RAIB

Rail Accident Investigation Branch

Rail Accident Report

Derailment of a passenger train at Gysgfa, Ffestiniog Railway
3 May 2008

Department for Transport

Report 18/2009
July 2009

This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC;
- the Railways and Transport Safety Act 2003; and
- the Railways (Accident Investigation and Reporting) Regulations 2005.

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Email: enquiries@raib.gov.uk
Telephone: 01332 253300
Fax: 01332 253301
Website: www.raib.gov.uk

This report is published by the Rail Accident Investigation Branch, Department for Transport.

* Cover photo courtesy of Roger Dimmick

Derailment of a passenger train at Gysgfa, Ffestiniog Railway, 3 May 2008

Contents

Introduction

1 The sole purpose of a Rail Accident Investigation Branch (RAIB) investigation is to prevent future accidents and incidents and improve railway safety.

2 The RAIB does not establish blame, liability or carry out prosecutions.

Key Definitions

3 The train involved in the derailment was travelling from Porthmadog to Blaenau Ffestiniog and in this report the terms left and right refer to the left and right sides of the train in the direction it was travelling.

4 Appendices at the rear of this report contain the following:

- technical terms (shown in *italics* the first time they appear in the report) are explained in Appendix A.

Key facts about the accident

5 On 3 May 2008 the rear two vehicles of the Ffestiniog railway 'Victorian train' became derailed as the train traversed the curves at Gysgfa, between Rhiw Goch and Tan-y-Bwlch. There were thirty four passengers and three crew on board the train at the time. Details of the vehicles which made up the Victorian train are given in paragraph 23.

6 One of the members of the train crew sustained a minor injury in the derailment. None of the passengers were injured.

7 The location of the derailment is shown in Figure 1.

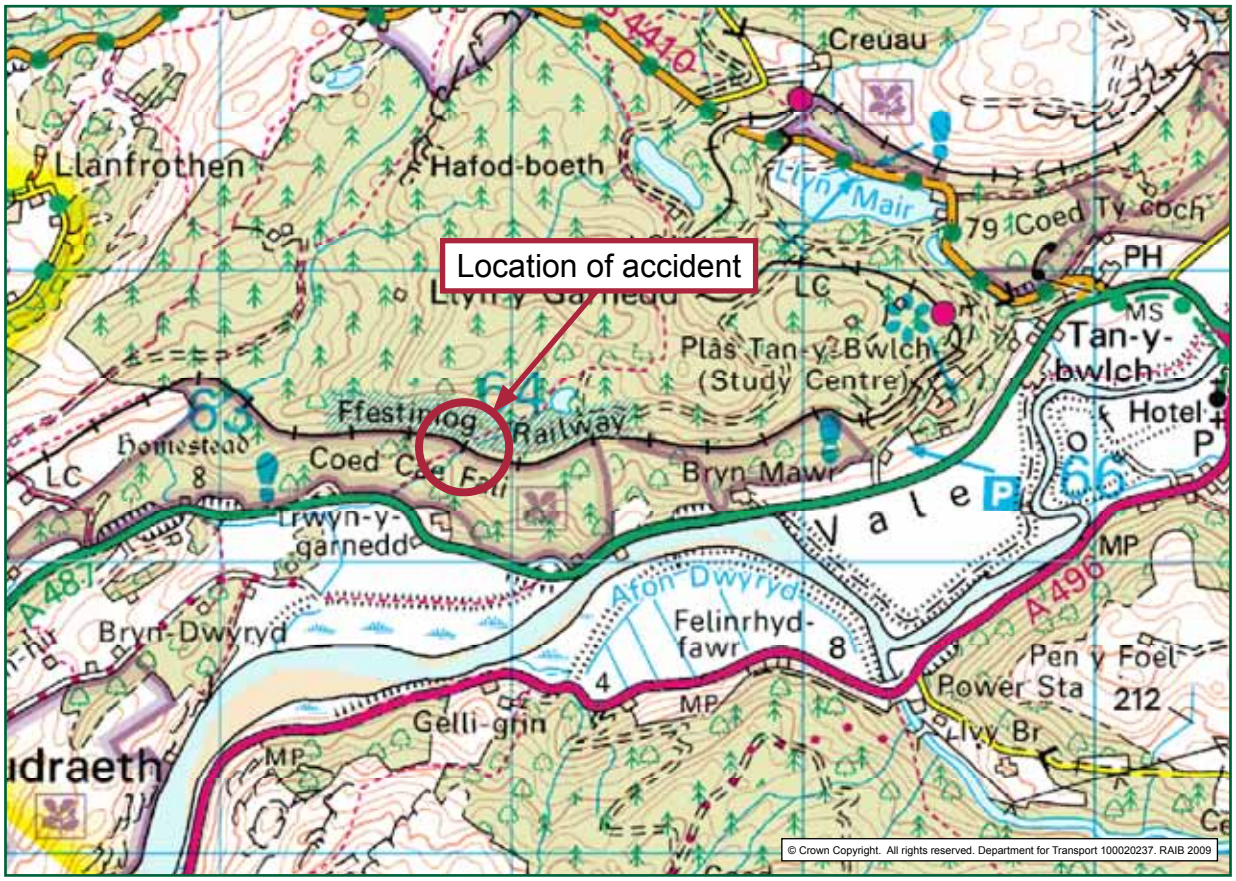

Figure 1: Extract from Ordnance Survey map showing location of accident

Immediate cause, causal and contributory factors, underlying causes

8 The immediate cause of the derailment was *gauge spread* of the track caused by the failure of eight consecutive *baseplates* which supported the outer rail of the curve.

9 Causal factors were:

- multiple failure of baseplates;
- the Ffestiniog railway had not experienced a failure of this type before;
- wrong diagnosis of a track fault;
- not measuring the track gauge when diagnosing track defects;
- the lack of a process for clearing debris from the track;
- the inspection system did not call for defects left in the track to be reassessed; and
- the design of the baseplate.

10 Possible contributory factors were:

- the substitution of a foot inspection by an inspection done from a locomotive; and
- the lack of a process to control changes to standing instructions.

11 The underlying cause was that the Ffestiniog railway did not control their procedures for track inspection and maintenance nor supervise compliance with these procedures.

Recommendations

12 Recommendations can be found in paragraph 74. They relate to the following:

- Festiniog Railway Company's understanding of the extent of baseplate deterioration likely to cause derailment;
- the means of detecting baseplate deterioration;
- Festiniog Railway Company's inspection, maintenance and change control procedures; and
- Festiniog Railway Company's process for the investigation of track defects.

The Accident

Summary of the accident

13 On 3 May 2008, the 15:00 hrs departure from Porthmadog to Tan-y-Bwlch was running through the curves at Gysgfa when the rear two vehicles derailed. These vehicles were a passenger coach and a luggage van.

14 One of the passengers in the derailed passenger coach pulled the emergency cord and this applied the brakes. When he saw that the train brakes were starting to apply, the driver fully applied the brakes and brought the train to a stand. The guard was unable to apply his brake as he had been thrown about the luggage van by the derailment.

15 The location of the derailment was in a heavily wooded hillside area and the passengers were rescued from the derailed train onto another train brought to site for this purpose.

16 Figure 2 shows the track immediately after the derailment.

Figure 2: Gysgfa curve following the derailment

The parties involved

17 The railway and train were owned and operated by the Festiniog Railway Company[1]. Inspection of the track was undertaken by paid members of Festiniog Railway Company staff and maintenance of the track was undertaken by members of Festiniog Railway Company staff assisted, where necessary, by volunteers.

18 The train crew were all Festiniog Railway Company volunteers.

Location

19 The Ffestiniog railway was built as a mineral line to convey slate from quarries inland at Blaenau Ffestiniog to the coast at Porthmadog. Since 1955 the line has been operated mainly by volunteers as a tourist railway. The railway has a track gauge of 23½ inches (597 mm).

20 Gysgfa curves are located between Rhiw Goch and Tan-y-Bwlch and are 5 miles (8 km) from Porthmadog Harbour station. At this point the railway runs through dense woodland and is located approximately 70 m above the level of the valley floor on an upward gradient of 1:80 towards Blaenau Ffestiniog. The curve on which the train derailed has a radius of 4 chains (80 m) and the line speed is 20 mph (32 km/h). Figure 3 shows the location of the derailment.

Figure 3: Gysgfa curve after recovery of the train and repair of the track

[1] Although described as the Ffestiniog railway, the legal name of the company is the 'Festiniog Railway Company'. This reflects Welsh spelling at the time that the company was formed in 1832.

External circumstances

21 The weather at the time of the derailment was fine and dry.

22 The Festiniog Railway Company was operating a special train service on 3 May 2008 in connection with the Ffestiniog Railway Society's AGM. This service included additional special trains. One of these trains was the incident train and was made up of Victorian coaches.

Train(s)/rail equipment

23 The train which derailed was known as the 'Victorian train' and consisted (in order) of locomotive 'Prince', an 0-4-0 steam locomotive built in 1863, its 4-wheeled tender, a replica 4-wheel passenger coach built in 2007, two original 4-wheel passenger coaches built in 1863/4, a bogie passenger coach built in 1879 and a replica bogie luggage van built in 2004.

24 The track at Gysgfa consisted of *BS 60A flat bottom rails* on pressed steel *Pandrol* baseplates. The baseplates were fixed to *Jarrah* hardwood sleepers using three *chairscrews* in each baseplate.

25 The track was laid in 1973 using new components throughout but did not include baseplates at that time, the rails being fastened directly to the sleepers using screws and clips. Figure 4 shows track of this type. After some years in service it was found that the rails wore into the surface of the timber sleepers on curves and, in 1993, baseplates were fitted to both rails through the Gysgfa curves. The original sleepers and rails were re-used. The baseplates chosen for this purpose were of a type that had been used previously on Ministry of Defence standard gauge sidings and industrial lines.

Figure 4: Ffestiniog railway track without baseplates, as originally fitted at Gysgfa

Events preceding the accident

26 On 3 May 2008 the Victorian train was scheduled to make two return runs from Porthmadog to Tan-y-Bwlch. The first trip passed without incident, apart from the train crew having some difficulty in getting the vacuum brake pipes between two of the vehicles to form a satisfactory seal. This delayed the departure of the first trip. Similar difficulties were experienced with the second trip (the 15:00 hrs departure), but that departure was not significantly delayed.

27 The train was scheduled to make a non-stop run from Porthmadog to Tan-y-Bwlch and departed Porthmadog at 15:01 hrs. The train passed Minffordd and the *single line token* was exchanged without the train stopping. The train passed Rhiw Goch at 15:21 hrs.

Events during the accident

28 The train reached Gysgfa at 15:25 hrs. As the train was rounding Gysgfa curves two passengers looking forward from windows in the bogie passenger coach, which was the penultimate vehicle in the train, noticed that the locomotive 'kicked' laterally.

29 The locomotive and the 4-wheel passenger coaches passed through the curve without derailing but the bogie passenger coach and the luggage van behind it became derailed. The mechanism of derailment was by spreading of the track gauge. This allowed the wheels of the coaches with bogies to drop into the *two foot*. They ran in this position for the extent of the gauge-spread length of track until the wheels on the side of the outer-rail (left-hand side) climbed out and over to the *cess* side.

30 One of the passengers who had been looking out of the window pulled the emergency cord as he felt the coach running derailed over the sleepers. The other passenger who had been looking out of the window also went to pull the cord but felt that the train brakes had already been applied.

31 The driver saw the brake pressure start to fall on his vacuum gauge and applied the train brakes fully. The train came to rest approximately 40 m from the point of derailment.

Consequences of the accident

32 The guard was slightly injured in the derailment due to the motion of the derailed luggage van. No passengers were injured.

33 The two derailed vehicles sustained damage to their wheels, bogies and brake gear. The track was damaged over a distance of approximately 10 m.

34 The line remained closed until 12:30 hrs the following day, after recovery of the train and repair of the track had been completed.

Events following the accident

35 The guard went along the train ensuring that the passengers were uninjured and then made an emergency call to Festiniog Railway Company control to report the derailment at 15:28 hrs.

36 Festiniog Railway Company control notified the RAIB at 15:52 hrs.

37 As the derailment location was remote, Festiniog Railway Company organised a rescue and re-railing train which arrived at the site at 16:55 hrs. The passengers were transferred to the rescue train which departed for Porthmadog at 17:15 hrs.

38 The train crew were routinely tested for the presence of drugs and alcohol following the incident and the tests showed that none was present.

39 The Festiniog Railway Company replaced the failed baseplates at the derailment location as part of their recovery work. During the period between 3 and 30 May, the Festiniog Railway Company also examined other curves of similar track type, age and radius. Ten sites were examined (including Gysgfa) and broken baseplates were found at 6 of these sites. A total of 71 broken baseplates were found and replaced during this exercise, in addition to the 8 replaced at the site of the derailment.

The Investigation

Sources of evidence

40 Information was obtained from the following sources:

- statements by Festiniog Railway Company staff and volunteers;
- evidence gathered on site and from examination of the train at the Festiniog Railway Company workshops;
- photographs taken by the RAIB and by Festiniog Railway Company staff;
- procedures and records supplied by Festiniog Railway Company;
- examination of the site and other curves on the Ffestiniog railway covered by trees;
- metallurgical examination of the baseplates recovered from the derailment site; and
- other railways which use baseplates of this design.

Previous occurrences of a similar character

41 The Festiniog Railway Company has had no derailments on plain track in the last seven years. There have been five derailments at points since 2001; all of them were related to the operation of the points.

Analysis

Identification of the immediate cause[2]

42 The immediate cause of the derailment was that the track gauge spread by a sufficient amount to allow the wheels of the coaches with bogies to drop into the two foot. The 4-wheeled coaches at the front of the train did not derail and this may have been due to their lower axle load or their wheels having wider treads than the coaches with bogies, though only by a small amount (the tread width of the 4-wheeled coaches was 95-100 mm and that of the coaches with bogies was 93-94 mm).

43 The gauge spread was caused by the failure of 8 consecutive pressed steel baseplates which supported the outer rail of the curve. The failures occurred by the baseplates fracturing where they passed beneath the rail. These failures allowed the foot of the rail to move outwards in the curve, widening the gauge. When measured after the derailment, the gauge was found to be a maximum of 25 3/16" (640 mm) at the point of derailment. The Festiniog Railway Company nominal track gauge is 23 ½" (597 mm) and the Gysgfa curve was designed to have *gauge widening* of ¼" (6 mm), so the gauge should have been 23 ¾" (603 mm). Gauge widening is applied to some sharp curves to ease the movement of vehicles round the curve.

44 When the derailed vehicles encountered track where the baseplates were intact, the narrowing gauge forced the wheels on the side of the outer rail to move over the rail and into the cess, where they ran until the train came to rest.

Identification of causal[3] and contributory[4] factors

Baseplates

45 The RAIB recovered the broken baseplates and the last intact baseplate prior to the derailment site in the direction of travel of the train. Four of the broken baseplates and the intact one were subjected to metallurgical examination. This examination confirmed that the plates had been manufactured from mild steel and found that the fractures had two distinct regions. The initial cracking of the plates occurred at the bend on the outside of the rail foot and had propagated slowly downwards into the plate thickness (Figure 5). At a later stage fatigue cracks had initiated from the underside of the plate at the same location and had propagated upwards at a faster rate, meeting the first set of cracks and causing complete failure of the cross section. The fracture surfaces of all of the plates were heavily corroded and indicated that failure occurred at least 3 months before the derailment. All of the baseplates had failed in the same way.

---

[2] The condition, event or behaviour that directly resulted in the occurrence.

[3] Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

[4] Any condition, event or behaviour that affected or sustained the occurrence, or exacerbated the outcome. Eliminating one or more of these factors would not have prevented the occurrence but their presence made it more likely, or changed the outcome.

Figure 5: Failed baseplate after removal from the track

46 The intact baseplate was subjected to magnetic particle inspection and found to have cracking on its top surface in the same location as the broken baseplates but did not have fatigue cracks on its underside. This plate was broken open to reveal the extent of the crack from the top surface. The depth of fracture was small and the crack surface was corroded. When cleaned, examination of the surface indicated that it was a fatigue crack.

47 Stress analysis of the baseplate was carried out. The loading and support conditions of the baseplate are not known with certainty, but assumptions were made of the extreme values that are possible. The support provided to the baseplate by the sleeper can be considered to vary from a 'soft' value, such that the pressure beneath the baseplate is uniform across the whole area in contact with the sleeper (shown in Figure 6(a)), to a 'hard' value, such that the sleeper appears very stiff compared to the baseplate and the pressure distribution is as shown in Figure 6(b). The maximum axle load on the Ffestiniog railway was eight tonnes and it was assumed that the axle load is uniformly distributed between the wheels, giving a four-tonne vertical wheel load to be reacted by the baseplate. The toe load provided by the Pandrol clip was not considered in this simple analysis.

48 Consideration of the 'hard' load case shows that the baseplate is only subjected to compression and there is negligible stress at the bends. The stresses in the root of the bends in the 'soft' case were found to be beyond the yield stress of the steel. Both of these support cases represent the credible extremes and the actual support conditions will be between these extremes.

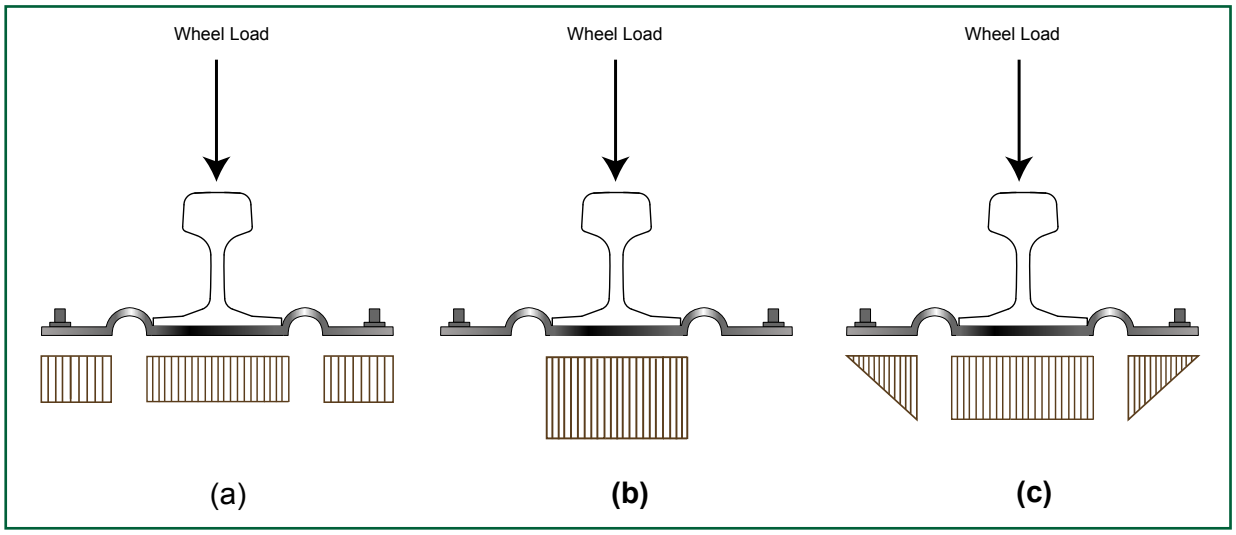

Figure 6: Pressure distributions beneath baseplate

49 The support conditions on a real sleeper are likely to be somewhere between the hard and soft cases, similar to that shown in Figure 6(c). Analysis of this loading gives a maximum stress at the root of the bend which is within the yield stress but is of such a magnitude that, based on the Ffestiniog railway traffic, the fatigue life is of the order of a few years.

Sleepers

50 The support provided to the baseplates by the sleepers was investigated by examination of the derailment site and of a number of sites on the Ffestiniog railway where failed baseplates had been found. The sites examined were Gysgfa, where the derailment occurred, Dingle, where 30 broken baseplates had been replaced, and Power Station. The Power Station curve site was included for comparison with the other sites as it is in the open with no tree cover and three broken baseplates were found there.

51 The highest proportion of broken baseplates was at Gysgfa, where a total of 19 baseplates had been replaced over a distance of 60 m. Although a greater number of baseplates were replaced at Dingle (30), the curve there (200 m long) is longer than at Gysgfa. Power Station curve is slightly longer than Dingle but only had three broken baseplates.

Figure 7: Timber surface adjacent to baseplate - damaged surface shown arrowed

Figure 8: Timber sleeper affected by decay

52 The factors which might have led to the high proportion of broken baseplates at Gysgfa were examined. The stress analysis of the baseplate suggested that the sleeper hardness would be an important factor. It was found that where leaf debris covered the timber surface, the timber beneath it was soft and easily crumbled. When the leaf debris was scraped from the top surface of the timber, the top layer of the timber came away with it leaving an uneven surface with the grain raised and open to water penetration (Figure 7). The mechanism of deterioration of the timber appears to be fungal attack (Figure 8). This was not seen on the sleepers which were in dry locations or were not covered with leaf debris.

53 The susceptibility of the baseplate design to overstress if supported on a soft surface (paragraphs 47 to 49) makes the issue of decay of the surface of the timber sleepers an important factor. It is considered that the combination of the baseplate design and sleeper condition was a causal factor to the derailment.

Track Inspection

54 The Festiniog Railway Company's inspection policy for track is detailed in its document 'Standing Instruction, Inspection of Track and Structures', PW SIN 002, issued in June 2006 (henceforth referred to as the standing instruction). This details the following inspections:

- track patrolling by a member of staff appointed by the civil engineering manager, to visually examine the track for integrity and condition;
- track inspections by the permanent way senior supervisor to determine maintenance priorities and check geometry; and
- inspections by the civil engineering manager to inspect the overall condition of the track, monitor the effectiveness of maintenance work and assess renewals priorities.

55 The frequency with which each of the inspections is to be carried out is given in the standing instruction and varies according to whether the railway is operating trains every day or on occasional days. Daily operations commenced for the 2008 season on 15 March and trains operated every day from then until the derailment. For daily operation, the standing instruction gives the following frequency of inspections:

- patrolling – weekly, two in three inspections may be carried out from vehicles authorised for this purpose by the civil engineering manager (certain passenger coaches or the leading cab of certain diesel locomotive being specified for this purpose);
- permanent way senior supervisor inspection – bi-monthly on foot; and
- civil engineering manager's inspection – 4 monthly on foot.

56 At the time of the derailment, a variation to the standing instruction's inspection sequence was in use. This involved a six-week cycle of inspections which comprised a foot patrol in week one, two 'ridden' inspections from trains in weeks two and three, an inspection using the civil engineering department's diesel locomotive in week four, and then two more ridden inspections in weeks five and six. The inspection from the loco allowed the patroller to stop, dismount, and look more closely at anything that warranted closer examination. This did not meet the requirement of the standing instruction which stated that only two in three inspections can be carried out from a train. The RAIB was unable to determine when the inspection regime changed from one-in-three inspections on foot to one-in-six on foot.

57 The first inspection of the daily operation season in 2008 was done by the permanent way senior supervisor on 17 March. This was followed by patroller's ridden inspections from trains on 26 March and 2 April. A foot patrol was carried out between 7 and 9 April (it takes two days to walk the whole line), and then two ridden inspections on 15 April and 24 April were performed. An inspection using the diesel locomotive was made on 28 April; it was the last inspection of the track at Gysgfa before the derailment on 3 May 2008. The track at Gysgfa was not examined on foot during this inspection. Although the sequence of patrollers' inspections was following the six-week cycle, due to the limited time elapsed between the start of the daily operation season and the incident, only one foot patrol had been replaced by a close inspection; the one on 28 April. The omission of the foot patrol of Gysgfa curve on 28 April is considered a possible contributory factor to the derailment as an opportunity to observe the track defect was missed. Failed baseplate where the rail foot had moved beneath the broken part of the plate would have been visible to the patroller. The lack of a foot patrol on this date arises from the practice of only conducting one-in-six inspections on foot.

58 The deviation from the standing instruction's foot-patrol frequency of one every three weeks to one every six weeks was not formally recorded by a change to the standing instruction. There is no evidence of a suitable risk assessment in the change from one-in-three to one-in-six foot patrols having been carried out. The Festiniog Railway Company did not have a formal process for change control of their standing instructions. Had a change control process existed, it might reasonably have called for a risk assessment of any proposed change to be made. The lack of a change control process that should have initiated a new risk assessment was a possible contributory factor to the derailment.

59 The last permanent way senior supervisor's inspection was on 17 March 2008 and was done on foot in accordance with the standing instruction. The date of the last civil engineering manager's inspection was not recorded but was stated to have been in 2007. This was not in accordance with the standing instruction, but this is not regarded as causal or contributory to the derailment.

60 The permanent way senior supervisor's inspection of 17 March 2008 reported a lurch at the same location as the derailment and the inspection report suggested that the rail joint there needed realignment. This fact was recorded in the list of defects requiring attention and given a priority of '2'. The standing instruction lists priorities ranging from 1 to 4 plus an 'immediate' priority for defects that threaten the safety of the line. The table of priorities is reproduced from the standing instruction in Table 1.

61 The priority of 2 assigned to the defect at Gysgfa was in accordance with the table for a fault which caused poor ride. Priority 2 defects should be included in the four-week plan of work. The level of resources available for track maintenance has restricted the amount of work items that can be attended to and an additional prioritisation category of 2+ has evolved to denote priority 2 items that need a closer look before deciding how to deal with them. The timescale for attending to priority 2 items has consequently been extended beyond the four-week target in the standing instruction. However, the defect at Gysgfa was actually wide gauge with failing fastenings and this should have been given a priority of 1, to be fixed within three days. The gauge of the track was not measured when investigating the lurch on 17 March 2008. Not measuring the track gauge was a causal factor to the derailment.

Priority	Attention / Action	Example
Immediate	Stop traffic	Broken rail, fishplate (pair) Line blockage Formation collapse
1	Within 3 days	Temporary repair made during inspection Broken fishplate Wide gauge with failing fastenings Suspected excessive twist Flooding Fence damage likely to allow ingress of livestock or people
2	Include in rolling stock 4 week plan of work	Developing faults likely to become priority 1, such as spreading gauge, voids developing likely to cause excessive twist Developing faults which will need extra work to rectify if not given urgent attention (stitch in time) Faults causing poor ride of train - passenger discomfort Risk of suspension damage, such as low joints, voids, misalignments Faults likely to wear/damage/shorten life of track structure if not given urgent attention, such as failing drainage, loose track fastenings
3	Within current maintenance season	Anything in need of attention, but which is not urgent
4	Record fault	Deteriorating fencing, wheel burns, minor top/alignment faults, not in need of current years attention but requiring observation

Table 1: Patroller's assessment of priority for defects found during inspection (from FR standing instruction PW SIN 002).

62 The Festiniog Railway Company had not experienced a failure of this type of baseplate before, apart from an isolated example due to a manufacturing defect that was found soon after installation. The fractures in the baseplates at Gysgfa were difficult to detect, being beneath the rail foot. The failure becomes apparent if the rail foot moves beneath the broken section of the baseplate as this is visible and leads to widening of the gauge.

63 The track at Gysgfa was covered by fallen leaves and leaf debris surrounded the baseplates during the permanent way senior supervisor's inspection of the track for the lurch, preventing observation of the baseplate breakage. This had a direct influence on the ability to identify the cause of the track faults present, and not clearing away the leaf debris when investigating track defects is therefore a causal factor to the derailment.

64 Once the defect was noted in the list of work items, no further attention was paid to it before the derailment. The patrollers who inspected the track were not made aware of the reports of a defect at this location and did not make any observation or reassessment of it. The lack of a system for the reassessment of defects that have yet to be fixed is a causal factor to the derailment.

Severity of consequences

65 The train was travelling at about 20 mph (32 km/h) at the time of the derailment and the line speed at this point is 20 mph (32 km/h). The speed is a driver's estimate as the locomotive was not fitted with a speedometer. The low speed of the derailment meant that, although the derailed vehicles moved towards the outside of the curve, they did not deviate far enough from the track to cause them to strike the sides of the rock cutting or risk falling over the side of the retaining wall on the other side of the line. The consequences may have been more serious had the derailment occurred elsewhere.

Conclusions

Immediate cause

66 The immediate cause of the accident was that the track gauge spread allowed the wheels of the coaches with bogies to fall between the rails. This gauge spread was caused by the failure of eight consecutive baseplates.

Causal factors

67 Causal factors were as follows:

a. multiple failure of baseplates (paragraph 43);

b. the Festiniog Railway Company had not experienced a failure of this type before (paragraph 62);

c. the inspection of the defect found on 17 March 2008 wrongly diagnosed the fault (paragraph 60 and Recommendation 3);

d. the Festiniog Railway Company method of diagnosing track defects did not require that gauge be measured (paragraph 61 and Recommendation 3);

e. the Festiniog Railway Company method of diagnosing track defects did not require that the rail support components be exposed to view (paragraph 63 and Recommendation 3);

f. the design of the baseplate is prone to overload when used on sleepers with a decayed surface (paragraph 53 and Recommendations 1 and 2): and

g. the inspection system used by the Festiniog Railway Company did not call for defects already in the track to be observed for signs of further deterioration whilst awaiting rectification (paragraph 64 and Recommendation 4).

Possible contributory factors

68 The following factors were considered to be possibly contributory:

a. the practice of conducting foot inspections on only one occasion in six (paragraph 57 and Recommendation 3); and

b. the lack of a formal change control process to regulate changes to standing instructions that reasonably should have initiated a new risk assessment meant that no formal risk assessment was carried out when the foot patrol frequency was changed (paragraph 58 and Recommendation 5).

Underlying Cause

69 The underlying cause of the derailment was that the Ffestiniog railway management did not control the track inspection and maintenance procedures nor supervise compliance with them (paragraph 56).

Actions reported as already taken or in progress relevant to this report

70 Festiniog Railway Company has developed a simple test they intend to detect broken baseplates during foot patrols.

71 Festiniog Railway Company has inspected similar locations where the same type of track is used and replaced the baseplates found to be broken.

72 Festiniog Railway Company has undertaken a programme of sleeper replacement, replacing sleepers where the surface has softened.

73 Festiniog Railway Company have reverted to conducting one in three track inspections on foot and have increased this to one in two during peak train service (paragraph 58).

Recommendations

74 The following safety recommendations are made[5]:

Recommendations to address causal and contributory factors

1 The Festiniog Railway Company should establish the number of consecutive defective baseplates that could lead to an unacceptable risk of a derailment (paragraphs 67a and f).

2 The Festiniog Railway Company should develop techniques to detect baseplate deterioration with a sufficient safety margin to prevent an unacceptable level of risk of derailment (paragraph 67f).

3 The Festiniog Railway Company should amend its track maintenance procedures and instructions, so that:

- They are consistent with one another (paragraph 68a).
- They implement the techniques identified from Recommendation 2.
- They contain a requirement to clear away debris around pressed steel baseplates at suitable intervals, and always when investigating track faults, so as to allow close inspection of the timber and baseplate. The intervals should be determined from the work done in response to Recommendations 1 and 2 (paragraph 67e).
- They list parameters that must be measured and recorded when investigating track faults and, where they do not already exist, include tolerances and relevant actions. This list must include track gauge and take account of relevant industry guidance (paragraph 67d).

4 The Festiniog Railway Company should revise their system of track inspection and defect recording such that overdue actions are either rectified or reassessed and reprioritised (paragraph 67g).

5 The Festiniog Railway Company should implement a change control procedure for standing instructions requiring that any risks arising from proposed changes to standing instructions are assessed, addressed and controlled as appropriate (paragraph 68b).

---

[5] Those identified in the recommendations, have a general and ongoing obligation to comply with health and safety legislation and need to take these recommendations into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the Office of Rail Regulation to enable it to carry out its duties under regulation 12(2) to:

(a) ensure that recommendations are duly considered and where appropriate acted upon; and

(b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 167 to 171) can be found on RAIB's web site at www.RAIB.gov.uk.

Appendices

Appendix A - Glossary of terms

Baseplate	A metal plate which supports the rail on the sleeper.
BS 60A Flat bottom rails	Rails with a flat-bottomed profile manufactured to British Standard profile 60A.
Chairscrew	A steel screw which attaches the baseplate to the wooden sleeper.
Cess	The area of ground immediately adjacent to a railway track.
Gauge spread	A defect in railway track whereby the distance between the rails (gauge) increases beyond the allowed limit.
Gauge widening	The use of a wider than normal track gauge in sharp curves to allow vehicles to traverse the curve more easily.
Jarrah	A type of tropical hardwood.
Pandrol®	A proprietary make of rail fixing clip.
Single line token	A metal token issued by the signalling system that authorises a train to occupy a single line.
Trailing	The converging direction of travel through a set of points.
Two foot	The space between the rails of a narrow (two feet) gauge railway.

This page is left intentionally blank

This report is published by the Rail Accident Investigation Branch,
Department for Transport.

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Telephone: 01332 253300
Fax: 01332 253301
Email: enquiries@raib.gov.uk
Website: www.raib.gov.uk