



Rail Safety & Standards Board

Formal Inquiry: Collision with a Road Vehicle and Subsequent Derailment of Passenger Train 1C92 1735 hrs Paddington to Plymouth at Ufton Automatic Half Barrier (AHB) Level Crossing on 06 November 2004

Preliminary Report

FI3103/P

SMIS Reference No: QGW/106754

Lead Organisation: Rail Safety and Standards Board

25 January 2005

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Statement

This inquiry is taking place in accordance with Railway Group Standard GO/RT3473, which requires the submission of a preliminary report if the final report cannot be produced within ten weeks of the accident. This preliminary report is based on the information that has been made available to the Panel up to 10 January 2005.

The inquiry is being conducted with the objective of determining the facts of an accident/incident, the immediate and underlying causes and of making recommendations to prevent, or reduce the risk of, recurrence. The report is for the use of persons with a direct responsibility for improving or maintaining railway safety. The Panel has not made any recommendations to date.

The objectives of this inquiry are not the allocation of blame or liability and thus the information contained should not be construed as creating any presumption of these.

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Remit (extract)

This remit is issued in accordance with Railway Group Standard GO/RT3473 and requires an inquiry into the following accident/incident.

| | |
|---|--|
| Accident/Incident The 1735 hrs London Paddington to Plymouth train travelling at approximately 100 mph, struck a car on the level crossing killing the car driver and causing the train to derail. As a result of this derailment, six people on the train were killed (including the train driver) and a number received serious injuries. | |
| Date | 6 November 2004 |
| SMIS Reference | QGW/106754 |
| Lead Organisation | Rail Safety and Standards Board |

1 Appointment of person to lead the formal inquiry

- 1.1** An independent Civil Engineering expert has been appointed as chairman to lead the inquiry.

2 Type of investigation

- 2.1** The form of investigation is to be formal inquiry.

3 Inquiry panel

- 3.1** In accordance with Railway Group Standard GO/RT3473, the following shall be invited to participate in the inquiry:

Panel Members:

An independent Traction and Rolling Stock expert

An independent Signalling and Telecommunications expert

4 Authority of chairman

- 4.1** The chairman has the authority to request information to be provided by Railway Group members involved in the accident, to interview witnesses, request technical evaluations to be conducted and obtain other information and support as required for the purpose of achieving this remit.

- 4.2** The person appointed may request similar information from non-Railway Group members. These organisations may not, however, be bound by the requirements of Railway Group Standard GO/RT3473 to provide this unless incorporated into contractual requirements with Railway Group members.

5 Objectives of inquiry

5.1 The Panel is required, through inquiry, to identify the circumstances of the accident/incident, including:

- a) the events leading up to the accident
- b) the immediate and underlying causes.

5.2 As such the inquiry must address at least the following issues:

- a) The mechanism of the derailment and subsequent behaviour of the train and infrastructure up to the point where the vehicles came to rest.
- b) The installation, maintenance and operation of the AHB crossing involved and its compliance with laid down standards, including:
 - layout
 - signage
 - operating timing and distances
 - inspection and testing
 - signalling arrangements
- c) The operation of the train, including:
 - speeds during the journey
 - braking times and performance
 - examination and testing
- d) The effectiveness of arrangements in place for managing risks at Ufton AHB Level Crossing, including previous incident history and traffic patterns.
- e) The effectiveness of industry arrangements for managing overall risks associated with AHB level crossings.
- f) The effects of train design and construction on the initial derailment, including obstacle deflection.
- g) The performance of the train in its derailed state including factors that may have affected the extent of derailment and exacerbated damage to the train.
- h) The integrity of the rail vehicle structures and their effectiveness in providing protection to passengers and workforce during the derailment.
- i) Interior vehicle design and construction factors, including instructions and equipment, that affected passenger/workforce injuries, survivability and means of escape.
- j) The adequacy of, and compliance with; instructions, rules regulations and standards, and the specific controls therein, concerning:

- The operation of the level crossing
 - The operation of the train
 - Management of the incident
- k) The competency (knowledge, skills and experience), capabilities (mental and physical) fitness for duty (including medical fitness) of any staff involved in the accident, and the systems for ensuring their medical fitness and competence. This should include the effectiveness of arrangements for management of hours of work and rest periods.
- l) The effectiveness of the industry's response to the relevant lessons learned from previous events such as:
- Great Heck 2001 (including road/rail interface risks)
 - Ladbroke Grove 1999 } (regarding HST vehicle performance)
 - Southall 1997 } and post accident management)
- m) The effectiveness of post accident evacuation, first aid and arrangements for attendance of the emergency services, protection, reporting, testing, evidence preservation, investigation and restoration, etc.
- n) The effects of weather and other environmental conditions.
- o) Any relevant information that may emerge during the course of the inquiry from separate investigations into the road component of the accident.

5.3 The Panel shall make relevant recommendations for:

- a) action(s) that may be taken to prevent, or reduce the likelihood of, the occurrence of a similar accident/incident.
- b) action(s) that may be taken to reduce the severity of the consequences of a similar accident/incident.
- c) other matters relevant to safety revealed during the inquiry.

Recommendations from formal inquiries may be addressed to any Railway Group member.

6 Reporting and timescales

6.1 The inquiry shall commence as soon as possible. The Panel are required to provide:

A preliminary report to RSSB by 14 January 2005 (unless the final report is available within this time – in which case a preliminary report is not required).

A draft final report to RSSB by 8 April 2005 or, if this is not available and is unlikely to be available by 6 May 2005, a provisional report including a statement regarding the timescales for the final report.

6.2 The format and structure of reports shall be in accordance with Railway Group Standard GO/RT3473. (A template is available from RSSB)

6.3 The Panel must inform the Designated Competent Person in the following circumstances:

- a) If you believe that the objectives of the remit (including the timescales) will not be achieved.
- b) If, at any time, the inquiry reveals a safety issue of significance such that, in your opinion, there is an urgent need to inform Railway Group members prior to completion of the inquiry.

1. Basic Details

| | |
|------------------|--|
| Date: | Saturday, 06 November 2004 |
| Time: | 1812 hrs |
| Location: | Ufton Automatic Half Barrier (AHB) Level Crossing at 43 miles 39 chains on the Down Line between Reading and Westbury. |
| Weather: | Dark and dry at the time of the derailment turning to slight drizzle shortly afterwards. |

2. Sequence of Events

- 2.1 The 1735 hrs London to Plymouth service was a 10-vehicle High Speed Train (HST) operated by First Great Western. The train would normally leave London with the standard class accommodation at the front but on this occasion the train was running in reverse formation with two first class coaches at the front, followed by a buffet coach and five standard class coaches. It departed from Paddington on time and after making a booked stop at Reading, it left the station one minute late at 1803 hrs. The train subsequently accelerated to the linespeed of 100mph and passed the 'strike-in' point for Ufton AHB level crossing at 1811 hrs, initiating the crossing sequence of lights, audible alarms and lowering of barriers.
- 2.2 On reaching the level crossing, the train struck a Mazda 323 car which was on the crossing and obstructing the Down Line. The collision caused the leading wheelset of the leading bogie of the front power car to derail towards the left hand side in the direction of travel. The bogie then ran for approximately 95 metres in a line parallel to the rails with only one wheelset derailed until it reached the facing points to the Down Goods Loop. The bogie was then guided to the left by the diverging rails of the points, causing the following bogies to derail and resulting in a full and catastrophic derailment of all the vehicles in the train.
- 2.3 Extensive damage was caused to the vehicles, particularly those in the centre of the train where the couplings broke and vehicles parted from the train formation. The rear power car came to rest 165 metres from the point of derailment and the leading power car came to rest 360 metres from the same point.
- 2.4 The car was broken up by the impact, with component parts being carried forward by the train and scattered along some 100 metres of track. There was also widespread damage to the track in the area where all the vehicles finally derailed.
- 2.5 The response to the accident by the railway companies and the civil emergency services was both rapid and efficient. The evacuation of the passengers from the train, for the most part, proceeded

smoothly. Regrettably, five passengers and the train driver died as a consequence of the accident, as well as the driver of the car.

- 2.6 A total of 66 passengers, including 18 who were quite badly injured, were conveyed to hospital for treatment. Many of the remaining passengers received minor cuts and bruises, which were treated locally.

3. Summary of Evidence

3.1 Detailed Evidence to Date

The Panel has received evidence relating to the following:

- The mechanism of the derailment.
- The preservation of evidence.
- The signalling and operation of the level crossing.
- The maintenance history of the level crossing.
- The signalling centre and on-train records.
- AHB emergency telephone system.
- Statistics and risk management of AHBs.
- Available research relating to AHBs.
- The operation and maintenance history of the train.
- The crashworthiness of the coaching stock.
- Emergency egress, lighting, windows and hammers.
- The design and performance of the bogies and couplings.
- Available research relating to the role of life guards and obstacle deflectors in derailment prevention.
- Available research relating to the structural crashworthiness of vehicles.
- Available research relating to the internal design of coaches and measures to minimise injury through design of fittings, use of seat belts, etc.
- The accident site management and liaison.
- The response of the emergency services.
- The evacuation and care of the passengers.
- Staff training and competence.
- The restoration of the line.

3.2 Current Status of the Inquiry

- 3.2.1 The formal inquiry is being led by a Panel, consisting of an independent chairman and two independent members, and attended by eight observers representing the organisations and businesses directly concerned, the Trade Unions and the Rail Passenger Council. The Panel formally commenced hearing evidence on 23 November 2004.
- 3.2.2 Up to the present time, the Panel has interviewed 34 witnesses, mainly rail industry employees but including eight passengers who were travelling on the derailed train, one of whom was an off-duty employee of First Great Western. An off-duty Thames Valley policeman, who was a key witness in that he was present at the level crossing when the derailment occurred, also appeared before the Panel to give his eye-witness account of the sequence of events.
- 3.2.3 In addition to hearing the evidence, the Panel has taken delivery of a large number of documents, including control logs, signal box records and on-train records. There are more documents to come.
- 3.2.4 A detailed investigation of the mechanism of the derailment was carried out by AEA Technology under contract to Network Rail. The Panel has been provided with a copy of their report. A member of the derailment investigation team responsible for preparing the report attended the inquiry to give his evidence. Other members of the staff from AEA Technology, who investigated how the vehicle structures and internal fittings behaved during the derailment, also gave evidence to the inquiry. They carried out their investigation under contract to Angel Trains, the owner of the train.
- 3.2.5 On the night of 20 December, the British Transport Police (BTP), in co-operation with the Thames Valley Police and Network Rail, staged a reconstruction of the events on the road immediately prior to the derailment.
- 3.2.6 A temporary closure of road and rail had been arranged and for the purpose of ensuring that the reconstruction reflected the derailment as closely as possible, the BTP had obtained an almost identical car to that involved in the accident. No train was involved in the reconstruction. The off-duty policeman, who had witnessed the derailment, advised on the movement of the car on the level crossing before it was struck by the train. Members of the Panel attended the reconstruction, which was extremely helpful to the inquiry with particular regard to the precise position of the car at the moment of impact.
- 3.2.7 Following the derailment, the Transport Research Laboratory (TRL) carried out a laser survey of the site which located the various components of the car, some of which were carried forward some distance from the point of impact. Members of the Panel have since visited the TRL where they obtained details of the disposition of the components of the car after the collision. This survey will be

of considerable assistance to the Panel in understanding how the car caused the train to derail.

3.2.8 The BTP, the Thames Valley Police and the Health and Safety Executive have all been fully supportive of the Panel in its conduct of the inquiry during the progress to date.

3.2.9 The Panel convened for its last session of taking evidence on 05 January 2005. It is not anticipated that there will be the need for any further witness interviews. Pending the receipt of some outstanding items of documentation, the Panel can proceed with its analysis of all the evidence and the preparation of the final report.

4. Findings to Date

4.1 The Derailment

The mechanism of the derailment is not yet fully clear, but present indications are that a large component of the car, probably the engine block or gearbox, became lodged beneath the gear-case of the leading axle of the train whilst it was still on the level crossing. The consequent relief of vertical load allowed flange-climb of the leading left hand wheel. Movement of this wheel across the head of the rail was initially inhibited by contact between the right hand wheel flangeback and the edge of the concrete slabs forming the roadway in the four-foot, which acted like a check rail. However the right hand flange subsequently climbed onto the roadway slabs near the trailing end of the level crossing, leading to the eventual derailment of the leading wheelset towards the left. The train then ran in this state until it reached the facing points at a distance of approximately 95 metres from the level crossing. The derailed left hand wheel then followed the left hand stock rail, pulling the trailing axle of the leading bogie, and then other bogies, into derailment.

4.2 The Level Crossing

4.2.1 Ufton AHB level crossing is situated on an unclassified road leading from the A4 to the village of Ufton Nervet in Berkshire. As with all AHB crossings it is protected by half barriers that close the entry to the crossing but leave the exit clear. Warning lights, audible alarms and an emergency telephone system to contact the signalling centre in emergencies are also provided as standard equipment. The crossing is not provided with road lighting or with closed circuit television surveillance. A data recorder is provided that automatically records the operation of the crossing control devices, the warning lights/audible alarms and the operation of the half barriers themselves. A voice recorder in the signalling centre automatically records use of the emergency telephone system.

4.2.2 The line speed for trains passing through the crossing is 100mph. The crossing is not connected with or protected by the railway signalling system. The crossing is operated entirely automatically by the approach of a train and the operating 'strike-in' point for

Down Line trains is correctly positioned to give a minimum warning time for road users of 27 seconds for trains running at line speed.

- 4.2.3 The equipment and operation of the level crossing is in accordance with the relevant Level Crossing Order made by the Secretary of State for Transport and the automatic half barrier equipment and its associated ancillary equipment is in good condition and properly maintained.
- 4.2.4 The records available from the level crossing data recorder show that the crossing operated correctly for the passage of the 1735 hrs Paddington train. The emergency telephone system was in good order and working at the time the accident occurred.
- 4.2.5 There are over eight thousand level crossings on Network Rail's infrastructure and the majority of these (approx. 77%) are footpaths or farm type crossings where the user operates field gates. There are 458 AHB level crossings, mainly on rural roads, and Ufton level crossing is one of 31 that are located on lines with a line speed of 100mph.
- 4.2.6 Network Rail reviews its risk assessments at level crossings annually and the last review of Ufton was undertaken in July 2004. The Rail Safety and Standards Board (RSSB), together with Network Rail, have an ongoing programme of research into the management of risk at level crossings. This research, as well as the risk assessment methodology, are matters that the Panel will consider further.

4.3 The Train

- 4.3.1 Analysis of the on-train recorder output showed that the driver shut off power and coasted for around four seconds, which was normal for this point in the journey. He then made an emergency brake application at or about the time of impact with the car.
- 4.3.2 It is not yet clear whether an obstacle deflector would have prevented the derailment. HST power cars, which are not so equipped, pre-date the current requirement to fit them to certain categories of rolling stock operating at high speed. However HSTs have a relatively heavy axleload and would, even if introduced today, be exempt from the requirement. Lifeguards are fitted to HST power cars, but protect only the wheel/rail contact area and are thus ineffective against an object in the four-foot of the track.
- 4.3.3 All vehicles of the train were derailed when passing over the points or subsequently, and there was considerable damage to the track and ploughing of the ballast. Many of the coach bogies, which do not have any form of positive retention, became separated from their respective vehicle bodies and in a number of cases the underfloor equipment compartment was completely lost, probably as a result of contact with embedded bogies. However all the power car bogies, which have retaining straps, remained in position.

- 4.3.4 The front power car and the first and second coaches came to rest still coupled and roughly in line, with the vehicle body structures substantially intact, but with the power car and the first coach on their left hand side and the second coach leaning to the left. The left hand driving cab door came open, allowing a large quantity of ballast and debris to enter the cab.
- 4.3.5 The third coach, which contained the buffet, impacted or was impacted by a loose bogie. This caused severe damage to the underframe in the area of the kitchen, weakening the structure and allowing the body to be bent in plan view through an angle of around 150 degrees.
- 4.3.6 The fourth coach, the body structure of which remained substantially intact, separated from the buffet coach and turned onto its right hand side, coming to rest on the Up Line.
- 4.3.7 The fifth coach separated from the fourth and sixth and came to rest having rotated clockwise in plan to an angle of approximately 45 degrees to the direction of travel and having rolled through almost 360 degrees. There was severe deformation in the area where the roof and the left hand bodyside are joined, probably as a result of the vehicle body having rolled over a loose bogie, resulting in significant loss of survival space within the vehicle.
- 4.3.8 The sixth, seventh and eighth coaches and the rear power car came to rest still coupled and leaning at various angles to the vertical, but with the vehicle body structures substantially intact.
- 4.3.9 Analysis of the coupler failures is ongoing, and it is not yet clear if there were any weaknesses of design or construction which contributed to the separation of the coaches. The performance of the vehicle body structures was such that with the exception of the third and fifth coaches, which were subject to extreme localised loading, survival space was generally maintained within the vehicles. However, a number of bodyside windows broke during the accident, with severe consequences for passengers who were thrown towards them.
- 4.3.10 The assessment of injury to passengers and crew resulting from impacts with fittings within the vehicles is ongoing and it is not yet possible to say what were the significant factors involved.
- 4.3.11 Lighting was completely lost in all the coaches during the accident. As a result, passengers and crew found orientation difficult, though the provision of snap light wands alleviated this problem to some degree. Some passengers who attempted to break windows in order to escape from the vehicle were hampered by breakage of the window hammers, and by the difficulty of reaching the upper windows of a vehicle leaning heavily to one side.
- 4.3.12 The Panel has found no evidence that the maintenance condition of the train contributed in any way to the derailment or exacerbated its consequences.

4.4 The Rescue and Recovery Operation

- 4.4.1 Network Rail, First Great Western and the emergency services ie police, ambulance and fire brigade were very quickly alerted to the accident and the emergency services began arriving on the site only a few minutes later. The evacuation of the passengers began with some of the passengers, in the early post-derailment stage, finding their own way out of the derailed vehicles, in many cases assisted by other passengers who volunteered to take the lead. The two on-train managers, who were on duty on the train, gave advice and reassurance to the passengers, although they did not manage to access all of the coaches. The evacuation became better supervised once the emergency services had established themselves on the site.
- 4.4.2 Those passengers who were able to walk were directed to an inn, which fortunately was close to the accident site and served as the initial reception point. From there they were transported to a hotel, also in the same general locality, which had been established as the eventual clearing point. From the hotel, the passengers were conveyed to their intended destinations by road transport, either by coach or taxi.
- 4.4.3 The injured passengers were taken by ambulance to the Royal Berks hospital in Reading. Representatives of First Great Western attended the hospital to deal with the passengers' needs and concerns. A small number of passengers who received minor injuries were taken to Basingstoke hospital but they were not detained.
- 4.4.4 Network Rail's command structure on the site functioned efficiently, after experiencing some organisational difficulties during the very early stages of the recovery. There was also some delay in establishing effective liaison between the Rail Incident Officer and the senior officers of the emergency services. However, it cannot be said that these shortcomings had any material effect upon the progress of the rescue and recovery operation.
- 4.4.5 The last of the derailed vehicles was lifted clear of the site on Thursday evening, five days after the derailment, enabling the renewal of the severely damaged track and signalling equipment to proceed. This work was completed and the line returned to normal traffic on Tuesday of the following week, ten days after the derailment and one day ahead of plan. Line speed was finally resumed two days later.
- 4.4.6 No evidence has been presented to the inquiry that would indicate there were any deficiencies in the fitness for duty on the part of the staff of either Network Rail or First Great Western. The staff performed their duties in the emergency situation in a generally competent manner although the Panel believes that there may be lessons to be learned regarding the comprehensiveness of some elements of their training.

- 4.4.7 The weather was dry at the time of the derailment and was not a contributory factor. There was nothing to suggest that the ensuing light drizzle hampered the rescue but it did make matters more unpleasant for the passengers during the evacuation process.

5. Significant Issues Currently Under Consideration

- Level crossing risks and risk assessment methodology.
- Level crossing research, including obstacle detection.
- The influence of the level crossing road units on the mechanism of derailment.
- The AHB emergency telephone system.
- The role of obstacle deflectors and lifeguards.
- The behaviour of the couplers and the vehicle structures.
- The lack of bogie retention.
- All aspects of vehicle interiors, including the potential of seatbelts, for the protection of passengers and crew.
- The loss of lighting in the train.
- Evacuation arrangements, including training for on-train staff.
- The control structure for dealing with major accidents.
- Arrangements for the attendance of specialist investigators at the site.
- Arrangements for debriefing the response to the accident.

At the time of drafting this report, the Panel had not identified any safety issue requiring immediate action.

6. Timescale to Completion

It is anticipated that the final report will be available for publication within 6 to 12 months of the accident.

7. Glossary of Terms

| Term | Meaning |
|-------------|---|
| HST | High Speed Train |
| AHB | Automatic Half Barrier |
| BTP | British Transport Police |
| TRL | Transport Research Laboratory |
| RSSB | Rail Safety & Standards Board |
| SMIS | Safety Management Information System |