

Rail Accident Report



Fatal accident at Norbreck, Blackpool 5 August 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.

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Fatal Accident at Norbreck, Blackpool

5 August 2009

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Preface

- 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 All dimensions and speeds in this report are given in metric units, except speeds on Blackpool Tramway, which are given in imperial units in accordance with normal practice there. In those cases the equivalent metric value is also given.
- 4 Left and right are given relative to direction of travel.

The Accident

Summary of the accident

- 5 On 5 August 2009, at around 10:06 hrs, tram number 719, running south from Cleveleys towards Blackpool, struck a pedestrian who was crossing the tramway on a roadway crossing at Norbreck tram-stop. The pedestrian suffered serious injuries and died in hospital around five weeks later.

Organisations involved

- 6 Blackpool Council owns and maintains the Blackpool tramway infrastructure.
- 7 Blackpool Transport Services Limited (BTS), a subsidiary of Blackpool Council, owns, operates and maintains the tram involved. BTS also employed the tram driver.
- 8 Requests for information were made to BTS who freely co-operated with the investigation.

Location

- 9 The Blackpool tramway is 18 km long and runs between Starr Gate and Fleetwood (figure 1). It has northbound and southbound tracks; the northbound being closer to the sea. Norbreck tram-stop is around 9 km north of Starr Gate.

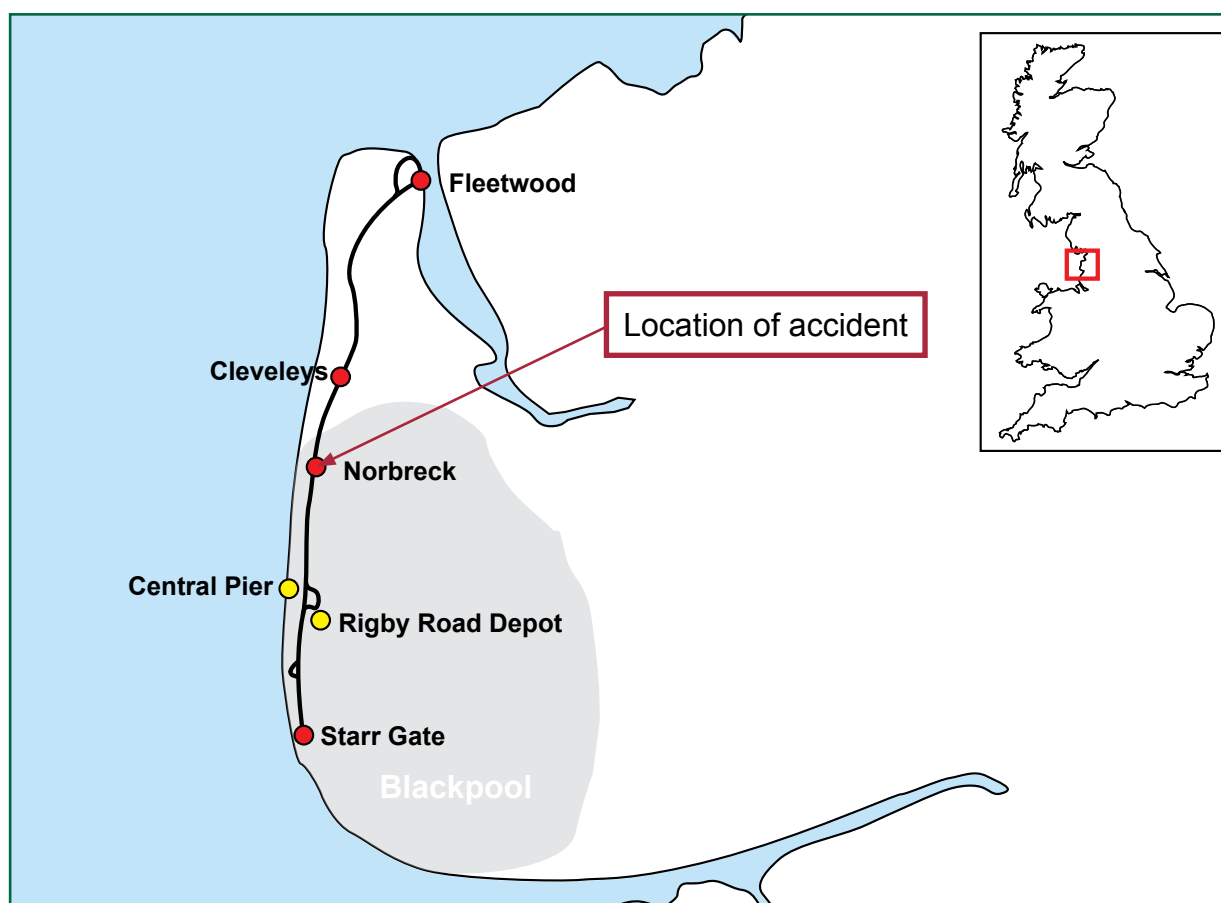


Figure 1: Map of the Blackpool area showing the location of the accident

- 10 The roadway crossing at Norbreck provides vehicle access for permit holders from Queens Promenade Road to the lower promenade. It also allows cyclists and pedestrians to cross the tracks. The northbound tram-stop is to the south of the crossing and the southbound tram-stop to the north of it (figure 2). Around 90 metres to the north of the roadway crossing is a separate foot crossing.

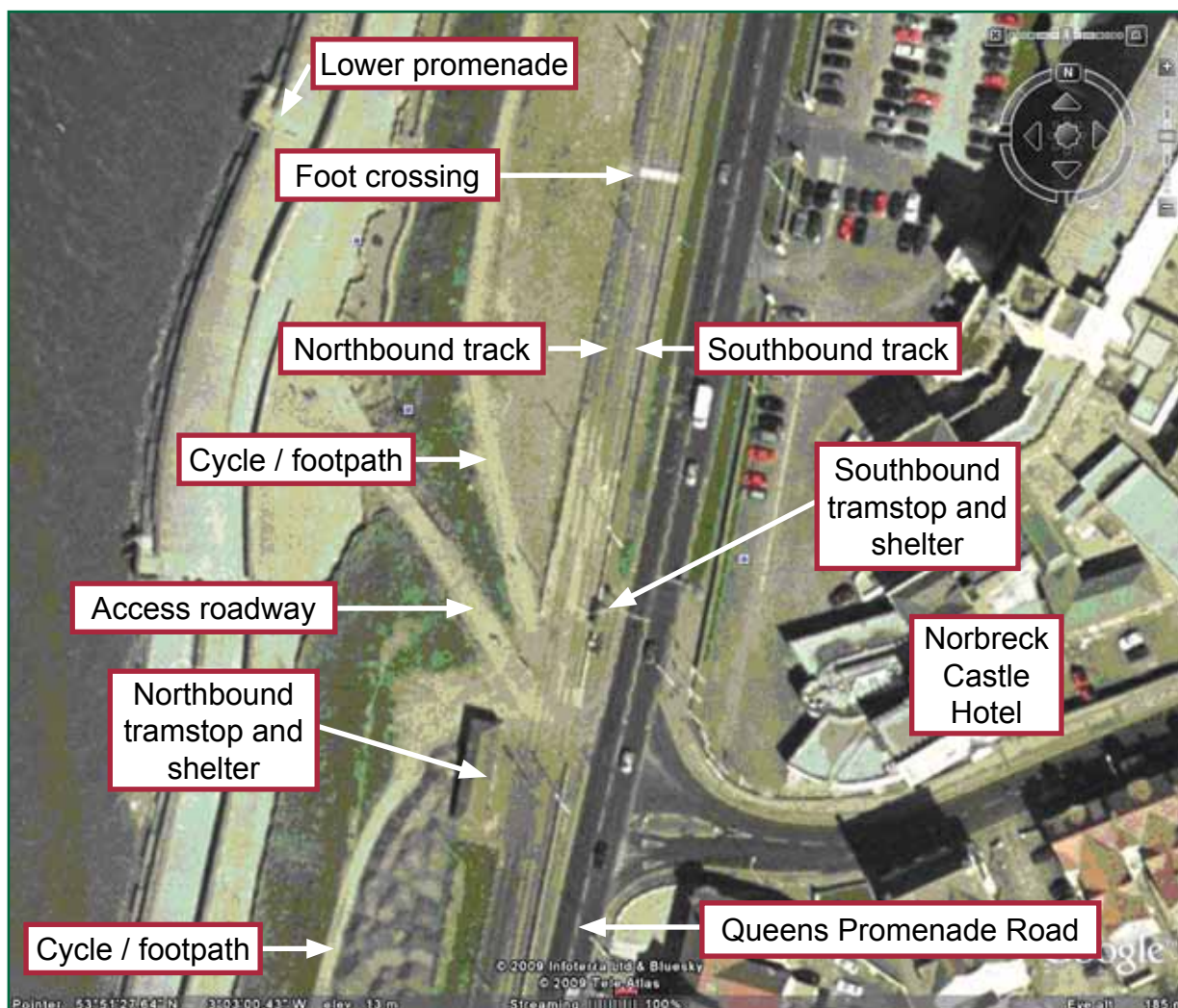


Figure 2: Aerial photograph of the site (image courtesy of Google Earth). The tramway crossover to the north of the tram-stop was removed before the accident

External circumstances

- 11 The weather on 5 August 2009 was dry, calm and clear, with patchy cloud and bright sunshine. There is no evidence that the weather played any part in the accident.

The tram

- 12 The tram involved was a double-decked vehicle that entered service in 1935. By virtue of its age, it does not have any facilities to record information about its operation, nor is it required to be fitted with a speedometer.
- 13 There are four primary speed limits on the Blackpool system of 4 mph (6 km/h), 12 mph (19 km/h), 16 mph (26 km/h) and 30 mph (48 km/h). Drivers are trained to relate their speeds to the position of the electric motor control handle and to judge speed 'by eye'.

- 14 The tram is fitted with both air brakes and a separate electric brake that uses the tractions motors as generators to slow the tram down.
- 15 The RAIB has examined the tram's pre-accident maintenance records. Post-accident tests and witness testimony demonstrated that the tram's headlights, horn and brakes were working normally at the time of the accident. The RAIB does not consider that the maintenance of the tram played any part in the accident.

The tram driver

- 16 The tram driver had worked for BTS since 1 June 2009, when he started training to be a tram driver. He was passed out to drive unaccompanied on 17 June 2009, seven weeks before the accident.

The pedestrian

- 17 The pedestrian was a 70 year old woman, Mrs Moreen Foxwell. She and her husband were visitors to Blackpool and were staying opposite the tram-stop at the Norbreck Castle Hotel in the days leading up to the accident. At the time of the accident Mrs Foxwell was crossing the tramway with her husband.

Events preceding the accident

- 18 Around 09:00 hrs on the morning of the accident the driver carried out his daily checks on tram 719 at Rigby Road depot; his first duty of the day. The tram entered service at 09:23 hrs heading north (figure 1). The tram turned round as scheduled at Cleveleys and started heading south, on time, at around 09:59 hrs.
- 19 Shortly before the accident, the pedestrian and her husband left their hotel with the intention of catching a southbound tram. They crossed Queens Promenade Road and then crossed the tramway using the foot crossing to the north of the tram-stop. They turned left and walked southwards along the cycle/footpath towards the tram-stop. The husband noticed people waiting in the southbound tram-stop shelter (figure 3).



Figure 3: View of crossing approaching from northerly cycle/footpath

- 20 As the pedestrians approached the roadway crossing, whilst still clear of the tramlines, the husband looked and saw the tram approaching from the north and estimated it to be close to the foot crossing. Expecting it to stop at the tram-stop, he and his wife continued walking side-by-side and started to cross the tracks; he was on the left-hand side, nearest to the approaching tram (figure 4).



Figure 4: Northward view from the west side of the roadway crossing – southbound tram-stop shelter and southbound tram 719 shown approaching just to the north of the foot crossing

Events during the accident

- 21 The tram approached the tram-stop having slowed from the line speed of 30 mph (48 km/h) to around 20 mph (32 km/h). The driver decided that as the people in the tram shelter did not put out their hands or move towards the tramlines, they did not want to catch the tram, and continued through the tram-stop without stopping (figure 5). These issues are discussed in more detail in the analysis section of the report.
- 22 On transferring his attention from the tram-stop to the roadway crossing ahead, the driver sighted the couple crossing the tramway from his right to left. He sounded the tram horn, and applied full air and electric brakes. The husband stopped clear of the southbound track but his wife stepped into the tram's path. She was struck by the front offside (right side) of the tram as she started to cross the southbound track.



Figure 5: Tram driver's eye view of the southbound approach to Norbreck tram-stop

Consequences of the accident

- 23 The pedestrian suffered serious injuries and died in hospital around five weeks later.

Events following the accident

- 24 Immediately after the accident, the emergency services were called. They arrived shortly afterwards and the injured pedestrian was taken to hospital.
- 25 The tram driver was tested for alcohol by the police and tested for drugs by BTS, in accordance with normal industry practice; all the results were negative.
- 26 BTS staff marked critical points on the ground with spray-paint. BTS and Lancashire Constabulary took measurements and photographs of the site. Around two and a quarter hours after the accident, BTS, witnessed by the police, conducted two emergency brake tests on tram 719 over the same part of the track that the tram had braked on during the accident. The tramway was reopened once those tests were completed.

The Investigation

Sources of evidence

27 The following sources of evidence were used:

- witness statements;
- site photographs, observations, brake test results and measurements;
- BTS photographs, reports and documentation;
- Lancashire Constabulary reports; and
- a review of previous RAIB investigations that had relevance to this accident.

Analysis

Identification of the immediate cause¹

- 28 **The immediate cause of the accident was that the pedestrian stepped into the path of the tram, which was unable to stop in time to avoid the collision.**
- 29 All witness evidence indicates that the couple were crossing the tracks together and that on becoming aware of the approaching tram, the husband looked up and stopped, but his wife continued forwards into the path of the tram and was struck. There is no evidence that the pedestrian slipped or tripped; the crossing surface was relatively even and dry.

Identification of causal² and contributory³ factors

- 30 The RAIB identified four causal factors and two probable causal factors. The causal factors relate to:
- the tram driver not perceiving the risk in sufficient time;
 - the speed of the tram and its relationship to the driver's training;
 - the tram not stopping at the tram-stop; and
 - the couple's assumptions about the tram's position.
- The probable causal factors relate to:
- the tram driver's attention towards the tram-stop;
 - the tram driver's assumptions about the people in the tram shelter; and
 - the feasibility that the tram driver's inexperience played a part.
- 31 Figure 6 shows how these factors fit together. The following paragraphs then explore each of them.

¹ The condition, event or behaviour that directly resulted in the occurrence.

² Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

³ 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.

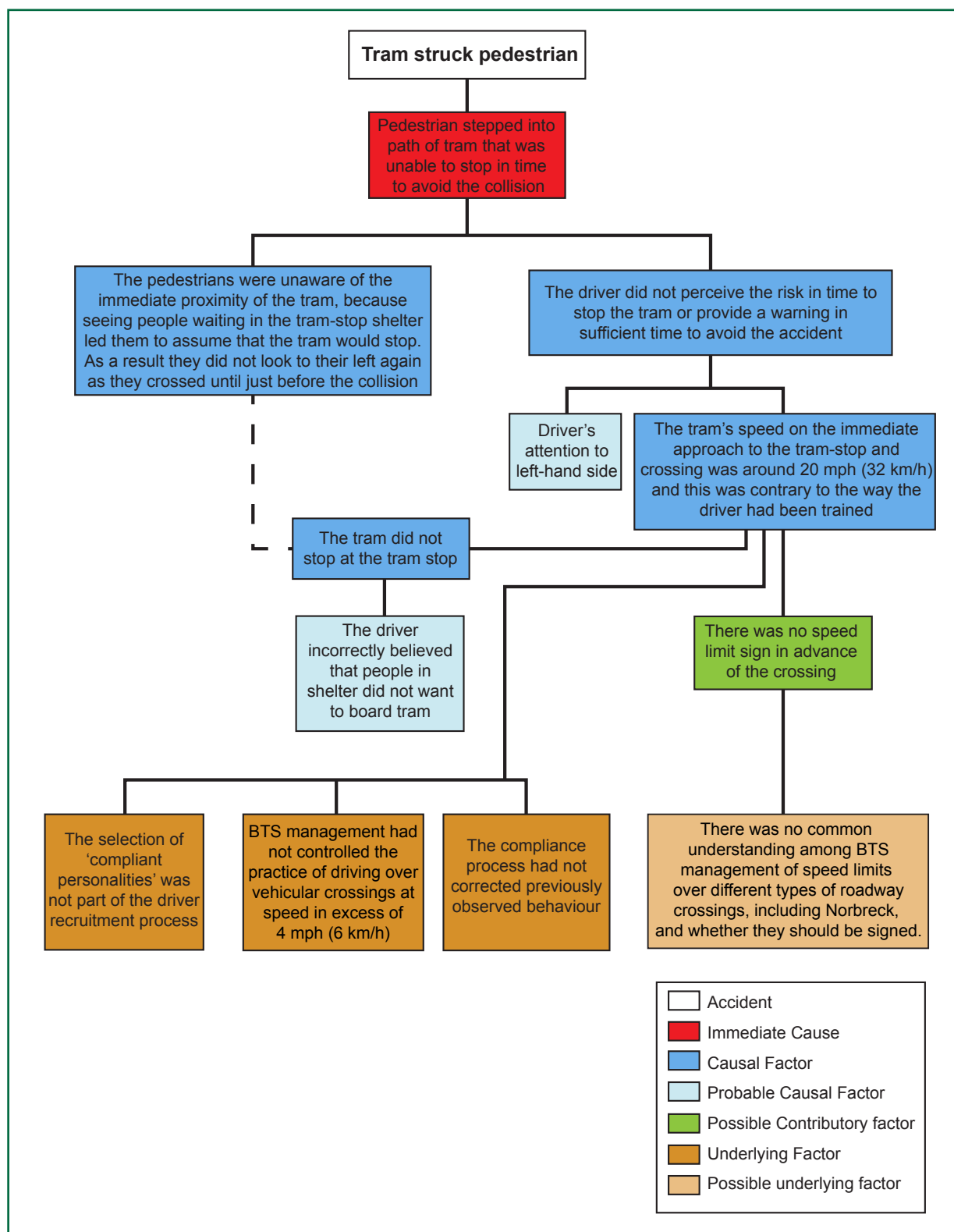


Figure 6: Diagram of causal factors

Tram driver's perception of the risk

32 The tram driver not perceiving the risk in time to stop the tram or provide a warning in sufficient time to avoid the accident was a causal factor.

33 The driver's early accounts of the accident indicate that he slowed the tram from 30 mph (48 km/h) to between 15 and 20 mph (24 and 32 km/h) on approach to the tram-stop. His later accounts were that he slowed to 4 mph (6 km/h) on approach to the tram-stop. All his accounts suggest that:

- he made the decision that those waiting in the shelter did not want to catch the tram because they did not move away from the shelter or signal to him;
- he then started to accelerate with his attention still to the left as he passed through the stop, as he stated that he had been trained to look for people trying to board or 'surf' non-stopping trams; and
- when he looked forward again, he saw the pedestrians crossing ahead.

A diagram of the crossing and tram-stop is provided in figure 7.

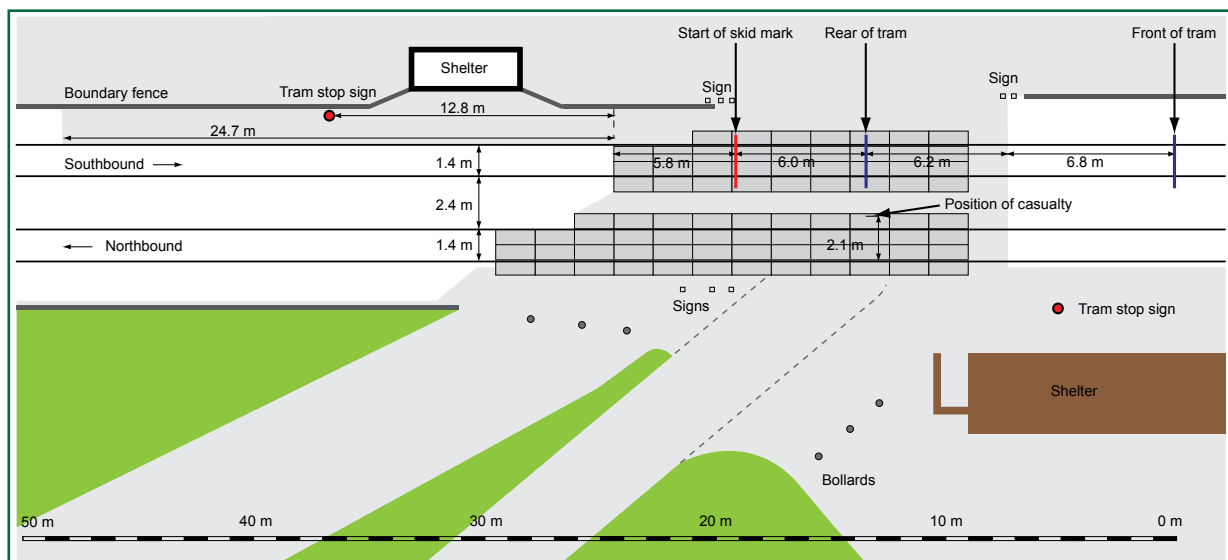


Figure 7: Layout of Norbreck tram-stop and crossing

34 The driver has stated that when he first saw that the couple were crossing from right to left in front of the tram, he sounded his horn and fully applied the air and electric brakes at the same time. Other witnesses also stated that the horn started sounding before the collision. Witness evidence, the position of the controls after the accident and wheel-slide (skid) marks found on what was a dry railhead, suggest that the tram brakes were fully applied.

35 Southbound visibility of the crossing is not significantly restricted (figure 5). As such, the reasons the driver did not perceive the risk in sufficient time could have been that:

- the pedestrians were travelling exceptionally quickly; or
- the driver was not paying attention in general; or
- the driver was paying attention but it was directed left, towards the stop; or
- the tram was travelling quickly.

- 36 The first reason is unlikely. The pedestrians were aiming to catch the tram and were aware that it was approaching; witness accounts suggest that they were in a hurry. Published data⁴ indicates that a normal walking speed range for a woman of 60 plus years is 1.2 to 1.4 m/s. Even if this is increased by a margin to allow for the pedestrians hurrying, it is still unlikely that they were travelling exceptionally quickly, considering that cycles and motor vehicles also use the crossing.
- 37 The second reason is a possibility. It could be that the tram driver did not stop to pick up waiting passengers and did not perceive the risk to the crossing pedestrians until late because he was generally not paying attention. While the tram had slowed on the approach to the tram-stop, it was still travelling at a speed that would have required heavy braking to stop and pick up the intending passengers.
- 38 There is no evidence that alcohol, drugs, fatigue or an external distraction played a role. The driver has stated that he was paying attention but that it was directed left towards the tram-stop as he approached the crossing. While the evidence is not conclusive, the RAIB consider it probable that the driver's attention was diverted to the left.
- 39 The direction of attention to the left combined with the speed of the tram is the most likely reason why the driver did not perceive the risk in sufficient time.

The speed of the tram

- 40 **The tram's speed of around 20 mph (32 km/h) on the immediate approach to the tram-stop and crossing was a causal factor, and this was contrary to the way the driver had been trained.**
- 41 The RAIB has calculated based on post incident brake test results (paragraph 26) and wheel-slide mark lengths, that the range of speeds at which the tram started braking in reaction to the pedestrians was most likely to have been between 8.3 m/s and 10.5 m/s (18.7 mph and 23.6 mph). This matches the driver's early accounts and other witness statements more closely than his later accounts (paragraph 33).
- 42 At this range of speeds, the range of distances from the front of the tram when it started braking and sounding the horn to the front of the tram after it had stopped was between around 26 and 40 metres. This corresponds to a likely time from the horn being first sounded to collision of between 1.5 and 2.7 seconds. If a 1 second driver reaction time is allowed for⁵, the driver saw the pedestrians and perceived the need to brake when the front of the tram was between 35 and 50 metres before the point where it stopped. Figure 7 can be used to identify where those positions would be.

⁴ Pedestrian Accident Reconstruction, J Eubanks, Lawyers and Judges Publishing, 1994.

⁵ The Highway Code, when calculating road vehicle stopping distances, allows around 0.7 seconds for a driver to react and apply the brakes. The assumption of 1 second allows for a small additional time to apply the tram brakes because two handles have to be moved, rather than a pedal depressed. This approximation is only used to estimate where the tram driver first perceived the need to brake and does not affect the calculation of tram speed.

- 43 Members of the training department of BTS have stated that the speed limit over the crossing is 4 mph (6 km/h), as they considered it a road crossing and delivered training on that basis. A number of reasons why the driver was not adhering to this have been considered:
- the driver was not trained to drive over this crossing at 4 mph (6 km/h);
 - the 4 mph (6 km/h) speed limit declared at this location in the drivers' log book⁶ made reference to a crossover that had been removed a year and a half before the accident; or
 - there is no 4 mph (6 km/h) speed limit sign on the southbound approach to the crossing.
- 44 The driver had, during training, signed the following declaration for each training module; 'Following the training I received in the above performance criteria I am confident that I have a full understanding of all of the subjects covered'. While this suggests he understood the training in general, it does not specifically confirm an understanding of how to drive at Norbreck. Although witness statements vary, they agree that the driver had passed over Norbreck roadway crossing on supervised training drives a number of times. The majority agree that had he passed over the crossing at speeds significantly above 4 mph (6 km/h), he would have been corrected and that trainees were taught that the road crossing speed limit of 4 mph (6 km/h) applied at this location. Based on this evidence, the driver not being trained to drive over the crossing at 4 mph (6 km/h) has been discounted as a factor.
- 45 BTS mandate that all drivers carry their log book whilst on duty. It defines among other things, speed limits that are applicable at each point on the tramway. With regard to the southbound passage through Norbreck it states:
- 'Norbreck Tram-stop/Crossing**
- Reduce speed to 4 mph before crossover and stop if necessary
 - Be aware that traffic can emerge across your path from both directions.
Take particular note of vehicles coming from the right as these have to climb up a severe gradient before arriving at the tram track and may arrive at speed.'
- 46 The crossover⁷ referred to above was removed in the winter of 2007/2008. Road crossings and crossovers both have a universal 4 mph (6 km/h) speed limit defined in the drivers' log book. As the driver has not made reference to this lack of clarity as a reason for the tram's speed, it has been discounted as a factor.
- 47 Unless they have automatic signals or compulsory stop boards, all Blackpool tramway crossings over public roads had associated 4 mph (6 km/h) speed limit signs to warn tram drivers, although the type of sign used varied. Some non-public roadway crossings had 4 mph (6 km/h) speed limit signs and some, like Norbreck, did not.

⁶ The drivers' log book contains rules and information and forms the basis of driver training. Among other things, it details the tramway route including applicable speed restrictions.

⁷ Two pairs of points linked together to allow a tram to reverse direction, or to allow trams to operate over a single line in both directions.

- 48 On the northbound approach, Norbreck crossing has a 'caution' sign to warn drivers of the restricted visibility to their left side as a result of the large brick shelter associated with the northbound tram-stop. On the southbound approach, there was no sign of any type relating to speed.
- 49 The tram driver stated in earlier interviews that as Norbreck crossing did not have speed limit signs, he did not consider that there was an applicable 4 mph (6 km/h) speed limit. In a later interview, he reiterated that there was no speed limit sign, but accepted that he had been trained to slow to 4 mph (6 km/h) on the approach to tram-stops. Had there been a speed limit board on the southbound approach, the driver may have approached the crossing at a slower speed than he did.
- 50 Had the tram's speed been lower, the chances of the accident happening would have been less and the consequences likely to have been less severe. The lack of a speed limit sign was a possible contributory factor.**

The tram driver's attention at the tram-stop

- 51 The driver's attention to his left on approach to the crossing was a probable causal factor.**
- 52 Paragraph 38 explains that the driver's attention was probably concentrated to his left on the approach to the tram-stop and crossing. As can be seen from figure 5, the tram driver's eye view of Norbreck crossing on a southbound approach is not significantly impeded. Had his attention been focused on the crossing earlier, instead of on the stop, he may have been able to give a longer warning and apply the brakes earlier, probably avoiding the accident.

Not stopping at the tram-stop

- 53 The tram not stopping at the tram-stop was a causal factor.**
- 54 The tram would not have approached the crossing at the speed it did, had it stopped at the tram-stop. The pedestrians could have then successfully crossed the tramway.
- 55 Tram drivers in Blackpool are trained to stop at tram-stops if there are people waiting there to catch a tram. There are exceptions; for example when a tram is already very full or is not in service.

The tram driver's assumptions about the people in the tram shelter

- 56 The tram driver's incorrect belief that the people in the tram shelter did not want to board the tram was a probable causal factor.**
- 57 There were a number of people in the shelter including a family group of five who intended to catch the tram. The tram driver has stated that he did not believe that the people waiting wanted to board because no one moved away from the shelter or signalled to him.
- 58 Blackpool tram drivers are trained to slow on the approach to a tram-stop and to stop if there are people near the tram-stop whether they raise their arms or not. The decision as to what is 'near' is a matter of judgement for drivers, depending on peoples' demeanour and where they are relative to the tram-stop; in this case the driver's judgement was incorrect. The BTS training department has stated that they would expect a tram to stop at Norbreck if there were people in the shelter and that they taught drivers on that basis.

59 The driver's judgements in the related matters of whether to stop at the tram-stop, and where his attention was focussed relative to the tram's speed on approach to the crossing, would perhaps have been better had he been more experienced. In a (UK and Ireland) Light Rail Operators Committee Driver Support Project study (which included BTS), '50% of light railways identified that newly-qualified drivers are likely to be involved in a safety related incident'. The report suggests this to be most likely within six months of qualification.

60 **While it is not possible to say with certainty that inexperience played a part in the accident, it is feasible that it did.**

The couple's assumptions about the tram's position

61 **The pedestrians were unaware of the immediate proximity of the tram, because seeing people waiting in the tram-stop shelter led them to assume that the tram would stop. As a result, they did not look to their left again as they crossed until just before the collision. This was a causal factor.**

62 Witness evidence suggests that the couple:

- had made a decision to cross when they saw the tram approaching close to the foot crossing to the north;
- believed that the tram would stop at the tram-stop because there were people waiting in the shelter; and
- were hurrying to catch the tram.

63 As a result, from the time they saw the tram near the foot crossing to the north to just before the collision, the pedestrians probably did not look to their left again.

64 The husband became aware of the tram and looked up in sufficient time to stop moving forward into its path, probably as a result of the tram's horn starting to sound. His wife, either in a belief that she would get across in time or because she did not have sufficient time to react and stop, stepped forward into the tram's path.

65 Trams generally stop at the southbound tram-stop at Norbreck; it is a popular place to board and southbound trams tend not to have filled up prior to arriving there. As the pedestrian and her husband had been staying at the hotel opposite the tram-stop and had used the tramway on a number of occasions during that time, they would have been used to trams stopping to pick up waiting passengers. In the circumstances, seeing waiting passengers led to an assumption that the tram would stop that in this case proved incorrect.

Identification of underlying factors⁸

Speed limits on Blackpool Tramway

66 **There was no common understanding among BTS management of speed limits over different types of roadway crossings, including Norbreck, and whether they should be signed. This underlies the lack of a speed limit sign on the southbound approach to Norbreck crossing and is a possible underlying factor.**

⁸ Any factors associated with the overall management systems, organisational arrangements or the regulatory structure.

- 67 The drivers' log book, which had been developed by the training department, lists areas and features with particular speed limits that apply to them. It states that the speed limit on all road crossings is 4 mph (6 km/h). It also provides a description of the route with applicable speed limits and states that the speed limit through Norbreck, southbound, is 4 mph (6 km/h) (paragraphs 45 and 46).
- 68 While there was some collaboration between the training department and other departments in preparing the drivers' log book, evidence indicates that different departments within BTS had different views on:
- whether all roadway crossings should be considered as 'road' crossings;
 - whether Norbreck was a 'road' crossing;
 - whether or not trams should be driven over Norbreck crossing at 4 mph (6 km/h) or possibly faster; and
 - whether all 4 mph (6 km/h) crossings should have associated speed limit signs.

Tram speeds on vehicular crossings

69 BTS management had not controlled the practice of driving over vehicular crossings at speed in excess of 4 mph (6 km/h). This was an underlying factor.

- 70 In the weeks after the accident the RAIB carried out short, 'by eye' surveys at three roadway crossings, at locations away from Blackpool town centre. At each site, the passage of around twelve trams was observed (because the three surveys were simultaneous, the same trams and drivers would have featured in more than one). The sites were chosen as ones where BTS inspectors were understood to be less likely to be found. The surveys found that the majority of trams that did not stop at an adjacent tram-stop, crossed the roadways at well in excess of 4 mph (6 km/h), irrespective of whether the crossing had 4 mph (6 km/h) speed limit signs or not.
- 71 Interview evidence suggests that some parts of BTS management consider levels of compliance to be good, others less so.
- 72 While this evidence is not conclusive, it suggests that there are a number of drivers with a habit of driving trams at over 4 mph (6 km/h) on roadway crossings. This had not been controlled by BTS management.

The tram driver's driving technique

73 Aspects of the driver's behaviour just prior to the accident had occurred previously and had been detected by BTS. Although they had taken steps to correct these, those steps had not been effective. The BTS compliance processes not correcting the tram driver's previously observed behaviour was an underlying factor.

74 The driver's records show that:

- He passed his practical driving test on 17 June 2009.
- A standard '2 week' assessment for new drivers (carried out by a member of the training department boarding a service tram without warning) was carried out on 29 June. This was marked with an 'x' (as opposed to a ✓ denoting competent) against 'appropriate speed' under the Planning and Awareness heading. The driver's errors were pointed out to him and a '2 week reassessment' required.
- The '2 week re-assessment' was carried out on 8 July. The assessment form includes 'x's against, 'Health and Safety Awareness', 'Observes all signs and signals', 'Appropriate speed' and 'Anticipates and responds to hazards'. Until the driver realised that the assessor was on the tram, records indicate that he drove at around 16 mph (25 km/h) in 4 mph (6 km/h) areas on three occasions. The record also states that 'On the return from Cleveleys (as he now realised I am on the vehicle) the drive was if [*sic*] he had been on his tram driving test. So it goes to prove that he can drive to company policies, but when he is not being watched he decides not to for whatever reason'. The driver's errors were pointed out to him and more senior training department staff decided to observe his driving.
- This observation took place later on the 8 July, when the driver was observed from a moving road vehicle. The records include, 'We witnessed *the driver* complying with all compulsory stops. However, his speed appeared far too fast in two places. Once at Orion curve and once a [*sic*] Bispham where there are 4 mph speed limits in place. He appeared to be travelling at approximately 16 - 18 mph.'
- On 9 July the driver was relieved from duty as a result of the sub-standard assessments. A BTS manager explained that his driving standard was unacceptable and 'the potential consequences if he continues to drive at this standard' were explained. The driver is noted as having understood, but that he was trying to keep to time. The file note then states, 'I explained to *the driver*, that the timecard is only a guide and that safety must come first. He promised me that he would drive to the standard to which he was trained. I told him he would be frequently reassessed'. The driver then returned to duty.
- On 29 July a further random check was carried out which concluded that the driving was 'to a very good standard, with all speed limits, company rules and tramway rules adhered to. The tram was approximately 7 minutes late arriving at Lindel Road northbound'.

75 The heritage trams that BTS operate are not fitted with any facilities to record information about their operation. Compliance inspectors are spread quite thinly between the tram and much larger bus operations, and although such inspectors are sometimes 'roving', tram drivers are likely to know where inspectors tend to be positioned. These factors make the monitoring of tram driver compliance more difficult.

76 Another role of inspectors is to turn late running trams round before the end of their scheduled route in order to try and maintain a consistent service. BTS management has stated that there is no penalty to the drivers of such trams if this occurs.

- 77 When a tram driver is seen not complying with rules by an inspector, the driver may be spoken to or given a written 'ticket'. Depending upon the severity of the non-compliance, various forms of disciplinary action may be taken. The range of actions is: counselling, verbal warning, written warning, final written warning and dismissal. There are no hard and fast rules for what, if any, actions are taken for a given non-compliance, although there are precedents which are used for judging what action is taken. The system is flexible to allow for the specific circumstances surrounding an incident.

BTS driver assessment and selection procedure

78 The assessment and selection of compliant personalities not being part of the BTS driver recruitment process was an underlying factor.

- 79 Tram drivers in Blackpool are, uniquely in the UK, recruited to drive both trams and buses. The selection process involves: the review of an application form, a Highway Code test, a comprehension assessment on the Driving Standards Agency theory handbook, a numeracy and literacy test, and a 20 minute evaluation drive in the largest road vehicle which the candidate holds a licence for.
- 80 Witness evidence suggests that the key qualities being sought are the ability to assimilate information, the ability to anticipate and react to hazards and the ability to interact with customers.
- 81 The driver involved appeared on a number of occasions in the past to have put adherence to timetable before maintenance of a compliant speed.
- 82 A number of organisations who recruit people for safety critical work now assess prospective candidates for, among other things, tendencies to comply (or not) with rules and directions. Such assessments usually take the form of psychometric tests. These are widely used for mainline train drivers and have been used on other UK tramways.
- 83 Had BTS used such assessment and selection techniques they may have had a cohort of drivers less likely to contravene speed restrictions and other rules, which would have made this accident less likely. Not using such techniques in driver selection may have increased the chances of this accident occurring.

Previous occurrences of a similar character

- 84 There have been ten other collisions between trams and pedestrians or cyclists on crossings of segregated lines notified to the RAIB since it became active in October 2005. The RAIB has investigated two of these⁹, but in all of the cases the collision was a result of the pedestrian not being aware of, or disregarding, the approaching tram. Neither the driving style of the trams nor the pedestrians believing that trams would stop at a tram-stops featured in any of these accidents.

⁹ RAIB reports: 01/2006, Tram, Pedestrian collision at Staniforth Road, Sheffield, 27 October 2005; and 06/2009, Fatal accident at Morden Hall Park footpath crossing, 13 September 2008; available at www.raib.gov.uk

Observations¹⁰

Western approach signage

- 85 The signage on the western approach to the crossing did not include a sign warning users of the presence of the tramway. The eastern approach does include such a sign. The pedestrian and her husband were aware of the tramway in this instance and as such, this issue played no part in this accident.

Timetable pressure

- 86 Some witnesses drew attention to recent timetable changes that have sometimes made it difficult for drivers to keep to the timetable given other constraints on the service speed of trams. In the case of this accident, the driver stated that he was not under such pressure at the time of the accident and his tram was running to timetable. However, timetables should be co-ordinated with, among other things, applicable speed limits and designed not to put undue pressure on drivers. BTS have stated that they do this.

Drivers' log book error

- 87 Paragraph 46 refers to an inaccuracy in the drivers' log book and explains why this has been discounted as a factor in this accident. However, this document is the primary document defining speed limit locations to trainers and drivers and should be accurate.

¹⁰ An element discovered as part of the investigation that did not have a direct or indirect effect on the outcome of the accident but does deserve scrutiny.

Summary of Conclusions

Immediate cause

- 88 The immediate cause of the accident was that the pedestrian stepped into the path of the tram, which was unable to stop in time to avoid the collision (paragraph 28).

Causal and contributory factors

- 89 The causal factors were that:

- the tram driver did not perceive the risk in time to stop the tram, or provide a warning in sufficient time to avoid the accident (paragraph 32, **recommendation 2**);
- the tram's speed on the approach to the tram-stop and crossing was around 20 mph (32 km/h) and this was contrary to the way the driver had been trained (paragraph 40, **recommendation 2**);
- the tram did not stop at the tram-stop (paragraph 53, **no recommendation is made**); and
- the pedestrians were unaware of the immediate proximity of the tram, because seeing people waiting in the tram-stop shelter led them to assume that the tram would stop. As a result, they did not look to their left again as they crossed until just before the collision (paragraph 61, **no recommendation is made**).

- 90 The probable causal factors were that:

- the tram driver's attention was to the left-hand side approaching the crossing (paragraph 51, **no recommendation is made, however development of a speed limit policy, recommendation 1, should consider a maximum speed through stops for non-stopping trams**);
- the tram driver incorrectly believed that the people in the tram shelter did not want to board the tram (paragraph 56, **no recommendation is made**); and
- it is feasible that the combination of factors relating to the way the tram was driven were caused by the driver's inexperience (paragraph 60, **no recommendation is made, however, the result of recommendation 2 should be increased levels of compliance irrespective of driver inexperience**).

- 91 A possible contributory factor was the lack of a speed limit sign (paragraph 50, **recommendation 1**).

Underlying factors

92 The underlying factors were that:

- BTS management had not controlled the practice of some drivers of driving over vehicular crossings at speed in excess of 4 mph (6 km/h) (paragraph 69, **recommendation 2**).
- The BTS compliance processes had not corrected previously observed behaviour (paragraph 73, **recommendation 2**).
- The assessment and selection of compliant personalities was not part of the BTS driver recruitment process (paragraph 78, **recommendation 2**).

A possible underlying factor was that:

- There was no common understanding among BTS management of speed limits over different types of roadway crossings, including Norbreck, and whether they should be signed (paragraph 66, **recommendation 1**).

93 Although not linked to the accident on 5 August 2009, the RAIB observes that:

- The western approach signage for crossing users at Norbreck was not to the same standard as the eastern approach signage; the sign warning of the presence of the tramway was missing (paragraph 85, **no recommendation is made because this has been corrected**, paragraph 98).
- Timetables should fully take account of speed limits among other things (paragraph 86, **no specific recommendation is made, however once recommendation 1 has been completed, the timetable should be re-examined to ensure that the speed limit policy and the timetable are compatible**).
- The drivers' log book contains an inaccuracy relating to the removed crossover (paragraph 87, **recommendation 1**).

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

- 94 As a result of the accident and initial investigations, the RAIB issued an Urgent Safety Advice (USA) to BTS on 21 August 2009. The main areas of advice to BTS were:
- decide what the required speed limit is for trams to pass over each of their road crossings;
 - notify their tram drivers of what the speed limit is on each of their road crossings, together with consistent signing of these speed limits on the approach to road crossings;
 - instruct their tram drivers to comply with the required speed limits and monitor their compliance; and
 - review the process that their tram drivers follow when running non-stop through tram-stops in the vicinity of crossings, and take appropriate action to reduce the risk of an accident.
- The full USA is shown in appendix A.
- 95 Subsequently, the Safety Authority (Office of Rail Regulation) issued an Improvement Notice to BTS on 24 August 2009. BTS did not contest the Improvement Notice and have stated that they are already taking actions to address the issues raised.
- 96 BTS has stated that they have set up a committee including the managing director and trades union representatives, with all relevant departments represented, to define and document in one place, the principles of driving to be applied at BTS. As part of its remit, it will define policies on speed limits and speed limit signage. BTS have also reported that they have updated their speed limit compliance monitoring scheme.
- 97 BTS has stated that they terminated the driver's employment on the grounds that he did not reach the required standards during his 6-month probationary period.

Actions reported which address factors which otherwise would have resulted in a RAIB recommendation

- 98 Blackpool Council has re-fitted a warning sign facing the western approach to the crossing warning crossing users of the presence of the tramway. In light of this, no recommendation is made in response to the associated observation (paragraph 93, first bullet).

Recommendations

99 The following recommendations are made¹¹.

Recommendations to address causal and contributory factors

- 1 BTS management should develop and document a company-wide policy for the determination and application of speed limits throughout the network. This should include a maximum speed for non-stopping trams through tram-stops. They should also develop, document, train and brief a speed limit signage policy.

The purpose of this recommendation is to introduce a universal speed limit policy, agreed by all parts of BTS and a corresponding speed limit signage policy. These should both be documented. Derivation of any timetables should fully take account of the speed limits applied.

- 2 BTS should develop and document an effective and consistent system to monitor compliance with speed limits among tram drivers, and adjust BTS recruitment, training and compliance procedures as necessary to increase levels of compliance.

The purpose of this recommendation is to improve the measurement of levels of non-compliance with speed limits and bring about improved levels.

¹¹ 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 www.raib.gov.uk

Appendices

Appendix A - RAIB Urgent Safety Advice

| 1. INCIDENT DESCRIPTION | | | |
|-------------------------|---|------------------|----------------|
| LEAD / INSPECTOR | | CONTACT TEL. NO. | |
| INCIDENT REPORT NO | 0374 | DATE OF INCIDENT | 05 August 2009 |
| INCIDENT NAME | Norbreck Tram Stop | | |
| TYPE OF INCIDENT | Collision at level crossing between a tram and a pedestrian | | |
| INCIDENT DESCRIPTION | <p>On 5 August 2009, at 10:06 hrs, tram number 719, running south from Cleveleys towards Blackpool, struck a pedestrian who was crossing the tramway by a public roadway which lies immediately after the southbound tram stop at Norbreck. The tram had slowed down but it had not stopped at the stop.</p> <p>A male and a female pedestrian had begun to cross the tramway from the west side to the east side, just as the tram passed through the stop and onto the crossing at an estimated speed of between 10 mph (16 km/h) and 15 mph (24 km/h). On seeing the pedestrians, the driver continuously sounded the tram's horn and applied its emergency brakes. The male pedestrian stopped on the northbound track but the female pedestrian continued into the path of the tram and was struck. She was knocked to the ground between the northbound and southbound tracks and suffered serious head and chest injuries as a result of the accident.</p> | | |
| SUPPORTING REFERENCES | | | |

| 2. URGENT SAFETY ADVICE | |
|---------------------------|---|
| USA DATE: | 21 August 2009 |
| TITLE: | Operation of trams on Blackpool tramway |
| SYSTEM / EQUIPMENT: | The RAIB's preliminary examination of this accident has identified issues with the operation of trams on Blackpool tramway. The primary issue is the speed at which trams are driven over road crossings. There is also an issue with trams running non-stop through tram stops in the vicinity of crossings. |
| SAFETY ISSUE DESCRIPTION: | <p><u>Speed of trams passing over vehicle crossings</u></p> <p>Blackpool Transport Services Ltd defines a road crossing to be any location where a vehicle can legitimately cross the tramway. The crossing at Norbreck is therefore a road crossing, as it provides a right of way for permit holders to gain vehicular access from a public road to the promenade. The training department at Blackpool Transport Services Ltd train their tram drivers to drive over all road crossings at a maximum speed of 4 mph (6 km/h). The training department also issues each tram driver with a log book which states that a maximum speed of 4 mph must be observed at all road crossings, including Norbreck specifically.</p> <p>On the Blackpool tramway, some road crossings are designated as compulsory stops and are signed as such, some have signs on their approach to indicate there is a maximum speed of 4 mph across them, and the remainder do not have any signage and require the driver to remember to comply with the 4 mph speed limit. There are no speed limit signs on the approach to the road crossing at Norbreck.</p> <p>From the evidence gathered during the RAIB's preliminary examination, the tram was travelling between 12 mph (19 km/h) and 18 mph (29 km/h) when it struck the pedestrian.</p> <p><u>Trams running non-stop through tram stops in the vicinity of crossings</u></p> <p>There are occasions when a tram may not stop at a tram stop when people are standing at the stop. This may be because the tram is full, or because the driver has judged that no-one is intending to travel. In these circumstances, Blackpool Transport Services Ltd train their tram drivers to slow down through the tram stop and look back over their shoulder to check that no-one at the stop is attempting to board the moving tram.</p> <p>This action of looking back diverts the driver's attention from observing what is ahead of the tram.</p> |

| | |
|---------------------------|--|
| CIRCUMSTANCES: | <p><u>Speed of trams passing over vehicle crossings</u></p> <p>The RAIB has observed tram drivers not complying with 4 mph speed limit as set by Blackpool Transport Services Ltd for road crossings. This includes the road crossing at Norbreck as well as at a number of other road crossings on Blackpool tramway. At locations where the road crossing was next to a tram stop, the instances of non-compliance occurred when the tram did not stop.</p> <p><u>Trams running non-stop through tram stops in the vicinity of crossings</u></p> <p>There are other tram stops on Blackpool tramway like the one at Norbreck, where the northbound and southbound stopping points are staggered with a crossing in between them. This arrangement means that in the direction of travel, the crossing lies immediately after the tram stop. When tram drivers do not intend to stop at one of these places and there are people at the stop, they are trained to look back towards the stop. This diverts their attention from looking ahead, so anyone arriving late at the crossing may not been seen until the tram has passed the stop and is almost upon the crossing. The risk of an accident is further increased as people using the crossing may anticipate that the tram is going to stop and begin to cross when it is unsafe to do so.</p> |
| CONSEQUENCES | All of the issues identified increase the likelihood of accidents happening on Blackpool tramway. Those accidents that happen at a higher speed will also tend to have more severe consequences. |
| REASONS FOR ISSUE: | <p>The findings of the RAIB's preliminary examination have raised concerns about the operation of trams on Blackpool tramway, especially over road crossings. Therefore the RAIB advises Blackpool Transport Services Ltd to:</p> <ol style="list-style-type: none"> 1. Decide what the required speed limit is for trams to pass over each of their road crossings. 2. Notify their tram drivers of what the speed limit is on each of their road crossings, together with consistent signing of these speed limits on the approach to road crossings. 3. Instruct their tram drives to comply with the required speed limits and monitor their compliance. 4. Review the process that their tram drivers follow when running non-stop through tram stops in the vicinity of crossings, and take appropriate action to reduce the risk of an accident. |

| USA SIGN-OFF* | | | |
|-----------------------------|----------------|-----------------------|----------------|
| INSPECTOR NAME: | | DCI NAME: | |
| INSPECTOR SIGNATURE: | | DCI SIGNATURE: | |
| DATE: | 21 August 2009 | DATE | 21 August 2009 |

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