Central Investigation Office of the

Federal Railway Accident Investigation Office

Accident Investigation Report



Collision between trains

at Hordorf crossover

Magdeburg central station – Halberstadt

Bonn, 14 September 2011

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Derailment, Stuttgart-Untertürkheim, 15 March2010

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1 Summary

1.1 Sequence of events

At approximately 22:28 on 29 January 2011, a frontal collision between freight train DGS 69192 proceeding towards Oschersleben and passenger train DPN 80876 proceeding towards Halberstadt occurred at the Hordorf crossover [double to single line junction] at kilometre 42.702. At that point, the Magdeburg – Halberstadt line (line No 6404) is single.

The passenger train, DPN 80876, unit No VT 810 of the LINT 41 type, was hit by freight train DGS 69192 proceeding towards Oschersleben and was completely derailed. The freight train was loaded with limestone and hauled by two diesel locomotives of the Vossloh G 1700-2 BB type.

1.2 Consequences

At the time of the accident thirty-two people were in the passenger train.

Ten people were fatally injured, amongst them the driver of the passenger train and a [female] train conductor. Twenty-three people were injured, some seriously, including the driver of the freight train.

Passenger train DPN 80876, operated by Veolia Sachsen-Anhalt GmbH, was flung off the track by the force of the impact and came to rest, severely damaged, beside the track.

Freight train DGS 69192, operated by VPS (Verkehrsbetriebe Peine-Salzgitter), remained completely on the track. After the impact, the leading locomotive of the two on the freight train was pulled off the track and came to rest some 130 m from the track. This locomotive was very severely damaged.

1.3 Causes

Immediately after arrival at the site of the accident at about 04:00, the investigation revealed that of the signals passed by freight train DGS 69192, the signal in advance showed the Vb aspect, 'expect stop' and the block signal showed the Hp0 aspect 'stop' and furthermore that No 1 switch at the Hordorf crossover had been run through. The

freight train entered an occupied section and in consequence collided with the passenger train approaching from the opposite direction on the single line.





Illustrations 1 and 2 – photographs at the site of the accident

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2 Preliminary remarks

2.1 Those involved

The following organisations took part in the on-site investigation and the subsequent determination of the causes:

- Federal Railway Accident Investigation Office, Berlin Area Investigation Office
- Section No 3 of the Federal Railway Authority [Eisenbahn-Bundesamt (EBA)]: Halle outstation Supervision of signal, telecommunications and electro-technical installations

2.1.1 Staff members, contractors and other parties involved and witnesses

At the time of the event there was a signaller on duty in the signal box at Hordorf. Undertaking: DB Netz AG.

The leading vehicle of freight train DGS 69192 was occupied by a driver. Undertaking: Verkehrsbetriebe Peine-Salzgitter (VPS).

Passenger train DPN 80876, unit No VT 810 of the LINT 41 type was occupied by a driver. Undertaking: Harz-Elbe-Express (HEX) passenger train operated by Veolia Verkehr Sachsen-Anhalt GmbH.

2.2 Organisational note

Directive 2004/49/EC on safety on the Community's railways (the Railway Safety Directive) obliged EU Member States to set up independent investigating bodies to investigate particular dangerous events. This directive was transposed into national law by the fifth Railway Regulations Amendment Act of 16 April 2007, and the Federal Railway Accident Investigation Office [Eisenbahn-Unfalluntersuchungsstelle des Bundes (EUB)] was established. The Railway Safety Directive was further transposed in the Railway Accident Investigation Regulation Regulation [Eisenbahn-Unfalluntersuchungsverordnung (EUV)] of 5 July 2007.

The management of the Federal Railway Accident Investigation Office is the responsibility of the Federal Ministry of Transport, Building and Urban Development [Bundesministerium für Verkehr, Bau und Stadtentwicklung (BMVBS)]. The management of the Federal Railway Accident Investigation Office can call on the

Central Investigation Office within the Federal Railway Authority to help it carry out investigations. For technical matters, the Central Office reports exclusively and directly to the director of the Federal Railway Accident Investigation Office.

Further details of these arrangements are given on the Internet under >> www.eisenbahn-unfalluntersuchung.de << [only available in German].

2.3 Purpose of railway accident investigation

The investigation was initiated because of the type of event (collision) and the severity of the accident.

The aim and purpose of the investigations is to establish the causes of dangerous events and hence to derive ways of improving safety. Investigations by the Federal Railway Accident Investigation Office do not serve to establish fault or to clarify issues of liability or other claims in civil law. They are conducted independently of any judicial investigation.

Investigation includes collecting and evaluating information, drawing up conclusions including establishing the causes and, as appropriate, issuing safety recommendations. The Investigation Office's proposals to avoid accidents and improve the safety of rail traffic are notified to the safety authorities and, as necessary, to other bodies and authorities and other EU Member States in the form of safety recommendations.

3 The event

3.1 Sequence of events

At approximately 22:28 on 29 January 2011, a frontal collision between freight train DGS 69192 proceeding towards Oschersleben and passenger train DPN 80876 proceeding towards Halberstadt occurred at the Hordorf crossover at kilometre 42.702. At that point, the Magdeburg – Halberstadt line (line No 6404) is single.



Figure 1: Outline situation plan

The passenger train, DPN 80876, unit VT 810 of the LINT 41 type was hit by freight train DGS 69192 proceeding towards Oschersleben and was completely derailed. The freight train was loaded with limestone and hauled by two diesel locomotives of the Vossloh G 1700-2 BB type.

The Harz-Elbe-Express (HEX) passenger train operated by Veolia Verkehr GmbH proceeding from Oschersleben should have crossed from the single track Oschersleben - Hordorf section to the double track section continuing to Halberstadt at Hordorf crossover. The route was set up for this movement, all the conditions were satisfied, i.e. No 1 switch was set and locked by No 1 point-lock, and the stop signal A was at proceed.

Freight train DGS 69192 came from the Halberstadt direction with a delay of some two hours, according to DB Netz AG. The book timetable schedules freight train DGS 69192 to run from the double track to the single track section towards Oschersleben without stopping.

Instead of waiting for passenger train DPN 80876 to take precedence and run past because of the delay, the [freight] train passed signals Vb and B showing 'expect stop' and 'stop' aspects. In doing so it ran through No 1 switch set for the passenger train.

The collision of the two trains took place at about km 42.702, a short distance after the Hordorf crossover in the direction of Oschersleben. Even the emergency stop instruction given by the signaller shortly beforehand could no longer prevent the collision. As a consequence of the impact, passenger train DPN 80876 derailed completely and the front section was completely destroyed. The [two sections] of the passenger train tipped over onto their sides and came to rest beside the track. The freight train came to rest 500 m further on. As it continued, the first of the two locomotives was separated from the train and only came to rest some 130 m later. That diesel locomotive was likewise severely damaged, particularly in the forward part around the diesel engine itself. The left hand side of the cab in the direction of travel was likewise completely destroyed.

3.2 Fatalities, injuries and damage to property

At the time of the accident thirty-two people were in the passenger train.

Ten people were fatally injured, amongst them the driver of the passenger train and a [female] train conductor. Twenty-three people were injured, some seriously, including the driver of the freight train.

The passenger train, a Harz-Elbe-Express (HEX) operated by Veolia Verkehr Sachsen-Anhalt GmbH DPN 80876, unit No VT 810 of the LINT 41 type, was completely destroyed.

The leading locomotive of the two diesel locomotives of type Vossloh G 1700-2 BB on the freight train was likewise 80 % destroyed.

The cost of damage to property was estimated by the infrastructure manager as some EUR 7 million.

3.3 Weather conditions

To establish whether and to what extent local weather conditions could have influenced the event, the German Meteorological Office was asked for an 'expert opinion'. It emerged from this report that visibility at the time of the accident could have been limited. The evaluation of satellite images revealed that at the time in question, the area around the site of the accident was continuously covered by cloud. However, the satellite images did not allow the experts to say whether the cloud reached down to the ground. Nevertheless, there was at the least a high probability of severe mist throughout the day, with visibility between 1 000 and 2 000 m. From time to time there was a build up of fog with visibility between 500 m and 1 000 m. Since the effect of fog can vary significantly as a function of time and distance, more specific statements on visibility are not possible in retrospect. Nevertheless, it is a fact that the topographical situation of the site of the accident typically favours the build-up of fog.

The driver of train 80877 – which travelled along the section towards Oschersleben before the freight train – said that visibility in the Hordorf area at around 22:10 was about 100 m to 150 m.

It can also be assumed from a recorded telephone call between the emergency control centre and the emergency manager that visibility conditions for the emergency manager's journey to the site of the accident were not good.

4 Investigation report

4.1 Summary of statements

The following section contains statements from the signaller at the Hordorf crossover, from the two wagon examiners who took part in the preparation of the freight train and from the driver of passenger train 80877 which preceded the freight train. The driver of the freight train provided no information about the incident.

Signaller:

Up to the time of the accident, work was as normal and there were few delays. The HEX from Magdeburg should have passed Hordorf crossover at 22:22, but it was delayed by two minutes. Signal A showed a proceed aspect for the passenger train. Freight train DGS 69192 was reported as leaving Groß Quenstedt at 22:13. Stop signal B showed a stop aspect and the freight train should have stopped there. The signal in advance, Vb, is linked to the stop signal and should have shown 'expect stop'.

At 22.21 the Hordorf signaller offered HEX 80876 forward with an anticipated time of 22:24. The signaller at Groß Quenstedt accepted the train. Subsequently he put No 1 switch into the appropriate position and locked it with facing point lock No 1. Then he put route locking lever 'a' in the correct position and locked it using the locking button a/b. Then he was able to clear signal A to 'proceed'.

Shortly after the route was set up, the signaller heard the noise of the freight train. He looked in the Nienhagen direction, the direction from which the freight train was to come. In his judgement, the freight train was approaching at about 80–90 km/h. He pressed the emergency stop button straightaway. No 1 switch had already been run through by the freight train. The crash occurred shortly afterwards.

Wagon examiner for train 59906 (16 wagons, which subsequently formed the first part of train DGS 69192 from Blankenburg station) :

The wagon examiner made a statement to the Federal Police that a routine examination of the train took place on the day of the accident. A record was made of this examination. Nothing unusual was detected in the technical examination.

Wagon examiner for train 59910 (16 wagons, which subsequently formed the second part of train DGS 69192 from Blankenburg station):

This wagon examiner also made a statement to the Federal Police that a technical examination of the wagons was made after they were loaded. He also stated that no damage or defects were present.

Furthermore, this wagon examiner reported that the brake test had already been carried out by the driver and a shunter in the 'FELS' plant in Rübeland.

He also reported that, on that evening, late shift staff in Blankenburg Nord station had coupled the two sections of the train together.

Driver of passenger train HEX 80877:

The driver stated that shortly before Hadmersleben station he had heard an emergency call over the train radio. After calling the Hadmersleben signaller he learnt simply that the emergency call did not apply to him.

On the weather, he commented that he would judge visibility in the area around Hordorf to be about 100–150 metres on that evening.

4.2 Safety management system

4.2.1 Management of emergencies

In accordance with Article 4(1) of the General Railway Act [Allgemeines Eisenbahngesetz (AEG)], railways have an obligation to cooperate in fire protection and technical assistance measures. The interior ministries of the *Länder* and DB AG have agreed the procedure to be adopted. For DB Netz AG, the *Länder* legislation for defence against fire and catastrophe applies. DB AG's emergency management [procedure] is described in more detail in, and governed by, DB Group Guideline (Ril) 123.

In accordance with Guideline 123.0110, emergency zones are to be defined in such a way that each point of deployment can be reached within thirty minutes.

DB Netz AG's emergency control centre in Leipzig was informed of the event by the Hordorf signaller at about 22:30.

There is no evidence that any delay, disruption or similar arose in the management of the emergency.

4.2.2 Investigation into management of training

The following section investigates the training management of the driver of HEX 80876 passenger train, the driver of VPS freight train DGS 69192, and the Hordorf signaller.

4.2.2.1 Driver of VPS freight train DGS 69192

Included in the investigation into the management of training, fitness, training and supervision, route knowledge and working time were examined.

4.2.2.1.1 Medical fitness

The driver was assessed as fit on 8 December 2008. His next medical examination is due in December 2011. In the examination, no failure to meet the VPS fitness criteria was noted. The requirements which Article 48 Railway Construction and Operating Notice [Eisenbahn-Bau- und Betriebsanweisung (EBO)] makes on operating staff are included in the VPS fitness criteria.

4.2.2.1.2 Training and further training

The driver sat and passed the examination for working as a train driver on the DB AG infrastructure on 18 March 1998.

It can be demonstrated that the driver regularly took part in further instruction and in simulator training. No failure to meet the requirements of VDV [Verband Deutscher Verkehrsunternehmen - Association of German Transport Companies] paper 753 'Train driving licence directive' was detected in the investigation.

4.2.2.1.3 Supervision and route knowledge

A train driver is supervised and his route knowledge monitored by means of the route knowledge self supervision record (a form taken from the VPS file). According to this document, the VPS driver of the freight train had route knowledge. The duty rosters also showed indisputably that the appropriate route knowledge had been acquired. No failure to meet the requirements of VDV paper 755 'Route knowledge directive' was detected in the investigation.

4.2.2.1.4 Working time

It may be assumed from the papers seen that the driver worked exclusively for VPS. At the time of the event, the driver had been on duty for some five hours. He had had an unbroken rest period of some eighteen hours before he started work at 17:30. His journey to work took some twenty minutes. The documentary check that was carried out provided no indication that overtiredness could have occurred on account of missing breaks or rest-time or exceeding driving time. As has already been explained in Section 4.1, the driver has not yet commented on the matter. The guidelines from the [German] Working Time Act [Arbeitsgesetz] formed the reference documents for the investigation. The pattern of work set down in the duty roster likewise complied with the provisions of the Working Time Act.

4.2.2.2 Driver DPN 80876

This staff member had the training and route knowledge required for the section in question. He took part in regular continuous training and was supervised in accordance with the internal regulations of the undertaking.

4.2.2.3 Signaller Hordorf crossover

This staff member had had the training required and had been examined on the signal box in question. He took part in regular continuous training and was supervised in accordance with the internal regulations of the undertaking. He had had the rest time required by the regulations.

4.3 Investigation of the infrastructure and signalling system

4.3.1 General description of the technology of the safety installations

Hordorf crossover signal box is of a standard mechanical type. The signal box has levers within a lever frame; there are two signal levers A and B, No 1 point lever, No 1 facing point lock lever and a route locking lever.

There is a mechanical block working with block equipment and route-locking mechanism with route locks and an interlocking box.

In a wall cupboard with a small service desk above is the type I - relay group for colourlight repeater signals Va and Vb.

The external installations consist of the two semaphore signals A and B, No 1 switch, the facing point lock for it and the external cable work necessary to set them. Repeater signals Va and Vb are colour-light signals, in each case 700 m before the semaphore signals. Intermittent automatic train control is not available. Train radio is analogue and equipment to report that the line is clear is not provided.

Immediately next to the signal box is a mechanical full barrier level crossing which is electrically driven (Dresden type). The operating desk for the electric mechanism to operate it is in the signal box and has a view over the level crossing.

4.3.2 Investigation of the safety installations

The following observations were made immediately after the event:

- The position of the levers in the lever frame was: No 1 switch 'reversed' and locked by facing point lock No 1, signal A in the proceed aspect;
- The lever setting of signal A, the position of the arm on the signal including the green spectacle glass, [lit] lantern under the arm concurred, all checked visually and documented by pictures;
- 1. No 1 switch had been run through, the fact that it had been run through was documented;

• As a cross-check, signal B could not be put into 'proceed'.

On arrival there was no indication either optically (through the light being out) or acoustically (by means of the light-out indicator warning bell) that the repeater signals had failed. The possibility that a different aspect was shown by the repeater signals from that shown by the stop signal (in this case Vb differing from B) can be excluded because the colour-light repeater signals Va and Vb are automatically controlled by the appropriate stop signal.

The clarity of the stop indication on the signals was confirmed and documented by the Federal Police on the spot.

4.4 Investigation of operational activities

Recordings and the papers available assisted the investigation of the operational activities. The emergency calls received by the operating centres provided further recordings.

The Hordorf signaller made an emergency stop order shortly before the collision. To provide specific proof, DB Netz AG submitted a recording from the operating centre; further evidence is provided by the statement by a HEX driver who was not involved in the accident.

4.4.1 Operational activities of the driver of freight train DGS 69192

Since, as has already been mentioned, the driver has not commented on the affair, activities can only be reconstructed on the basis of the plotter recording of the journey. It is apparent from the journey record that some 8 km before the impact at 22:19, a reduction in speed from some 71 km/h to a complete standstill was registered. The train stood for some 36 seconds. Why the train was stopped at this point could be established. Questions put to the VPS (Operations Director) and DB Netz AG did not produce answers. According to the plotter recording of the journey, the driver kept to the speeds laid down.

4.5 Exchange of voice messages in connection with the event including documentation of recordings

Hordorf crossover is fitted with analogue radio, i.e. operations-related conversations are not recorded.

4.6 Investigation of rolling stock and technical installations

4.6.1 Evaluation of diagnostic equipment records in freight locomotive cabs

The diagnostic equipment (with flash cards) from the locomotives of the freight train was recovered and dismantled by the regional police [Landespolizei].

The flash cards from the diagnostic devices in the possession of the police were read by the manufacturers, Vossloh Locomotives GmbH, Kiel, with the following results:

According to the statement dated 4 February 2011, it must be assumed that the leading locomotive 1704 was occupied by the locomotive driver and that rapid braking was also initiated by that driver. A signal recorded in the evaluation gave rise to the interpretation that it represented the deliberate operation of a lever. Braking had not then started; the speed after this record and at the time of the collision was still 69.7 km/h.

According to a statement by a Vossloh staff member, the error code of 62120 'malfunction of the compressor switch valve' which was shown, had no significance for the accident but simply referred to the changes in the rpm.

No faults were found in the braking equipment. A further indication that the braking equipment on freight train DGS 69192 worked, is an non-timetabled stop some 8 km before the site of the accident. This was recorded by the electronic journey registration equipment [Elektronische Fahrten-Registrierung (EFR)]. In stopping, the train braked from a speed of 71 km/h to a complete stop and in a braking distance of 540 m. This record was made at 22:19:27 (data cassette time) at about km 50.730 (based on the standard adopted) between Groß Quenstedt crossover and the block post at Nienhagen for a period of 36 seconds on the open line.

According to information from DB Netz AG, the driver did not report to either of the two signal boxes. The reason for this stop could not be clarified.

The SIFA [Sicherheitsfahrschaltung - Drivers's Safety Device] on traction units monitors the vigilance of the driver and if necessary initiates an automatic brake

application including switching off the traction. The process is as follows when the SIFA button is not pressed or is continuously pressed down (traction controller with a SIFA button and a lot more besides) on an active driver's work station:

- after 30 seconds an optical signal gives a warning (SIFA warning lamp);
- after a further 2.5 seconds an acoustic signal also gives a warning (SIFA warning lamp and buzzer);
- after a further 2.5 seconds there is automatic application of the brakes.

Operation of the SIFA button, the SIFA button on the traction controller or by means of the SIFA pedal restarts the process above.

If there is an automatic SIFA brake application because of non-operation or continuous operation of one of the SIFA operating options, this is captured and shown on the display in the cab as a malfunction or fault with the fault code 314 and is then stored in the system.

SIFA may be isolated by closing the air valve on the braking panel (SIFA isolating valve). That prevents traction (movement not possible) which once again can be overridden by switching on the SIFA malfunction switch (sealed) on the panel. Closing of the SIFA isolating valve is shown on the cab display with error code 311 and overriding the SIFA function is shown with error code 309 and stored in the system.

Since no relevant error message was stored in the system, it may be assumed that SIFA was switched on normally, was operational and was being operated normally by the driver.

4.6.2 Servicing and maintenance of freight train DGS 69192

No shortcomings which could have been linked to the accident were identified when checking compliance with the time intervals for servicing and maintenance specified by Vossloh.

This evidence was provided by maintenance records submitted by VPS.

4.6.3 Evaluation of the journey by the electronic journey recording equipment for freight train DGS 69192 and passenger train DPN 80876

Evaluation of the journey of freight train DGS 69192 revealed that the train complied with the speed limits.

At the time of the event, a drop in pressure was indicated of less than 2.2 bar. At that time (22:27:54), the speed was 69 km/h. After some 60 m the recording stopped. The collision with DPN 80876 took place at a speed of 68 km/h.



Figure 2: Excerpt from the evaluation of the record of the journey: DEUTA-WERKE ADS3 graphic representation of DGS 69192 with handwritten additions

Evaluation of the record of the journey of passenger train DPN 80876 up to the time of the event revealed that at 22:25:19 (time according to the recording equipment) a fall in the pressure of the main brake-pipe was recorded of less than 2.2 bar. The cause could be a rapid brake application by the driver.

After some 135 m and at a speed of 66 km/h the recording broke off.



Figure 3: Excerpt from the evaluation of the record of the journey: DEUTA-WERKE ADS3 graphic representation of DPN 80876 with handwritten additions

4.7 Evaluation of the documentation from the scene of the accident and records from individual pieces of control equipment

To identify any irregularities, the signaller's on-site paper records were checked with the indicators used to record exceptional operations such as the operation of special purpose signals and the illumination of fault indicators. This visual inspection did not reveal any irregularities. No malfunctions or fault indications were revealed.

The position of the lever for No 1 switch that was run through by freight train DGS 69192 proceeding from the Nienhagen direction was evident.

Freight train DGS 69192, which was involved in the accident, was visually examined on site. In doing so, the position of brake cocks, connection of the main brake-pipe, settings for the brake regime and the empty/loaded changeover levers were checked and documented by the Federal Police. No irregularities were noted in the examination.

4.8 Interpretation of the evidence from the accident

The damage from No 1 switch being run through was one of the pieces of evidence from the accident which was noted immediately after the collision.

The switch was run through by freight train DGS 69192 proceeding from the Nienhagen direction. The switch was locked. The locking bar went though the slot in the locking plate and hence prevented any further movement of the switch.

The switch and the facing point lock were documented in their run-through condition by the Federal Police.



Illustration 3: No 1 switch run through, Hordorf crossover

This evidence from the accident proves that the operator in Hordorf signal box set up the route from Oschersleben towards Nienhagen for signal A in accordance with the regulations.

The route for the opposite direction, for signal B, was not set up. It was not possible to clear signal B [set to the proceed aspect].



Illustration 4: signal box, Hordorf crossover

On the basis of the findings above, it can be assumed that the cause of passing of the repeater signal showing 'expect stop', the stop signal B showing 'stop', and lastly the collision was human error. The investigation, which used the process of elimination, does not allow any other conclusion, since no credible indication of other causes can be identified.

5 Analysis and conclusions

On lines on which technically effective automatic train control systems are not explicitly required by Article 15 Railway Construction and Operating Notice (EBO), safety responsibility for not passing signals at danger without authorisation is exclusively within the driver's personal responsibility for safety. Since speeds in excess of 100 km/h are not authorised on the lines in question, there is no fundamental obligation to equip them with automatic train control.

On the basis of the investigation undertaken, it can be concluded that the event would not have occurred had there been a track- and train-based automatic train control system. Such a system would reduce the effect of human error (in passing signals at danger without authorisation) to virtually nothing.

According to information available, on average there are thirty-three signals passed at danger without authorisation each month. Other measures to minimise the risk of passing a signal at danger without authorisation could be adopted on lines without a track-based automatic train control system until it is installed.

The following measures in particular, or a combination of them to take account of the types of traffic, may provide options to reduce the probability of occurrence of and/or the extent of the consequences of passing a signal at danger without authorisation, until a line is equipped with automatic train control system technology:

- reducing speeds;
- extending headway between trains, for example by 'double block' working;
- double manning of traction units with drivers or driver's assistants to observe the line and signals.

6 Measures taken by safety authorities or railway undertakings so far

On 6 May 2011, DB Netz AG published an intermittent automatic train control [Punktförmige Zugbeeinflussung (PZB)] upgrading plan for operating locations without the basic PZB equipment in technical notice TM 2011-1191 I.NVT3. This should be

implemented by 31 December 2012 in the operating locations listed in Appendix 2 of the document.

In addition, DB Netz explained that equipping all lines with supplementary safety systems was just about complete in the western *Bundesländer* but for historical reasons there was still a need to catch up in the eastern *Bundesländer*. In the past few years, numerous sections had been equipped with intermittent automatic train control (PZB) in several comprehensive programmes.

7 Safety recommendations

The following safety recommendations are issued in accordance with Article 6 of the Railway Accident Investigation Regulation and Article 25(2) of Directive 2004/49/EC:

Serial	Safety recommendation	Undertaking
No		concerned
1	Updating all lines with automatic train control by	Infrastructure
	means of which a train which passes a signal at	managers
	danger without authorisation can be automatically	
	brought to a halt. Additionally, on main lines an	
	approach to a signal at danger without authorisation	
	can be prevented automatically.	
2	Until sections of line are updated with automatic train	Infrastructure
	control in accordance with recommendation No 1,	managers and/or
	additional measures should be taken to reduce the	railway undertakings
	probability of occurrence and/or extent of the	
	consequences of passing a signal at danger without	
	authorisation. These measures should be suited to	
	individual circumstances.	

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