrol of Krško Traffic Police Station were dispatched to the site of the accident. The latter inspected the site and documented the scene after the accident. An inspector of the Uniformed Police Division of Krško Police Directorate, an investigative judge of Krško Local Court, a state prosecutor of Krško Local Prosecutor's Office and the Chief Investigator of Railway Accidents and Incidents of the Ministry of Transport inspected the site of the accident.

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

After the notification provided by the Sevnica station traffic controller, an emergency plan of rescue measures was set in motion. A physician from Sevnica Health Centre arrived at the scene of the accident and, having examined the driver of the road vehicle and his passenger,

confirmed their deaths.
Afterwards, the fire-fighters from Sevnica Professional Fire Brigade who arrived at the scene of the accident with one special fire-fighting vehicle cut the vehicle to remove the two dead bodies.
The fire-fighters removed the road freight vehicle from the front of electric motor unit 94 79 6 312 119-1 of train no. 2803 where it had become attached to the coupler and ended up wedged under the traction vehicle.

2.6 Fatalities, injuries and material damage

The driver of the company road freight vehicle, a 43-year-old employee of PUH, d.d., and citizen of the Republic of Slovenia, and Bosnia and Herzegovina, and the passenger in this vehicle, a 22-year-old citizen of Bosnia and Herzegovina, temporarily residing at [redacted] and also an employee of PUH, d.d., were killed in the accident.

The front of the traction unit of electric motor unit (series 312-119) was damaged: the automatic coupler was damaged and the metal sheet bent. According to a non-expert assessment, material damage amounts to EUR 4,000.

The following track devices were also damaged: two axle counters, a distributor of magnetic track contacts, two magnetic track contacts and their covers. According to a non-expert assessment, material damage amounts to EUR 25,000.

The road freight vehicle was totally wrecked in the accident. According to a non-expert assessment, material damage to the road vehicle amounts to EUR 3,000.

2.7 External circumstances

Weather conditions at the time of the accident: sunny, +21° C, good visibility. The sun did not reduce the visibility of the driver of the freight vehicle in the direction of Sevnica. From the level crossing at km 481+840 in the direction of Sevnica, the sighting distance is 370 m.
The public road surface was dry and dusty, with a well stabilised base; and the tyre grip was suitable for a tarmac road with a stabilised base.

3 RECORD OF INVESTIGATIONS AND INQUIRIES

At 14:30 on the day of the accident, 6 April 2009, the Chief Investigator of Railway Accidents and Incidents at the Ministry of Transport inspected the site of the accident.
Incident Registration Form No. 12/2009 dated 7 April 2009 was received from Slovenske železnice, d.o.o., Ljubljana Traffic Management Section (*Sekcija za vodenje prometa Ljubljana*), Dobova Supervisory Station (*Nadzorna postaja Dobova*).
On 22 April 2009, the Railway Accident and Incident Investigation Division received a copy of the investigation material, no. 0211-16/2009/2 (3D6611-6) of 20 April 2009, from Krško Traffic Police Station.
On 24 April 2009, the Railway Accident and Incident Investigation Division received from the Internal Control Service (*Služba za notranji nadzor*) of Slovenske železnice, d.o.o., the investigation material, no. 1.0.4./15-950/09 of 22 April 2009, prepared by Ljubljana Traction Section (*Sekcija za vleko Ljubljana*) and Ljubljana Traffic Management Section (*Sekcija za vodenje prometa Ljubljana*).
On 22 May 2009, the Chief Investigator of Railway Accidents and Incidents at the Ministry of Transport carried out measurements of the visibility of this level crossing and collected additional information on the accident.
On 7 September 2009, the Railway Accident and Incident Investigation Division received the Commission's report on the investigation into incident no. 12/2009 dated 20 May 2009 from Slovenske železnice, d.o.o., Ljubljana Traffic Management Section (*Sekcija za vodenje prometa Ljubljana*), Dobova Supervisory Station (*Nadzorna postaja Dobova*).

3.1 Summary of testimonies

In the Daily Report on Incidents EV-49, no. 133/09 Mb of 7 April 2009, the locomotive driver of train no. 2803 stated that train no. 2803 had hit a road vehicle at km 481 on 6 April 2009 at 12:18.

Events related to the oncoming train and events immediately following the collision are described in the Protocol of the interview with a worker who is a party to the proceedings – a witness – the locomotive driver of train no. 2803. The locomotive driver explained that when his train had been approaching the site of collision, he had noticed a road vehicle driving towards the train on the left-hand side of the railway line. Without any prior warning, the vehicle drove onto the level crossing and crossed the neighbouring track; the locomotive driver thought that the vehicle would stop in front of the crossing, but in fact at the last moment the driver accelerated, which resulted in the collision. After the collision, the locomotive driver immediately notified the dispatcher of the accident via the emergency channel of the A60 radio dispatch communication system. The site of the accident was protected by two members of the train crew.

A resident of [redacted] who was at the time of the accident next to his house, where his view of the entire area of events prior to the accident was not obstructed, stated that the road freight vehicle had been driving along the public path towards the level crossing from Gornje Brezovo to Sevnica.

3.2 The safety management system

Road users are warned of the level crossing with a double-track railway line at km 481+840 between Blanca and Sevnica stations by road signs no. I-38 ("St. Andrew's Cross"), and no. II-21 ("Height limit for vehicles"), which marks a road or a section of the road where entry is prohibited for vehicles exceeding the maximum height specified on the road sign. The two signs are posted one on top of the other on poles erected on both edges of the road and are diagonally connected with wires at the height of road sign no. II-21.

The road is 4 m wide; its surface is tarmac and is well maintained. The road runs parallel to the railway line at the same elevation and crosses the railway line at a right angle. The crossing is suitably marked, road signs are clear and, considering the driving conditions on this road, it is visible to road users at an adequate distance. Nothing blocks the view of these road signs.
Ahead of the level crossing, there is a slight bend in the road running parallel to the railway line. The sighting distance of road users at the level crossing is 370 m for trains approaching from Sevnica and 399 m for trains from Blanca.
The maximum permitted speed for trains on this section is 100 km/h.

Figure 2: Visibility or view of the railway line from the level crossing in the direction of Sevnica

3.3 Rules and regulations

Crossings of roads with railway lines at unprotected level crossings are governed by Articles 51 and 52 of the Safety of Railway Transport Act (*Uradni list RS* [Official Gazette of the Republic of Slovenia], No. 61/2007 of 10 July 2007), and Articles 50 and 51 of the Safety of Road Transport Act (*Uradni list RS*, No. 56/2008 of 6 June 2008).

Crossings of roads with railway lines at level crossings are regulated in more detail by the Rules on Railway Level Crossings (*Uradni list RS*, No. 85/2008 of 29 August 2008).

Dimensions of road vehicles are stipulated by Article 3 of the Rules on Dimensions and Weights of Road Vehicles (*Uradni list RS*, No. 138/2006 of 28 December 2006).

The status of a public road is defined in Article 14 of the Public Roads Act, official consolidated text (ZJC-UPB1 – *Uradni list RS*, No. 33/2006 of 30 March 2006).

3.4 Operation of rolling stock, technical facilities and technical installations

All Siemens series 312 electric motor units of Slovenske železnice, d.o.o., have built-in Deuta Werke electronic speed recorders. This device also records every application of braking and safety systems installed in such units.

The recorded speed of the train 295 m before stopping was 97 km/h, which means that the locomotive driver activated the high-speed brake immediately prior to collision. The train hit

the road freight vehicle at a distance of 289 m from the point of stopping – 6 m ahead of collision. Considering that the average response time of locomotive drivers equals 1 s and that it took about 3 s for the brakes to actually become operational from the moment of their activation, the locomotive driver activated the high-speed brake about 80 m ahead of collision.

3.5 Documentation on the operating system

The unprotected level crossing between Blanca and Sevnica stations at km 481+840 is not fitted with operating or any other safety systems. Busier level crossings along the entire section of the Dobova state border–Zidani most railway line are protected by barriers, half-barriers or illuminated road signs for road users. Level crossings with barriers or half-barriers are for protection equipped with two different devices:

- automatic protection with remote control in station area (*DK–PO*), and
- automatic protection with remote control (*DK*).

3.6 Man-machine-organisation interface

At the level crossing between Blanca and Sevnica stations at km 481+840, no special devices are installed to assist drivers of locomotives and road vehicles in reducing the speed and stopping. Locomotive drivers and drivers of road vehicles operate their vehicles by pressing or releasing the accelerator and applying braking devices.

Series 312 electric motor units are fitted with a pneumatic braking system that becomes effective after 2 seconds.

The locomotive driver of train no. 2803, who was involved in the railway accident at the level crossing at km 481+840 between Blanca and Sevnica stations on 6 April 2009 at 12:19, 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.

The driver of the road freight vehicle with a dual citizenship of the Republic of Slovenia, and Bosnia and Herzegovina, who died of the injuries 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 freight vehicle involved in the accident, but there is no record of his driving experience since his driving licence was issued by Idrija Administrative Unit on 22 April 1999 in exchange for a foreign driving licence.

3.7 Previous occurrences of a similar character

A similar occurrence at the level crossing between Blanca and Sevnica stations at km 481+840 was recorded on 26 August 1998 at 18:20. Freight train no. 45935 collided with a tractor on the left-hand track. Train no. 45935 was travelling from Sevnica along the left-hand track and hit the tractor that was crossing the railway line. The driver of the tractor was seriously injured in the accident.

4 ANALYSIS AND CONCLUSIONS

According to the analysis of the visibility at the level crossing, the views of the drivers of the road vehicle and the locomotive were not obstructed at the time of the accident. Road signs no. I-38 ("St. Andrew's Cross") and no. II-21 ("Height limit for vehicles"), marking a road or a section of the road where entry is prohibited for vehicles exceeding the maximum height specified on the road sign, are posted one on top of the other on poles erected on both edges of the road on the two sides of the level crossing, and clearly indicate the crossing of the road with the railway line.

From the direction of the level crossing towards Sevnica, a road user's field of view is limited by the bend and the church standing by the roadside at the end of the bend. The field of view measures 370 m. At the end of the bend in the direction of Blanca, the field of view is limited by a gentle slope and measures 399 m.

At a speed of 100 km/h, a train travels 27.7 m/s, which means that it covers a distance of 370 m in **13.4 s**.

The distance to be covered by a road user crossing the level crossing does not depend solely on the danger zone at the level crossing but also on the length of the vehicle and time spent by the driver checking in both directions if there are any trains approaching, and making the decision to cross the tracks.

The danger zone at this level crossing or the crossing is 10.270 m long.

Figure 3: Train coming into a road user's view

4.1 Final account of the event chain

Considering the fact that the train was travelling at a speed of 97 km/h, which means 26.94 m/s, it covered a distance of 370 m in **13.73 s**.

The danger zone at this level crossing or the crossing is 10.270 m long.

The road vehicle, a Fiat Doblo, measures 4.253 m in length and therefore must cover a distance of 14.523 m from the point where it enters and exits the danger zone. Furthermore, considering the fact that road vehicles drive slowly when crossing the railway line because of the road surface, it takes a road vehicle driving at a constant speed of 5 km/h, which equals 1.38 m/s, at least **10.52 s** to drive through the danger zone.

With respect to this particular accident, the time spent by the driver checking if any trains were approaching must also be taken into account. In this case, the driver had to make sure

that the right-hand track was free, which might have taken **3 s** or even longer. If the driver wanted to know for certain that the right-hand track was free while driving towards the level crossing, he had to turn the upper part of his body for around 180 degrees.
It is possible that the driver while driving towards the level crossing observed the railway line in the direction of Sevnica and, since he did not see a train because the latter was at that moment hidden behind the bend, believed that no train is coming from this direction. For this very reason, immediately ahead of the level crossing he probably focused on checking for trains in the direction of Blanca. At the moment he entered the danger zone of the level crossing, he suddenly saw the train approaching on his left along the left-hand track.

4.2 Discussion

Constructed level crossings of roads with double-track railway lines that are marked with road signs but are located at bends are especially dangerous for road users. The distance that they have to cover to exit the danger zone of the level crossing is anything but short.

Drivers of road vehicles must perform a number of actions within the available time, instantly make decisions and simultaneously operate their vehicles. Considering the sighting distance of road users at this level crossing, it is very difficult for them to establish along which track the train is approaching, let alone the speed of the train and the distance covered by the train within a certain period of time.

It is of utmost importance to provide road users at constructed level crossings marked by road signs with sufficient time to cross the railway line safely. All the individual units of time needed for safe crossing of a railway line must be included into this time frame. Sufficient time must be available to make sure that the left- and right-hand tracks are free. The speed of vehicles on rails must be adjusted to the sighting distance or visibility.

Figure 4: Illustrates that at the start of the field of view road users cannot assess along which track the train is travelling

4.3 Conclusions

At a speed of 100 km/h, a train travels 27.8 m/s, which means that it covers a distance of 370 m in **13.31 s**.

The length of road vehicles is limited to 12 m and the level crossing between Blanca and Sevnica stations at km 481+840 is 10.27 m long. The sum equals 22.27 m in length.

A 12-meter long road vehicle travelling at a speed of 5km/h (i.e. 1.4 m/s) covers a distance of 22.27 m in **15.9 s**.

The road freight vehicle, a Fiat Doblo, involved in the accident is 4.253 m long, which means that it must cover a distance of 14.523 m considering the length of the level crossing (10.27 m). At a constant speed of 5 km/h (i.e. 1.39 m/s) the vehicle covers a distance of 14.523 m in **10.45 s**.

The calculated time that is needed to drive safely over the level crossing explains the cause of this accident. The driver of the road freight vehicle did not properly check if a train was approaching the level crossing. He entered the danger zone of the level crossing at the moment when train no. 2803 was approaching along the left-hand track from the direction of Sevnica.

The investigation has established that the driver of the road vehicle did not yield way to the train at the unprotected level crossing. This is the direct cause of the accident in which train no. 2803 collided with the road freight vehicle on the left-hand track at the constructed level crossing marked with road signs between Blanca and Sevnica stations at km 481+840.

4.4 Additional observations

The agricultural area measuring around 100,000 m² and located between the Sava river and a section of the double-track railway line Dobova state border–Zidani most is connected to the settlement of Gornje Brezovo on the opposite side only via the level crossing at km 481+840. For safe crossing of the railway line by road users, provisions of Article 34 of the Rules on Railway Level Crossings (*Uradni list RS* [Official Gazette of the RS], No. 85/2008 of 29 August 2008) must be complied with.

It is also possible that immediately before the driver decided to cross the railway line, his view of the railway line on his left was obstructed by the windscreen column of his vehicle, which would explain the statement by the locomotive driver of train no. 2803 that the driver decided to drive over the level crossing in spite of the approaching train.

The investigation has established that all road users are not given sufficient time to drive safely over the level crossing between Blanca and Sevnica stations at km 481+840. The maximum permitted speed of trains prescribed by the time table is too high throughout the visibility area at the level crossing and should be reduced.

It has also been established in the investigation that the additional 6 s for safety as prescribed by Article 34 of the Rules on Railway Level Crossings (*Uradni list RS* [Official Gazette of the RS], No. 85/2008 of 29 August 2008) are not taken into consideration at this level crossing. The latter stipulates that when vehicles stop in front of the “St. Andrew’s Cross” road sign at an unprotected level crossing, the distance from the point of stopping or the point where the driver must be able to see an approaching train to the point of sighting must be such that the approaching time of a rail vehicle, including the additional 6 s for safety, is longer than the time required by the longest road vehicle to drive over the level crossing minus the stopping distance at an average speed of 5 km/h.

The longest vehicle measuring 12 m covers the distance of the danger zone (10.27 m) at the level crossing in 16.04 s, plus the additional 6 s for safety equals **22.04 s** or the time that must be provided to road users. This means that 370 m ahead of the level crossing the speed of trains must be reduced to maximum 60 km/h in order to prolong the time needed by a train to pass the level crossing to **22.19 s**.

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 the accident at this level crossing.

4.6 Recommendations

For the purposes of safety at the level crossing between Blanca and Sevnica stations at km 481+840, the maximum permitted speed of trains must be limited to 60km/h on the left-hand track from the direction of Sevnica for 370 m ahead of the crossing, and to 65 km/h on the right-hand track from the direction of Blanca for 400 m ahead of the crossing.

5 BIBLIOGRAPHY

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Daniel Lenart, Undersecretary
Chief Investigator of Railway Accidents
and Incidents