



Investigation Report

Bus/Tram Collision 7th September 2008

Park Lane/George Street/Wellesley Road,
Croydon

Issue	Date	Status
1	10 th October 2008	Draft
2	3 rd December 2008	2nd Draft, Issued to investigation panel
3	22 nd December 2008	Issued for comment
4	26 th January 2009	Issued



Contents

1. Executive Summary	3
3. TfL Organisations Involved	4
4. The Incident	5
5. Traffic Signals	7
6. Driver Competency	9
7. CCTV Footage	10
8. Road Conditions.....	11
9. Condition of tram rails	11
10. Vehicle condition	12
11. Review of Previous Incidents	12
12. Information from the Metropolitan Police.....	12
13. Reconstruction of Incident.....	12
14. Incident Management.....	13
15. Conclusion	14
16. Recommendations.....	13

Appendices

- A: Terms of Reference
- B: Evidence log
- C: Additional photos taken at scene
- D: Map of junction/area
- E: Root cause diagram



1. Executive Summary

- 1.1 On the 7th September 2008 a collision occurred between a bus and tram at George Street/Wellesley Road/Park Lane junction in Croydon. The incident resulted in the death of a member of the public who had been travelling on the bus. A joint investigation was commissioned between London Rail and Surface Transport, both Modes of TfL. The purpose of the investigation was to establish the cause of the collision and, where possible, to make recommendations to prevent or reduce the possibility of reoccurrence.
- 1.2 As a result of the incident both the bus and tram sustained significant damage. There was also substantial damage to a number of shop fronts, street furniture and a parked car. The granite kerbing on the footpath in George Street (West) was damaged as a result of the derailment of the tram. The incident resulted in severe disruption to both the bus and tram services on the day and the imposition of an operational temporary speed restriction for trams, of 20kph, which was also put in place at this junction on the day after the incident.
- 1.3 At the time of writing this report the Metropolitan Police (MP) are still carrying out an investigation into this incident and the Rail Accident Investigation Branch (RAIB) is maintaining an interest. To date the Health and Safety Executive (HSE) have shown no interest. This report sets out the results of the joint investigation, looking at the root causes of the incident and making a number of recommendations

2. Limitations to the Investigation

- 2.1 It has not been possible to interview either the bus or tram driver or obtain any statements made by either. No technical reports on the bus, post incident have been made available. The key evidence that this investigation had relied on has been available CCTV footage from the tram, which was viewed on the 9th September 2008 at the tram operators premises, (although subsequently 'impounded' by the MP), CCTV footage from the bus, which was released, by the MP, to the bus operator on or about the 12th November 2008 and viewed on the 28th November 2008 at the bus operators premises, visual examination of the site, photographic evidence taken by Transport for London (TfL) and bus company staff at the time of the incident and logs maintained by CentreComm. This has meant that whilst our conclusions are grounded in fact, there are some areas where we have to admit we cannot be absolutely sure.



This is not unique and investigations often have to rely on incomplete evidence. However, we have been able to provide conclusions as to the cause of the accident, the likely root causes and have been able to make a number of recommendations.

- 2.2 At a meeting with the MP on the 12th November 2008 certain limited verbal information was made available to the TfL investigation panel. However the MP have stated that as the incident is still under investigation by them and they have not concluded their investigations into the cause of the incident that no report by TfL can be made public. Circulation within TfL may have to remain restricted.

3. TfL Organisations Involved

3.1 London Tramlink

- 3.1.1 London Tramlink is a division of TfL's London Rail. In June this year TfL acquired Tramtrack Croydon Ltd, the Private Finance Initiative (PFI) Concession holder and now directly manages the operation of Tram services in Croydon. The trams are provided by Tram Operations Limited (TOL). TOL are a part of the First Group.
- 3.1.2 London Tramlink is also responsible through a number of contracts for the maintenance of the tram network. Under the Railway and Other Guided Transport Systems (Safety) Regulations (ROGS) London Tramlink have the responsibilities of Infrastructure Manager.
- 3.1.3 The tram system in Croydon is relatively new - it opened in 2000. It carries 22 million passengers a year, on a fleet of 24 trams, over a 28km network of tracks. The network consists of a mixture of street track shared with other vehicles, dedicated track within the street, and off-street track.
- 3.1.4 There are 39 stations and trams run over the following routes:
- Route 1 Elmers End-east Croydon
 - Route 2 Beckenham Junction-East Croydon
 - Route 3 Wimbledon-New Addington
- 3.1.5 Trams operate from an overhead power supply at 750 V DC, and have a maximum speed of 80 km/h (50 mph).



3.2 London Bus Services Ltd.

- 3.2.1 Bus services in London are generally operated under contract to London Bus Services Ltd which is part of Surface Transport. Surface Transport in turn is part of Transport for London.
- 3.2.2 The London bus network is one of the biggest urban networks in the world and operates 24 hours a day 7 days of the week. Passengers on the network make over 6.5 million journeys each week day. The network is made up of over 700 bus routes. There are over 7,000 buses operating over 450 million Kms a year on these routes. These vehicles are a mixture of single deck, double deck and articulated buses. There are over 7,000 bus stops across London.
- 3.2.3 The bus involved in the incident was on route 468. This route is operated by London Central which is part of the Go Ahead Group, one of the largest contractors in the London bus market. The route operates between South Croydon and Elephant & Castle using a double deck vehicle 7 days of the week.

3.3 London Streets, Directorate of Traffic Operations

- 3.3.1 The Directorate of Traffic Operations (DTO) forms part of London Streets under the Chief Operating Officer (COO) within Surface Transport. DTO are responsible for the installation and maintenance of traffic signals, CCTV, Variable Message Signs and Overheight Vehicle equipment across the Transport for London Road Network (TLRN) and within all 33 London Borough.
- 3.3.2 There are approximately 6,000 traffic signal sites throughout London and these are maintained through out-sourced contracts by engineers accredited to the National Sector 8 scheme. Included in this signal asset base are 22 signal sites on the London Tramlink network.

4. The Incident

- 4.1 On Sunday 7th September 2008, at 09:56, a London double-decker bus operating on route 468 (operated by London Central) and was travelling north from Park Lane towards Wellesley Road, collided with a tram being operated by First Tram Operations Limited (TOL) travelling west along George Street. As a result of the collision a member of the public travelling on the top deck of



the bus was fatally injured when they were ejected through the front off-side top window of the bus.

- 4.2 The bus had stopped at the red traffic lights protecting the junction. It was positioned slightly over the stop line and slightly across the first and middle lanes. After waiting, the bus then departed even though the traffic lights immediately in front were still at red.
- 4.3 The tram had been given a proceed signal to cross the junction. Trams have priority over other road vehicles. The bus collided with the tram at the centre of the junction (see Appendix D). The tram was travelling at 29kph at the point of impact (as recorded on the on train monitoring recorder OTMR).
- 4.4 The tram was derailed and came to rest some metres along George Street at its junction with Wellesley Road (fig 1). The bus, striking the nearside of the tram, was forced through 90 degrees by the impact and ended up facing west down George Street. The bus then continued under motive power down the left hand side pavement of George street (travelling away from the junction) before striking a parked car. The car and bus came to rest on the opposite side of the road when the car struck a building (fig 2). The bus caused damage to a number of shop fascias and to street furniture (see Appendix c).



Fig 1



Fig 2



- 4.5 As a result of the impact between the bus and the tram a member of the public travelling on the top deck of the bus was ejected through the front off side top window of the bus and received fatal injuries
- 4.6 The drivers of the bus and tram sustained injuries as a result of the collision; both attended hospital but were released later that day. Although not confirmed, it was also reported that a number of passengers travelling on the tram sustained minor injuries. The bus driver was detained by the police and later released.

5. Traffic Signals

- 5.1 The current signal installation and associated highway modifications were introduced in 1999 as part of the accommodation works for Tramlink.
- 5.2 In March 2008 the Highways Authority, Croydon Council, made a request to the Directorate of Traffic Operations (DTO) to increase the time allowance for pedestrians to cross Park Street at its junction of Park Lane. This request followed an incident earlier in March in where a member of the public was 'struck' by a bus turning from Park Street into Park Lane.
- 5.3 Following a review of the timings and remodelling, which included holding buses on the bus bridge to allow increased access for pedestrians, undertaken in accordance with internal DTO procedures, an additional pedestrian 'green man' period across Park Street was introduced and a new programmable read only memory (PROM) was ordered. Following extensive testing in a controlled environment, the new 'PROM' was installed in the control unit on site between 08:05 and 09:30 on the morning of Saturday the 6th September 2008. No other alterations were made to the timings or sequencing of the traffic signalling system at any other part of the junction and no defects were noted by the DTO or signal company engineers in relation to this junction at the time of their visit. TOL have confirmed that at 08:20 on the 6th September, the TfL signals engineer called the tram control room to advise that all traffic and tramway signals at the junction were to be switched off. This was to facilitate the installation of the new PROM. At 08:51 the engineer called again to confirm that the signals had been switched back on.
- 5.4 The signals operate on a demand system (vehicle actuated) relating to traffic flow, pedestrians crossings or tram movement. Trams approaching the



junction take priority over traffic and pedestrian flow. Trams approaching the junction from East Croydon station put in a 'demand' to the signal controller giving the tram priority, turning all traffic and pedestrian crossing signals within its path to stop/red. As the tram approaches the junction, a signal loop in the road, controlling the tram signals, allows the tram signal to change from 'a do not proceed' (stop) signal to a 'proceed' (go) signal. Once the front of the tram clears the junction, another signal loop in the road communicates with the controller allowing the resumption of traffic/pedestrian flow.

- 5.5 The signals controlling pedestrian and traffic movement at the junction of Wellesley Road are fitted with louvred hoods on the amber and green aspects of the signal. This is standard practice throughout London at similar junctions and is employed at this junction to minimise the risk of misjudgement by drivers waiting at the Park Lane/George Streets stop line, approximately 30 meters to the south of the crossing (see map appendix D). On the day of the incident it was noted by DTO staff on site that the louvers to the signals had been damaged, enabling a green signal to be seen from the stop line at Park Lane (fig 3). This was the first report of damaged louvres.



Fig 3

- 5.6 The signals at the junction were inspected on the 30th August 2008 with no defects identified. The damage to the louvers identified on the day of the incident was not the result of vehicle collision suggesting a more likely cause being vandalism.
- 5.7 Before the change made on the 6th September 2008, buses turning left into Park Lane from Park Street were held at the Park Lane/George Street junction on a red signal with the signals at the Wellesley Road crossing also showing red allowing pedestrians to cross; stage 1 of the signal process. This gave priority to trams approaching the junction from George Street East. The signals at both Park Lane and Wellesley Road would then change to green in stage 2 at approximately the same time allowing traffic to flow across the junction.
- 5.8 Following the introduction of the rephasing of the signals at Park Street/Park Lane, buses turning left from Park Street into Park Lane are still presented



with a red stop signal at the Park Lane/George Street junction, with the signals at Wellesley Road crossing also at stop. The next stage in the signalling process could however allow for the signals at Wellesley Road to change to green in advance of the signals at the Park Lane/George Street junction. However, drivers should not be reacting to this change if they pay proper attention to the signals at the northbound stop line in Park Lane which have legal precedence at the junction.

- 5.9 The review of the operation of the signals pre and post incident, undertaken by an independent specialist consultant found that in providing increased access to crossing time for pedestrians at the Park Street/Park Lane junction, there had been no change to the phasing of the signals at the Park Lane/George Street/Wellesley Road junction.

6. Driver Competency

- 6.1 The bus driver, aged 28, has been with London Central for two and a half years commencing employment in March 2006. He had passed his Passenger Service Vehicle (PSV) test shortly before his appointment with London General. On his appointment with London General he underwent a driving induction course. During his time with the company he had been involved in 3 minor collisions all occurring within the first 9 months of his employment. The bus company reported that they were unaware of any medical conditions, confirmed that he had no endorsements on his licence and that his training was up-to-date. His driving rota for the week leading to the day of the incident shows that he 'rested' on the 4th and 5th September and was on duty between 08:31 and 17:01 on the 6th September. On the day of the incident, he commenced work at 09:05. The bus company have confirmed a that the driver was tested by the police for drugs and alcohol and that this test was [REDACTED]
- 6.2 The tram driver, aged 59, has been with First Tram Operations Limited (TOL) for nine years commencing employment in October 1999. Her driving record indicates no disciplinary action. On the day of the incident she commenced work at 06:55 and had worked consecutive days since her last rest day on the 2nd September. In accordance with standard practice, the driver was tested for drugs and alcohol with a [REDACTED] result being provided.



7. CCTV Footage

- 7.1 CCTV footage viewed from the internal forward facing camera of the tram (viewed on the 9th September 2008) shows the tram approaching the stop sign at the junction of George Street (East) and Wellesley Road. As the tram approaches, the tram stop signal changes to 'proceed' and pedestrians can be seen crossing the road in its path. A bus can be clearly seen out of a nearside tram window, stationary at the traffic signals at the junction of Park Lane and George Street. As the tram progresses across the junction, sight of the bus is lost until impact. Following impact the bus can be seen to continue down George Street at speed on the pavement until it comes to rest following its collision with the parked car. During its journey down George Street the bus driver can be seen 'hanging' from the driver's window, assumed to be unconscious.
- 7.2 The CCTV footage from the bus (viewed on the 28th November 2008) shows the bus stopping at the traffic signals at the Park Lane/George Street junction. The bus comes to rest just ahead of the stop line with the nearside secondary signal clearly in view. The signals at the Wellesley Street crossing can also be seen, both these and the Wellesley Road signals clearly showing a red stop signal. Three pedestrians can be seen to cross in-front of the bus. The red signal at Wellesley Road can be seen extinguishing whilst the third of the pedestrians is crossing in front of the bus and a green signal can be seen through the damaged louvers. The secondary signal at Park Lane can clearly be seen to be showing a red stop signal. Approximately 3 seconds after the Wellesley Road signal extinguishes, the bus pulls away from the Park Lane signals. Note: the CCTV time clock was running approximately two hours ahead of actual time.
- 7.3 From the CCTV footage, the tram can not be seen until just before the collision. The bus can then be seen to travel along George Street (the MP have estimated at approximately 20kph), hitting the car and eventually coming to rest.
- 7.4 From the internal CCTV the deceased can be seen sitting on the top deck of the bus in the front right hand aisle seat. As the bus collides with the tram it appears that he is 'thrown' across the empty seat to his right and he strikes the side window which brakes. He is then seen to fall through the window. Three other passengers are seen from the CCTV, one is seen to enter the top deck



before the collision and move towards the middle/rear of the bus. Two other passengers are seen on the lower deck, beyond the stairs to the top deck. At the point of impact only the two on the lower deck are observed. One is seen to be 'thrown' about in her seat and she can later be seen to be 'crouching' on the floor between seats. There is no CCTV of the driver from the internal cameras.

- 7.5 The bus operator indicated that at approximately 09:58 the driver made a radio call. This was picked up by the New Cross control room who were unable to make contact with the driver when they called back. There is no information as to why the driver made the initial call.

8. Road Conditions

- 8.1 Weather conditions at the time of the incident were overcast and it had been raining earlier making the road surface wet.

- 8.2 Ahead of the stop sign at Park Lane/George Street there were two large 'pot holes' in the carriage way and road markings showed signs of wear (fig 4). However it was determined that these did not contribute to the incident

Fig
4



9. Condition of Tram Rails

- 9.1 There is no evidence to suggest that the condition of the tram rails was in any a contributory factor in the derailment of the tram. However, documentation relating to the inspection and maintenance of the track was not available for review by the investigation team.
- 9.2 After the incident, prior to the resumption of services, the tram rails in the vicinity of the derailment were inspected and handed back as satisfactory for use. The details of this inspection were not documented.



10. Vehicle Condition

- 10.1 The bus company have confirmed that the bus involved in the incident had undergone all necessary checks and inspections in the period leading up to the accident.
- 10.2 TOL have confirmed that the incident Tram underwent a post incident inspection and this concluded that the tram had been in satisfactory condition prior to the incident.

11. Review of Previous Incidents

- 11.1 Information provided by the London Road Safety Unit (LRSU) covering a five year period, there have been no similar incidents reported at this road junction.
- 11.2 A report undertaken by TOL has stated that two tram driver reported, after the incident on the 7th, 'near misses' with buses at the junction. The report also identifies that since 2004 there have been three major incidents at the junction, but that these were tram/pedestrian incidents.

12 Information from the Metropolitan Police

- 12.1 A meeting took place on the 12th November 2008 with the investigating officers from the MP. At the meeting they confirmed that the incident was the subject of an ongoing investigation and that under normal circumstances they would not be in a position to disclose information until the Crown Prosecution Service (CPS) had seen the evidence and advised on an appropriate way forward.
- 12.2 The MP confirmed the bus has been examined by the Vehicle and Operator Services Agency (VOSA) and that it was mechanically sound pre collision. They also confirmed that the CCTV from the bus had been released to the bus operator on the 11th November 2008.
- 12.3 An expert available to the MP reviewed the signal operation and in their opinion don't consider that the rephrasing of the traffic signals had any bearing on the incident.



13 Reconstruction of the incident

- 13.1 It should be noted that the Metropolitan Road Traffic Police carried out a reconstruction of the incident on Sunday 2nd November 2008.
- 13.2 The Police were able to update TfL (in the meeting referred to earlier in this report) with regards to the actual sequence of events.
- 13.3 As part of the reconstruction the police noted the following; once the bus driver had driven away from the red traffic lights that there was a very short period of time whereby part of the bus – the column/pillar that forms part of the cab (and the drivers mirror) may have created a blind spot for the driver as he was looking to his right. The investigation panel are of the view that considering the overall size of a tram this may be a very minor contributory factor in the incident.
- 13.4 Similar viewing restrictions were found from the trams driver's position – but again this could only be classified as a possible minor contributory factor.

14. Incident Management

- 14.1 The following agencies responded to/were involved in the initial incident
- TOL
 - DTO
 - Network Operations
 - The Bus Company
 - The Blue Light service – Fire, Police, Ambulance
 - London Underground Emergency Response Unit
 - RAIB
- 14.2 Initial calls regarding the incident were made to CentreComm from a bus passing the incident. The Tram operator was also able to raise the alarm relatively quickly by calling the tram control room.
- 14.3 From available copies of e-mail correspondence TfL senior managers were initially informed of the incident within 30minutes of the collision and continued



to receive regular communication as further information became available, coordinating their response.

- 14.4 The TfL Incident Care Team were advised of the incident shortly after it occurred. There was some delay in obtaining a response from the Metropolitan Polices Family Liaison Officer, even though the senior investigating officer had been contacted on the Tuesday after the incident. By the time the appropriate contacts were made in the following week the family of the deceased had already left the country. The deceased mans family have now been advised that the TfL Incident Care Team are available to help; as yet there have no requests for any form of help.

Note: Subsequent to this incident TfLs legal department has prepared a memorandum of understanding for dealing with such incidents. The memorandum is designed to ensure a more integrated approach between TfL's incident care team and the Metropolitan Polices Road Traffic division.

15. Conclusion

- 15.1 Due to the lack of any corroborating evidence, other than CCTV footage, the panel are not in a position to draw any firm conclusions as to the cause of the accident. The panel can only therefore speculate as to the root cause of this incident. Mechanical failure of the bus has been ruled out by VOSA. Therefore the only remaining conclusion, based on the evidence available, is bus driver error.
- 15.2 If driver error, it is possible that the driver was distracted by the pedestrian crossing in front of the bus and he reacted to the extinguishing red signal at the Wellesley Road rather than observing and reacting to the Park Lane/George Street junction signals, which remained at red. It is not possible to say whether the driver was distracted by something else because at the time of writing he was still not available for interview. However, the police have been able to rule out the use of mobile phone.
- 15.3 The independent review of the operation of the traffic signals shows that they were operating as designed and that the minor works undertaken on the morning of the 6th September to the signals at Park Street/Park Land, did not affect the operation or safety of the Park Lane/George Street junction.



- 15.4 Whilst not part of the Terms of Reference of this investigation, the panel believe that the following is worthy of further attention. As acknowledged in the Office of Rail Regulations (ROGs) guidance, Highway Authorities are not normally deemed as Infrastructure Managers. In this instance the interfaces between the Highways Authorities, the operator and the infrastructure maintainers are both crucial and complex and the responsibilities of Highway Authorities are significant in terms of developing and maintaining the infrastructure on which the trams operate. Based on this assumption it is possible that the Highways Authorities may have Infrastructure Manager responsibilities as defined in the regulations.

16. Recommendations

- 16.1 A change control system should be introduced involving DTO, the bus operator(s), tram operator and the Highways Authority to ensure adequate communication and liaison between all parties whenever works, including the imposition of speed restrictions, are considered at this and other junctions where there is tram/bus/vehicle/pedestrian interface.

Action: Trams to develop/lead on development of a change management process; (Nick Baker)

Monitoring: London Tramlink Safety Executive.

- 16.2 That where there are alterations to traffic signal timings, DTO liaise with the Highway Authority to determine whether or not warning signs should be displayed. Such liaison must occur in advance of any works being undertaken.

Action: DTO to develop a protocol and incorporate into internal QA procedure; (Mark Beasley)

Monitoring: DTO SMT.

- 16.3 Although it is accepted that both the DTO and signal company engineer undertook a visual inspection of the area to confirm that the new 'PROM' was working correctly and as part of this would have noted any defects, there is no formal record. As such a simple check list should be developed to formally record such inspections and defects noted.

Action: DTO to develop proforma for the purpose of recording inspections and implement process; (Mark Beasley)



Monitoring: DTO SMT.

- 16.4 A process for formally recording all maintenance, including visual inspection, of tram rails must be introduced.

Action: London Tramlink; (Head of Infrastructure)

Monitoring: London Tramlink Safety Executive.

- 16.5 DTO should review their preventative maintenance inspection programme and consider increasing inspection frequency.

Action: DTO; (Mark Beasley)

Monitoring: DTO SMT

- 16.6 LBSL and/or the bus operator should consider having discussions with the bus manufactures to explore the possibility of strengthening the top deck front side windows, with a view of preventing them from falling out if struck from the inside.

Action: LBSL;

Monitoring: Suitable governance meeting.

- 16.7 Tramlink needs to introduce a documented system for recording their track maintenance and inspection regimes. This should also consider arrangements for documenting hand back of the tramways after an incident.

Action: London Tramlink; (Head of Infrastructure)

Monitoring: London Tramlink Safety Executive.

- 16.8 TfL to have formal discussions with the Metropolitan Police to understand how evidence such as CCTV can be used to facilitate our own investigations without delay.

Action: LBSL;

Monitoring: Suitable governance meeting.



Appendix A

Terms of Reference

Confirm what happened and the consequences:

Identify why it happened, in particular the immediate, underlying and contributory and root causes of the incident:

Review any previous similar incidents and see if there are any common themes with this incident:

Review the action taken immediately after the incident and review the effectiveness of the post incident management:

Make recommendations that in the light of the analysis of the cause(s) will reduce the chance of a repeat incident.

The Investigation panel is to provide an initial report on the factual findings by 17:00 on the 10th September and a detailed report by 17:00 on the 10th October 2008.

The Investigation Panel

Keith Harwood: Health and Safety Manager – London Streets (Chair)

Tom Breen: Safety & Resilience Manager – London Rail



Appendix B

Evidence Log

1. Independent review of road traffic signal operation at George St/Park Lane undertaken by Rail Systems Consultation Ltd. Issue 2, October 2008
2. CentreComm Incident Log
3. Network Traffic Controller's Incident timeline Log
4. Network Traffic Controllers incident report and statement
5. Tram Operators Ltd, First alert and incident timeline
6. DTO Controller specification for Microsense MTC for Wellesley Road/George Street/Park Lane
7. Traffic signal phasing diagrams
8. London Road Safety Unit incident history Wellesley Road/George Street
9. Bus Driver duty roster
10. Tram Drive duty roster
11. Periodic Inspection Report for traffic signals
12. Signal Consultant CV
13. Tram Operations Limited incident report



Appendix C

Additional photo evidence taken at scene



Extensive damage to front of bus



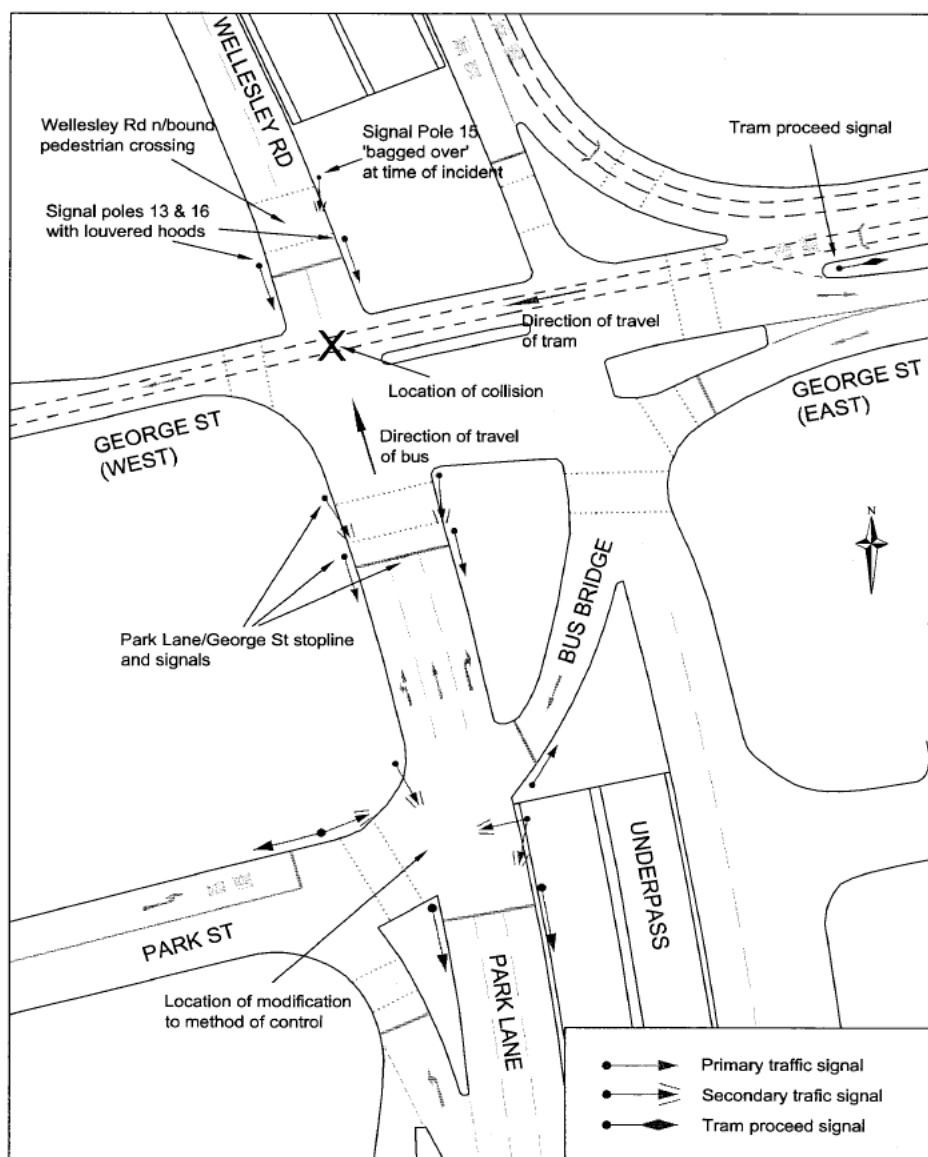
Damage to street furniture and shop fronts (taken up George Street (West) towards junction)



Damage to carriage of tram



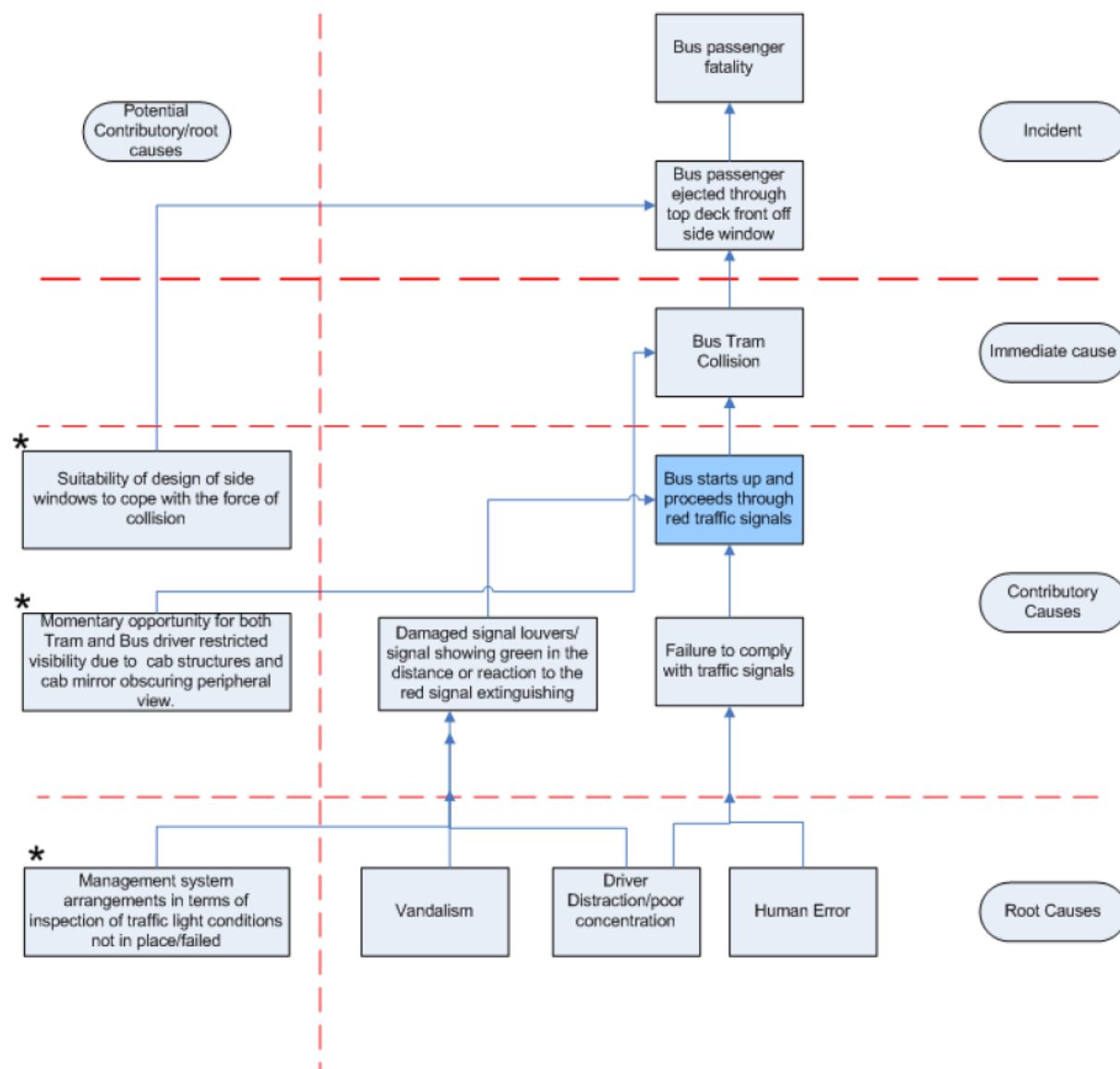
Appendix D





Appendix E Root Cause Diagram

Root cause diagram for the Bus Tram fatality George St /Wellesley Road



* These items were considered in the root cause analysis but the investigation panel were unable to confirm that they were definite causes.