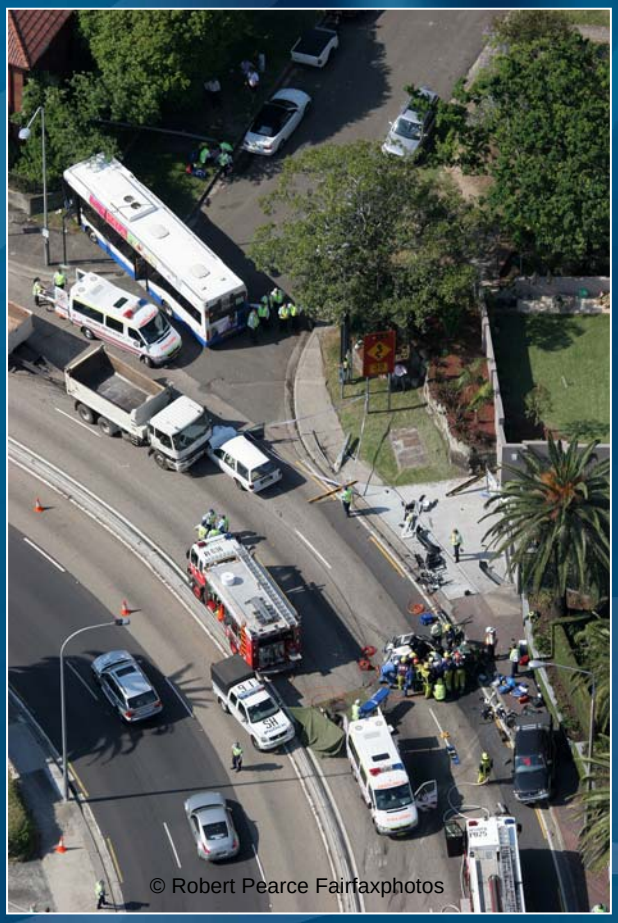
OTSI Office of Transport Safety Investigations

BUS SAFETY INVESTIGATION REPORT

STA BUS COLLISION
SPIT ROAD MOSMAN

14 NOVEMBER 2005



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14 NOVEMBER 2005

OTSI File Ref: 04219
15 September 2006

Office of Transport Safety Investigations
Level 17, 201 Elizabeth Street
Sydney NSW 2000

The Office of Transport Safety Investigations (OTSI) is an independent NSW agency whose purpose is to improve transport safety through the investigation of accidents and incidents in the rail, bus and ferry industries.

Initially established by the *Transport Administration Act 1988* on 1 January 2004 and with amending provisions which define its independent status having effect from 1 July 2005, the Office is responsible for determining the causes and contributing factors of accidents and for making recommendations for the implementation of remedial safety action to prevent recurrence.

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Information about OTSI is available on its website or from its offices at:

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The Office of Transport Safety Investigations also provides a Confidential Safety Information Reporting facility for rail, bus and ferry industry employees. The CSIRS reporting telephone number is 1800 180 828.

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ACRONYMS AND ABBREVIATIONS

ABS	Anti-Lock Braking System
CCTV	Closed Circuit Television
EMU	Engine Management Unit
ITSRR	Independent Transport Safety and Reliability Regulator
MoT	Ministry of Transport
NTC	National Transport Commission
OTSI	Office of Transport Safety Investigations
RTA	Roads and Traffic Authority
STA	State Transit Authority

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The Accident

At approximately 2:58pm, Australian Eastern Daylight Time, on Monday 14 November 2005, a State Transit Authority (STA) Volvo passenger bus failed to negotiate a sweeping left-hand bend whilst travelling North along, and descending, Spit Road, Mosman.

This peak-hour express bus (E68) was a scheduled service between Wynyard and North Balgowlah, carrying seven passengers. The bus passed the Medusa Street traffic lights without incident but subsequently crossed the median strip and collided with a number of vehicles travelling South, or "Up" Spit Road, before crashing into a masonry wall at the junction of Upper Spit and Spit Roads.

As a result of the collision, 10 people were conveyed to hospital by ambulance and one by helicopter. Their injuries ranged from minor cuts and bruising to broken limbs and serious head trauma.

Findings

As a result of its investigation, OTSI finds:

a. In the matter of **causation**, that the Driver lost control of the bus as it descended Spit Road.

b. In the matter of **whether the vehicle was being operated appropriately at the time of the accident**, that:

   i. The bus was operated in an inappropriate gear and at a speed in excess of that required to safely negotiate a winding and descending section of Spit Road.

   ii. The Driver exhibited signs of reduced concentration prior to the accident and may have suffered a micro-sleep as he descended

Spit Road. This, in combination with speed, resulted in the Driver being unable to negotiate a sharp bend and the bus subsequently crossing over the median strip into the path of oncoming traffic.

iii. Throughout the journey from Wynyard, the Driver was not wearing a seat belt, which would have made it more difficult for him to regain control of the bus during the collision sequence.

c. In consideration of **whether mechanical functions and/or design features contributed to the cause of the accident**, that the bus had been regularly serviced, was in good mechanical condition and that design matters were not at issue.

d. In consideration of **whether there are any policy, organisational and/or administrative factors which relate to safety management and contributed to the cause of the accident**, that:

i. In 1996 and on two occasions in 1997, the Driver had collapsed in his seat whilst his bus was stationary, but that subsequent medical examinations failed to identify any medical condition that might have triggered these collapses. Further medical examination following the accident on Spit Road also failed to identify any medical condition that might have induced fatigue or a collapse.

ii. MoT was aware of the three incidents where the Driver was found collapsed in his seat and had suspended his authority to drive a public passenger vehicle after the second and third instances, but lifted its suspensions following receipt of medical advice which indicated that the Driver was fit to perform his duties.

iii. The second restoration of the Driver's authority to drive a public passenger vehicle was conditional upon a requirement for the Driver to submit to an annual, rather than a bi-annual, health assessment, but that MoT did not notify his employer (at the time, North and Western Services Pty Ltd) of this requirement.

iv. MoT did not insist on, nor follow-up, its own stipulation that the Driver be required to submit to an annual health assessment and

that the assessments that were conducted in 1997, 1999, 2001 and 2004 were undertaken by the Driver's own doctor. In each instance, that part of the health assessment documentation requiring the Driver to declare whether he had ever fainted or blacked-out was completed in the negative.

e. In the matter of **the adequacy of the emergency response and management, and the level of safety and protection offered to all involved at the accident site,** that:

i. Emergency services were initially alerted to the accident by a member of the public who called 000 at 3:00pm.

ii. Emergency services responded in a timely and effective manner within 10 minutes of the 000 call.

iii. Because STA staff at the Traffic Management Centre were not notified of the accident immediately by STA Depot staff at the scene, official confirmation of the accident, and consequent notification to OTSI, did not take place until 42 minutes after the occurrence.

iv. STA was over-represented at the scene of the accident by staff who had no specific function to perform.

f. **Other matters**:

i. The CCTV security camera and VHS recorder installed in the bus failed to record key parts of the accident sequence because they were subjected to severe jolting at the onset of the collisions.

ii. STA could make greater use of the electronic data that can be obtained from the computing control systems onboard later model buses to further its understanding of matters that cause or contribute to accidents.

iii. The Driver's record of traffic violations, official warnings and episodes of collapse at the wheel of a bus, demonstrate his unsuitability for employment as a public transport bus driver.

Recommendations

Implementation of the following remedial safety actions by the specified responsible entity is recommended:

a. State Transit Authority

i. Review its response to this accident in order to improve the timeliness of its internal and external incident notification processes.

ii. Promulgate the policies and procedures that are necessary to ensure that only its essential emergency response personnel attend bus accident scenes.

iii. Give priority to the replacement of all existing analog CCTV recording equipment with digital recording equipment which is not subject to extreme motion interference.

v. Enhance its capability to access the electronic data from the computing systems that are onboard its later model buses.

vi. Continue to reinforce the requirement for its drivers to wear seat belts and actively monitor compliance with that requirement.

vii. Actively monitor drivers' compliance with any newly imposed speed limits on Spit Road.

b. Roads and Traffic Authority

i. Impose a mandatory speed limit of 40km/h for buses and heavy vehicles on the Spit Road in the section between Medusa and Ida Streets, Mosman, and examine the feasibility of requiring those same vehicles to travel in the left-hand lane within that section.

c. Ministry of Transport

i. Review its system of monitoring adherence to the health assessment regime.

ii. Review its system of monitoring compliance with any special conditions attached to a driver's authorisation.

iii. Ensure that it maintains an independent capability to conduct thorough and timely reviews of medical assessments of drivers holding, or seeking to hold, a Public Passenger Vehicle Driver's Authority.

iv. Cancel the Bus Driver's Public Passenger Vehicle Driver's Authority and ensure he is not re-authorised.

PART 1 INTRODUCTION

Notification and Response

1.1 At 3:40pm on Monday 14 November 2005, the Office of Transport Safety Investigations' (OTSI) Duty Officer was notified by the State Transit Authority's (STA) Safety Investigation and Audit Officer that shortly before 3:00pm, a bus had crossed to the wrong side of the road and collided with a number of vehicles on the Spit Road at Mosman.

1.2 Based on the information provided by the reporter, the Chief Investigator directed the deployment of an OTSI Investigating Officer to the incident site. The Investigating Officer arrived at the incident site at 4:24pm and commenced the inspection, assessment and evidence collection process.

Initiation of Investigation

1.3 As a result of the primary evidence collected by OTSI's Investigating Officer at the incident site, the Chief Investigator initiated a Bus Safety Investigation in accordance with s46BA of the *Passenger Transport Act 1990*.

Interim Factual Statement

1.4 On 18 November 2005, the Chief Investigator notified all Directly Involved Parties (DIPs) that OTSI was investigating the accident and requested that each organisation nominate an officer to act as the point of contact for all inquiries made by the appointed OTSI Investigator in Charge. The Terms of Reference for the Investigation were provided to the DIPs with this notification.

1.5 An Interim Factual Statement notifying OTSI's investigation and describing the collisions in terms of what had happened was published on the OTSI website on 18 November 2005.

Terms of Reference

1.6 The Chief Investigator established the following Terms of Reference to determine why the accident had occurred and what to do to prevent recurrence:

a. establish why the accident happened and what caused it;

b. determine whether the bus was being operated appropriately at the time of the accident;

c. determine whether mechanical functions and/or design features contributed to the cause of the accident;

d. identify whether there are any policy, organisational and/or administrative factors relating to safety management that may have caused or contributed to the accident;

e. assess the adequacy of the emergency response and management, and the level of safety and protection offered to all involved at the accident site;

f. make safety recommendations, the implementation of which by the responsible entities, would minimise the potential for a recurrence of this type of accident, and

g. propose any course of action in relation to matters arising from the investigation that would enhance the safety of bus operations.

Methodology

1.7 OTSI utilises the ICAM (Incident Cause Analysis Method) approach in the conduct of its investigations and applies the Reason Model of Active Failures and Latent Conditions to its analysis of causative and contributory factors.

1.8 The underlying feature of the methodology is the Just Culture principle with its focus on safety outcomes rather than the attribution of blame or liability.

Consultation

1.9 On 11 August 2006, a copy of the investigation Draft Report was forwarded to all DIPs to provide them with the opportunity to contribute to the compilation of this Final Report by verifying the factual information, scrutinising the analysis, findings and recommendations, and by providing any commentary that would enhance the structure, substance, integrity and resilience of the Investigation Report. DIPs were requested to submit their comments by 28 August 2006**.** Submissions were received from ITSRR, MoT, RTA and STA.

1.10 The Chief Investigator considered all representations made by DIPs and where appropriate, reflected their advice in this Final Report. On 8 September 2006**,** the Chief Investigator informed DIPs which matters from their submissions had been incorporated in this Final Report and, where any proposal was not included, the reasons for not doing so.

Investigation Report

1.11 This report describes the collisions which occurred at Mosman on 14 November 2005 and explains why they occurred. The recommendations that are made are designed to minimise the potential for a recurrence of this type of accident.

1.12 OTSI acknowledges the assistance and cooperation provided to it by the Directly Involved Parties throughout the course of this investigation.

PART 2 FACTUAL INFORMATION

Accident Synopsis

2.1 At approximately 2:58pm, Australian Eastern Daylight Time, on Monday 14 November 2005, a State Transit Authority (STA) passenger bus crossed the median strip and collided with a number of vehicles travelling South, or up, Spit Road before crashing into a masonry wall at the junction of Upper Spit and Spit Roads. As a result of the collision, 10 people were conveyed to hospital by ambulance and one by helicopter. Their injuries ranged from minor cuts and bruising, to broken limbs and serious head trauma.

Accident Narrative & Location Description

Before the collision

2.2 The Driver of the bus commenced his regular Monday morning shift at 6:50am and departed the STA Brookvale depot at 7:00am. The Driver returned to the depot at 10:13am having operated a Mercedes Mark IV over a route which took him through Seaforth, Frenchs Forest, Manly, Wynyard and finally back to Brookvale. Having taken a meal break at the depot, the Driver departed the depot at 11:30am for Chatswood via Manly in a Volvo B10BLE. The Driver then drove back to Manly and subsequently to Wynyard. Enroute, the driver took a 10-minute break at Chatswood and a 2-minute break at Manly. After departing Manly, the Driver travelled 16km to Wynyard where he was able to take a 20-minute break before commencing the first of the scheduled afternoon peak express services (E68) to Balgowlah at 2:40pm.

2.3 After departing Wynyard at the start of the E68 service, the Driver moved to a bus stop in Carrington Street where five passengers boarded. The bus then travelled through the City before crossing the Sydney Harbour Bridge into North Sydney where it turned East into Falcon Street and

subsequently entered Military Road. A passenger boarded the bus at a scheduled stop outside the Big Bear Centre in Neutral Bay. Passengers on board the bus advised that the Driver failed to stop at the next scheduled bus stop at Wycombe Road despite being clearly hailed by an intending passenger. The next stop was at the junction of Military and Spit Roads at which another passenger boarded. The bus was now approximately 1.4km from where the accident later occurred. Shortly after turning into Spit Road, the bus stopped at traffic lights at Awaba Street. This was to be the final stop before the accident.

Location Description

2.4 Spit Road is a six-lane major arterial road connecting the Northern Beaches area and the Lower North Shore of Sydney. Spit Road runs approximately North-South and the three lanes of traffic in each direction are separated by a concrete median strip. The road is sealed, kerb and guttered, and painted with line markings. All lane markings were clear and the road surface was dry on the day of the accident. The general location of the Southern portion of Spit Road is shown in *Figure 1*.

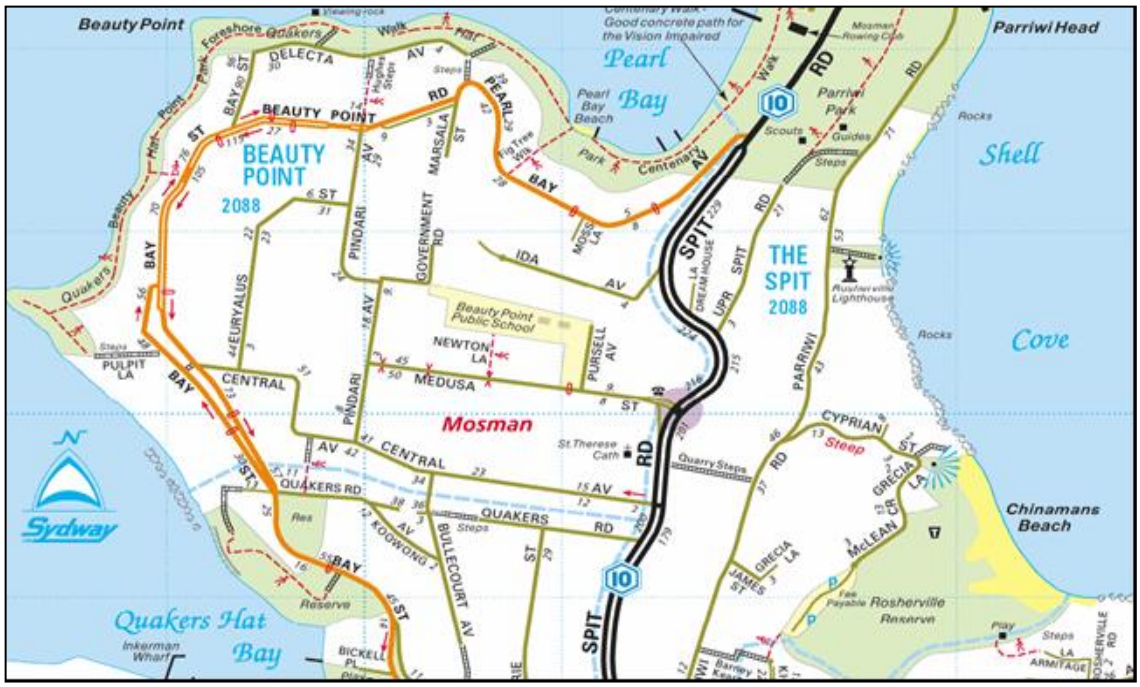

Figure 1: General locale of the Southern portion of Spit Road

2.5 The speed limit is 60km/h for the entire length of Spit Road, although Northbound, there is a 35km/h advisory speed sign as the road descends and curves down Spit Hill. Parking along Spit Road, North from Spit Junction, is restricted by a peak-hour 'Clearway' which comes into effect at 3:00pm. There is also a 'No Stopping' zone North from Medusa Street traffic lights. These traffic lights are clearly visible from a distance of 200m. The RTA advised that data collected in 2004 indicated that approximately 32,000 vehicles travelled along Spit Road on a daily basis. Summary speed data collected in 2000 suggested that average free speeds from Northbound vehicles in this vicinity were between 59km/h and 66km/h.

The Accident Sequence

2.6 Statements taken from the bus passengers and motorists who were witnesses to the accident indicate that as the bus passed the intersection at Medusa Street, it was travelling in the middle lane. At this point, the Driver needed to negotiate a steep, descending left-hand curve. Instead, the bus continued straight ahead into the lane adjacent to the median strip and then crossed the median strip at a point approximately 80m past the Medusa Street lights.

2.7 Having crossed the median strip, the bus was immediately confronted with traffic travelling South, or "up" Spit Road. The bus struck a Peugeot 307 sedan travelling in the lane nearest the median strip and pushed the Peugeot diagonally across the road causing it to strike the side of a Toyota Hi-Lux. The bus then struck a Ford Falcon station wagon causing it to spin 180° into the path of a Hino tip-truck with trailer. The Ford became trapped under the front passenger side of the Hino. The bus, however, continued downhill on Spit Road before mounting the footpath and striking a steel light-pole. The light pole, designed to separate upon impact, was carried with the bus as it crossed Upper Spit Road and then projected onto an unoccupied white BMW car parked in Upper Spit Road. The bus was finally halted when it impacted with the

masonry base of a steel fence. This fence was the front boundary of a three-level apartment building, known as Muston Court, on the Northern corner of Upper Spit Road and Spit Road, Mosman. The strength and mass of the fence's masonry base and the density of the surrounding subsurface rock was sufficient to withstand the impact and the damage to the fence was relatively minor. The sequence of the collisions is indicated in *Figure 2.*

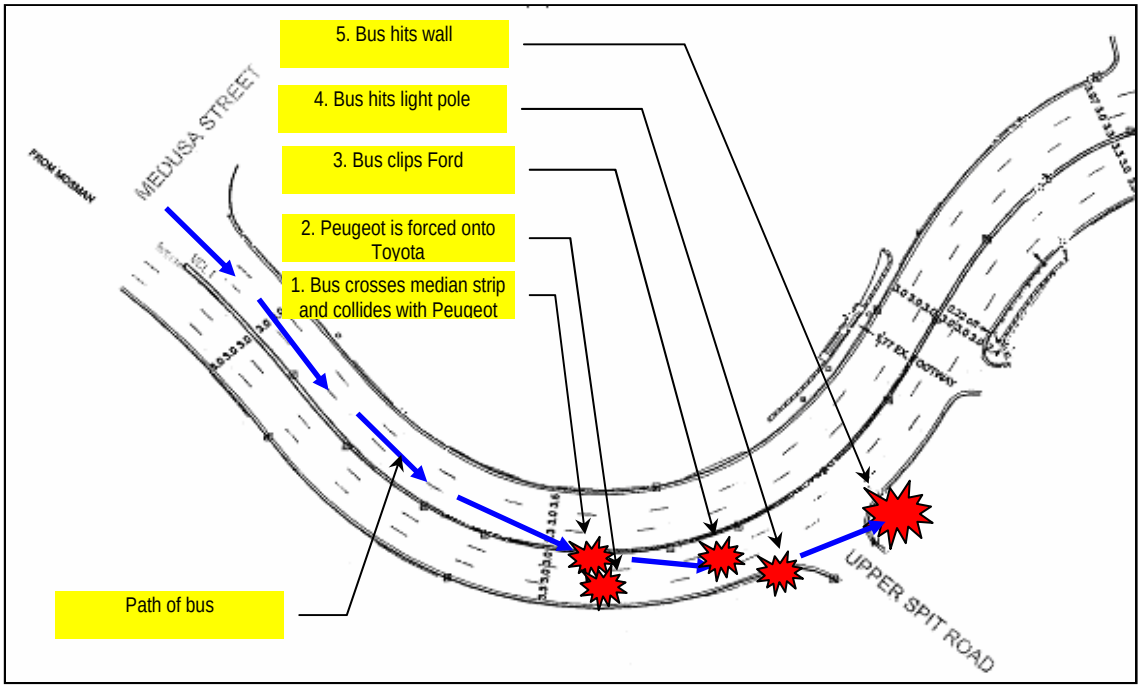

Figure 2: Accident sequence along Spit Road

2.8 The damage to the Peugeot, Toyota Hi-Lux, Ford Falcon and Hino tip-truck are indicated in *Photographs 1-3* respectively.

Photo 1: Damage to Peugeot 307

Photo 2: Damage to Toyota Hi-Lux

2.9 The point at which the bus came to rest is indicated in *Photographs 4* and *5* and the limited extent of damage to the fence in *Photograph 6*.

Photo 3: Damage to Ford and Hino

Photo 4: Position of the bus, at rest

Photo 5: Position of the bus, at rest

Photo 6: Damage to Fence

After the Collision

2.10 As the front of the bus hit the wall, the Driver, who was not wearing his seat belt, was thrown from his seat into the windscreen and then into the entrance area adjacent to the front door of the bus. Footage from the CCTV security camera shows the Driver getting to his feet and attempting to check on the condition of his passengers. It also shows him subsequently being assisted by another person, and two injured passengers being assisted by a different person. Later footage shows passengers gathering their belongings and leaving the bus via both the rear and front doors. About 10 minutes after the collision, Ambulance and Fire Brigade personnel are seen entering the bus and assisting the other injured passengers.

Emergency Response

2.11 A large number of representatives from the Fire Brigade, Police and the Ambulance Service attended the accident as is illustrated in the photograph on the front cover of this report. While rescue and investigation operations were underway, three Southbound lanes and one Northbound lane on Spit Road were closed and remained so until approximately 10:00pm.

2.12 Having heard commercial radio reports of the incident, the first representatives from the STA to arrive on the scene came from Brookvale Depot. The radio reports monitored by the Brookvale staff were from a radio announcer who witnessed the accident and described the accident scene live-to-air. Although the Brookvale staff arrived on the scene approximately 10 minutes after the accident, they did not report the accident to the STA duty Safety Investigation Officer. STA staff, co-located in the RTA Traffic Management Centre, were approached by RTA staff requesting confirmation of the involvement of an STA bus in the accident. At 3:11pm, the STA dispatched a Customer Services Officer (CSO) to the accident site. The CSO reported back at 3:40pm to confirm that an STA bus was involved in the accident. Approximately 40 minutes after the occurrence, the accident was notified to the STA duty Safety Investigation Officer who then notified the OTSI Duty Officer. STA Safety Investigation Officers arrived on site at approximately 4:10pm.

Injuries

2.13 The Driver and five of the seven passengers onboard the bus at the time of the accident were transported to hospital; their injuries ranged from cuts and bruising, to broken bones and head trauma. The most seriously injured person was the driver of the Peugeot 307, the first vehicle hit by the bus. She remained trapped in her vehicle for an extended period and sustained multiple injuries, including broken legs. When released from her car by the Emergency Services, she was flown

to Royal Prince Alfred Hospital in Camperdown where she was to remain for five weeks. The Bus Driver's injuries were relatively minor and he was released from St Vincent's Hospital, Darlinghurst, the same evening.

Bus Driver Information

2.14 The 40-year old Driver had held a driver's licence since 1982 and obtained his bus licence and Public Passenger Vehicle Driver's Authority in 1995. His HR (Heavy Rigid) Unrestricted Class licence, issued in January 2005, was not due to expire until September 2007.

2.15 The Driver resigned from the STA on 27 April 2006.

Bus Information

2.16 The bus involved in the collision, registered as Mo3888, was manufactured by Volvo in 1998 and is one of 125 model B10BLE buses operated by the STA. The bus is diesel-powered and is equipped with automatic transmission and an air-braking system. It is licensed to carry a maximum of 43 seated and 19 standing passengers. At the time of the accident there were seven seated passengers who were seated as shown in *Figure 3*.

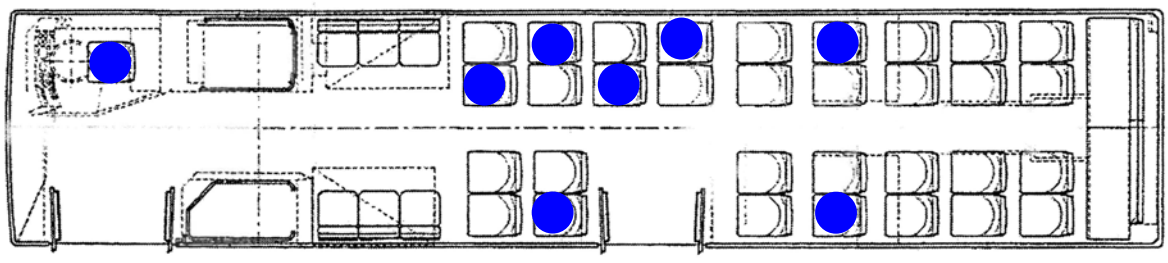

Figure 3: Seating plan at the time of the accident

2.17 The bus is 12.4m long, 2.5m wide and 3.4m high, with a wheelbase of 6.4m. Both the steering wheel and driver's seat height are adjustable.

The driver's seat has five adjustments which allow its height, inclination and firmness to be altered and the seat to be moved forward or rearwards. The driver also has access to a lap-style seat belt. The passengers' seating is of a polymer construction, with the tubular steel frame being bolted to the floor. At the top edge of each passenger seat is a firm polymer cushion.

2.18 The six-cylinder, rear-mounted diesel engine develops a maximum power of 180kW at 2000rpm. The automatic transmission is operated by pressing one of five gear selection push-buttons on the dashboard of the bus. The selection button "D" is pressed for normal operations and this button was found to be depressed/engaged, as shown in *Photograph 7*, when the bus was inspected at the scene of the accident. The "2" button is used for heavy and/or difficult traffic conditions and has a retarding effect. The "1" button is used for moving the bus a short distance. It should be noted that there is no "Park" button which means that the parking brake must be applied when the bus is not being driven.

Photo 7: Gear selection buttons in the bus

2.19 The braking system relies on front-disc brakes with a supplementing retarding system. The retarder is engaged by depressing the brake pedal 1-3cm. An Anti-lock Braking System (ABS) is automatically

engaged if the wheels of the bus start to 'lock up', to minimise skidding and to assist the driver to retain control.

Meteorological Information

2.20 The weather on the afternoon of the accident was fine and sunny and there had been no rainfall in the previous 48 hours. The accident occurred at approximately 2:58pm at which time the sun was setting in the West at an approximate angle of 55°. The sun's altitude was high enough not to have caused problems for the Driver as he travelled Northwards, or for drivers travelling in the opposite direction up Spit Hill. Sunset was predicted at 7:21pm.

PART 3 ANALYSIS

Mechanical and Design Issues

3.1 The bus met all of the requirements identified in the Australian Design Rules for Omnibuses Designed for Hire and Reward (ADR58/00). ADR 58/00 gives numerous guidelines for the design and dimensions applicable to this bus. The bus was also equipped with a CCTV camera. The original intention of these cameras was to improve security for drivers and passengers by acting as a deterrent to prospective offenders by aiding in their detection and identification. The cameras have also become a valuable aid in accident investigation. A variety of parameters, including vehicle speed and braking application, were also captured on the bus's anti-skid braking system (ABS) via its electronic engine management unit (EMU). The information obtained from these systems greatly assisted OTSI's investigation.

3.2 The bus's safety design features included plastic padded seating, toughened safety glass windows and screens, and a laminated glass front windscreen. The bus also has a full, steel chassis; the engine, transmission and driveline are all mounted on the chassis. The coach body has a flat floor to which the seating is bolted. The seating area is maximised, with seats extending immediately behind the driver's seat, rearwards to abut with the back windscreen. This configuration provides little in the way of a 'crumple zone'. The glass used in the doors, windows and screens throughout the bus met the requirements of Australian Design Rule 58/00. In the event of significant impact, the toughened glass used in the side windows and internal dividers is intended to shatter into small uniform pieces, rather than shards, in order to reduce the prospect of severe lacerations.

3.3 The front of the bus was crushed when it impacted with the masonry wall. The corner of the masonry wall penetrated into the steering

assembly of the bus which resulted in damage through the drive train to the transmission at the rear of the bus. The front laminated-glass windscreen shattered and was projected outwards. The damage to the windscreen and the driver's injuries are consistent with the driver being thrown against the windscreen. OTSI noted that the driver was not wearing the fitted seatbelt at the time of the collision. The damage to the front of the bus can be seen in *Photograph 8*.

Photo 8: Damage to front of bus

3.4 The driver's seat is of a type which is fully adjustable and can be adjusted to accommodate the height and weight of drivers. The Bus Driver, who was short and relatively light, indicated that he had adjusted the seat to his requirements. Other drivers advised that they preferred to set the seat to its upper level of adjustment for weight because it provided greater rigidity and less bounce. In this instance, the Driver may have bounced out of the seat when the bus hit the median strip, causing him to lose control over the accelerator and brake pedals.

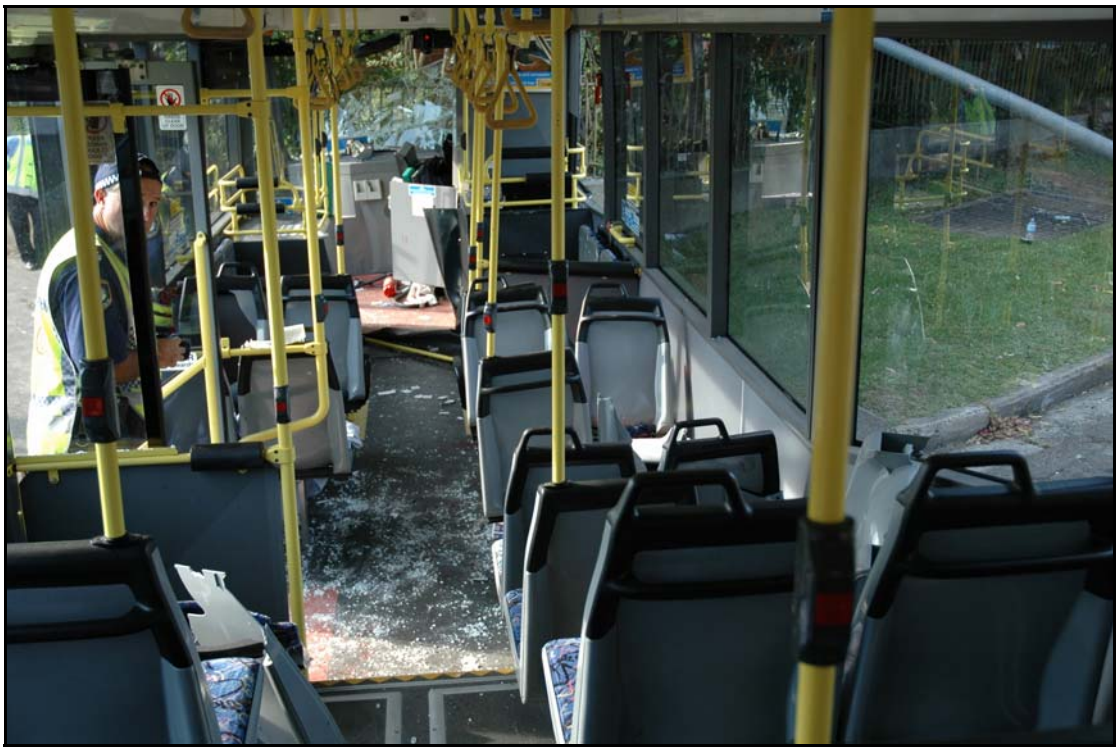

Photo 9: Inside of the bus, looking forward

3.5 *Photograph 9* shows some of the interior damage to the bus. Two toughened-glass side windows, on the driver's side, also shattered upon impact with the wall. The remainder of the bus's bodywork and windows were relatively undamaged. OTSI noted that one passenger was projected from his seat and through safety screens placed on either side of the rear inward opening door. All passengers were seated in forward-facing double seats at the time of the collision. The seats were subjected to considerable load, either by passengers being projected into the rear of the seats in front of them, or by the act of passengers gripping the handgrips on top of the seats to brace themselves. As a consequence, 10 seats were broken. The bending of some steel brackets bolting seats to the floor was indicative of the forces involved. OTSI also noted that the points at which some seats fractured presented some sharp edges.

3.6 The bus was examined in detail by the NSW Police's Engineering Investigation Section and there was nothing to suggest that the Driver had been confronted with any mechanical or electrical defect that might

have limited his control. The ABS was confirmed as operational at the time of the accident, although it was not activated throughout the collisions.

3.7 STA's records indicated that the bus had been subjected to inspection and servicing every six weeks, the most recent being on 16 October 2005. The records also indicated that matters identified during inspections were attended to during servicing. The odometer reading on 16 October 2005 was recorded as being 388,385km. The reading immediately after the accident was 393,098km. OTSI noted that this was a relatively recent model bus with average 'mileage' by NSW bus industry standards.

Bus Management

3.8 OTSI used the images and timings captured on the onboard CCTV security camera with visible landmarks to assess the speed at which the bus was being operated. This established that the bus was operated within the required speed limits for much of the journey prior to the collisions. Allowing for time spent at traffic lights and bus stops, the average speed of operation from Wynyard to Spit Junction was calculated to have been approximately 39km/h**.** However, having stopped at the red traffic light at Awaba Street, the bus's speed subsequently increased to approximately 56km/h leading up to the traffic lights at Medusa Street. The average speed beyond this point using the CCTV footage could not be determined because the footage was blurred. Separate analysis, in conjunction with the NSW Police's Engineering Investigation Section, using electronic data downloaded from the bus's ABS electronic control unit, established that the bus reached a maximum speed of approximately 63km/h beyond Medusa Street, after which there was a rapid deceleration which occurred when the bus hit the wall.

3.9 As previously stated, the bus's gear selector was found to be in "D" after the accident. OTSI noted that just after the Medusa Street lights there is

a warning sign indicating that 'Trucks & Buses Must Use Low Gear'. This sign, indicated in *Photograph 10*, is visible from a distance of 150m.

Photo 10: Approaching Spit Hill at Medusa Street traffic lights, looking North

3.10 Australian Road Rule 108 states that "If the driver of a truck or bus is driving on a length of road to which a trucks and buses low gear sign applies, the driver must drive the truck or bus in a gear that is low enough to limit the speed of the truck or bus without the use of a primary brake." There is also a 35km/h advisory speed sign 46m North of the Medusa Street traffic lights which is visible from a distance of 150m. Had the Driver engaged a low gear, an action that would have been consistent with the low gear warning sign, the 35 km/h advisory speed sign and good driving practice on such a section of road, the bus would have been operated at a safer speed. Given the curvature and gradient of Spit Road North of Medusa Street, a severe braking application would have been necessary to counter any control or traffic problems a bus driver might encounter while negotiating the descent.

3.11 At the time of the accident, the Driver had some ten year's bus driving experience and was familiar with the route over which he was travelling. He was not under any time pressure, indeed he was slightly ahead of schedule, and the traffic conditions were relatively light. Nevertheless, he changed lanes a number of times as he travelled down Spit Road and positioned the bus in the middle lane as he approached Medusa Street. Given the impending descent and speed restriction, the most practical, and safest, route would have been in the left-hand, or kerbside, lane.

3.12 The Driver advised OTSI that he has no recollection of the events immediately before, during or immediately after the accident. The CCTV footage of the 20-minute journey from Wynyard to Mosman showed the bus driver as being restless and yawning and stretching frequently. These indications are often associated with fatigue. It also showed the driver reading a book at a set of traffic lights. As the bus passed Central Avenue, 150m before Medusa Street, the Driver is seen to slump to his right side and his right hand leaves the steering wheel. This was not characteristic of earlier recorded movements. The Driver remained in this slumped position as the bus travelled between Central Avenue and Medusa Street, a period of approximately five seconds, after which he began actively steering. The Driver was wearing sunglasses and the CCTV was therefore unable to reveal whether the Driver's eyes were open throughout this five-second 'episode'. This footage does suggest that the Driver may have experienced a micro-sleep at this time. The following eight seconds of footage are interrupted by violent jarring and blurring, consistent with the bus crossing the median strip and the commencement of the collisions. There are, however, some discernable individual frames which show the Driver still at the steering wheel and one passenger being thrown from his seat. The images from the 13 seconds thereafter are completely undiscernible. The footage then resumes and shows the Driver injured and disoriented passengers moving about the stationary bus.

Impairment

3.13 Blood and urine samples provided by the Driver to the Police were analysed and returned no indications of the presence of drugs or alcohol. The Driver's roster for the previous month indicated that he had been generally working Monday to Friday, from 6:00am to 3:00pm, and having the weekends off. His roster for the previous week was analysed using the Fatigue Audit InterDyne (FAID)[1] and the Driver was well below the range where work-related fatigue should have been an issue. Nevertheless, the RTA's research[2] indicates that the high risk times for fatigue-related crashes are 10:00pm - 6:00am and 1:00pm - 3:00pm. These periods coincide with dips in the body's circadian rhythms[3]. OTSI noted that this accident occurred during the afternoon circadian 'low'. Research also suggests that the risk of motor vehicle accidents increases once a driver's shift exceeds eight hours[4]. If the time taken by the Driver to get to work is added to the time he had been on duty, it would not be unreasonable to assume that he may have experienced reduced alertness and been at a heightened risk of involuntary sleep. When interviewed, the Driver indicated that there had been no recent changes to his sleep pattern and that on the night before the accident he had gone to bed at around 11:00pm and woken before 6:00am. Notwithstanding individual differences, it is generally recognised that most adults require eights hours sleep if they are to function effectively the next day. Sleep of only six continuous hours is associated with an elevated likelihood of a crash.[5]

[1] Fatigue Audit InterDyne™ is the name given to a range of fatigue risk management software, developed by InterDynamics Pty Ltd.

[2] Roads and Traffic Authority (2006) *Fatigue Information.* RTA web site http://www.rta.nsw.gov.au/roadsafety/fatigue/index.html

[3] Circadian rhythms are fluctuations in biological processes, such as body temperature, heart rate and hormone levels, occurring on a 24 hour basis. For further information refer to Flinders University website http://som.flinders.edu.au/FUSA/NEUROSCIENCE/sleep.htm

[4] Folkard, S. (1997) *Black times: temporal determinants of transport safety.* Accident Analyses and Prevention, 29, 417-430.

[5] Stutts, J.C., et.al., "Driver Risk Factors for Sleep-related Crashes", *Accident Analysis and Prevention*, 2003

Driver's Work History & Related Medical Issues

3.14 The Driver first commenced work with STA, as a trainee driver, in August 1995. However, in November 1995, he resigned following an accident in which he was driving a bus. STA's personnel records contained an annotation stating that his 're-employment is not recommended'. In April 1996, the Driver resumed bus driving duties with North and Western Services Pty Ltd (North & Western), a private bus company operating out of a depot in Gladesville, but left in September 1997 to work in a family business. The Driver was re-employed at North & Western in November 1998 and became a permanent employee in February 1999. He rejoined STA in February 2000 when North & Western were acquired by STA. Under the terms of the acquisition, STA was obliged to employ all of North & Western's staff.

3.15 While the Driver was employed by North & Western, there were three reported instances, between 1996 and 1997, where he was found collapsed at the wheel of his stationary bus. The first was on 3 October 1996 and the second on 10 March 1997. North & Western's records indicated that they notified the MoT about these incidents. The Driver's authority to drive a public passenger vehicle was suspended by MoT on 11 March 1997. He was subsequently examined by a neurologist who found no evidence of epilepsy or seizure. Consequently, the MoT lifted its suspension on 24 March 1997. A week later, on 3 April 1997, the Driver was again found collapsed at the wheel of his stationary bus and was transported by ambulance to Westmead Hospital. He was immediately stood-down from driving duties by North & Western. The Company's owner wrote to MoT expressing his concern following the Driver's collapse, stating "…that the next time may be more serious. Perhaps a bus full of school children travelling out-of-control down Victoria Road, crossing the median strip and hitting an oncoming truck." MoT again suspended the Driver's accreditation, on 7 April 1997.

3.16 The Driver was again examined by a neurologist and subsequently a cardiologist; neither could find any indication of an abnormality. His examining medical practitioner certified the Driver as being fit to resume bus driving duties, but with the qualification that he "not be expected to perform excessively long shifts as has been the case apparently in the past" [6]. MoT again lifted its suspension but with an annotation on the related documentation stipulating that it was: "OK to reissue authority with annual medical review" [7]. North & Western, and subsequently STA, were not made aware of this requirement. OTSI noted that the Driver submitted to health assessments in 1997, 1999, 2001 and 2004 and that there was no record of MoT having followed-up its own stipulation that the Driver be assessed on an annual basis throughout this period. OTSI also notes that in each instance the assessment was conducted by the Driver's General Practitioner. OTSI further noted that in each instance, that part of the health assessment documentation requiring the Driver to declare whether he had ever fainted or blacked out was completed in the negative.

3.17 Among a wide range of safety issues, the Special Commission of inquiry into the January 2003 Waterfall train accident addressed the issue of medical assessments for rail workers. The inquiry highlighted many deficiencies in the railway medical assessment system that prevailed at the time, which had flow-on implications for the medical assessment of other front-line transport staff. The Medical Journal of Australia (January, 2006) examined this issue in an article entitled: *The Inquiry into the Waterfall train crash: implications for medical examinations of safety-critical workers.* It suggested that "Medical examinations of safety-critical workers need to be particularly designed to take into account the company's duty of care to the public and other employees …in situations where sudden incapacity, like a heart attack, could lead to serious consequences, a quantitative and predictive risk assessment

[6] Doctor's Certificate dated 21 May 1997
[7] Department of Transport letter to the Driver on 23 May 1997

should be considered."[8] It also stated that whatever the frequency set for medical examination, a system should be established to monitor safety-critical workers for markers of ill-health and that any occupational health examination is best conducted by a doctor who has a good understanding of the particular occupation. OTSI was advised that MoT has since redesigned its Medical Assessment certificate to accommodate the National Transport Commission's (NTC) policy "*Assessing Fitness to Drive Commercial and Private Vehicle Drivers 2003".* This has resulted in the self-reporting section being expanded to include sleep disorder, sleep apnoea and narcolepsy, and an improved section on drugs and alcohol. There is also an improved clinical examination proforma reflecting a national medical standard for drivers. The MoT now also requires that bus operators have a Safety Management System which requires the implementation of a transport safety employee monitoring program addressing such matters as driver health, fitness for duty and fatigue management.

3.18 At OTSI's request, the Driver voluntarily submitted to an examination at a centre for sleep disorders, in Sydney. One test performed was a Maintenance of Wakefulness Test. The Medical Journal of Australia[9] refers to the test as "… an objective measurement of daytime sleepiness" and describes the test as consisting of "…four trials, two hours apart, in which the subject is seated in a dark, quiet room, in a comfortable chair, and is instructed to stay awake. The subject is monitored polysomnographically for sleep onset. If the subject falls asleep in any of the trials, the time to sleep onset is calculated, and compared with the normal range.'". After testing, the Centre concluded that the Driver had a normal ability to maintain wakefulness. Of course, this does not preclude the possibility that the Driver experienced a micro-sleep.[10]

[8] Hocking, B. (2006) *The Inquiry into the Waterfall train crash: implications for medical examinations of safety-critical workers.* Medical Journal of Australia 184 (3): 126-128.
[9] Desai, A.V. Ellis, E. Wheatley, J.R. Grunstein, R.R. (2003) *Fatal distraction: a case series of fatal fall-asleep road accidents and their medicolegal outcomes.* Medical Journal of Australia; 178 (8): 396-399.
[10] A micro-sleep is a brief sleep intrusion typically lasting for four to five seconds. The eyes of the person experiencing the micro-sleep may remain open and they may not be aware that they are experiencing, or have experienced, the intrusion.

3.19 In addition to possible health or concentration issues, the Driver had a history of traffic violations[11] including speeding, negligent driving and traffic light offences; failing to stop following an accident and failing to give way to a pedestrian; improper passing or overtaking and driving under the influence (DUI). The Driver had also had a large number of passenger complaints made against him, including failing to stop for passengers and rudeness. STA had issued the driver a final warning letter regarding his behaviour on 16 August 2004.

3.20 Having reviewed all the evidence available to it, OTSI concluded that as the Driver descended Spit Road, and in the 20 minutes prior, he exhibited signs of fatigue. He failed to respond to speed advisory and road warning signs and operated his bus at an inappropriate speed. The combined effects of reduced concentration, a possible micro-sleep and speed, resulted in the Driver being unable to negotiate the sharp bend at that point on the Spit Road, causing the bus to cross over the median strip into the path of oncoming traffic.

Emergency Response

3.21 The NSW Police, Fire Brigade and Ambulance services all had representatives on site, as depicted in *Photograph 11*, within 10 minutes of the accidents occurring.

Photo 11: Emergency Services at the accident scene

[11] A number of these offences, including the instance of DUI, were not work-related.

3.22 The Emergency Services were initially alerted to the accidents by a member of the public who called 000 at 3:00pm.[12] The first ambulance responded within eight minutes and a total of one Rescue Helicopter, 13 Ambulance vehicles and one Ambulance Rescue truck were used to convey 11 persons to hospital (including a bystander not involved in the accident). Two persons were transported to St Vincent's Hospital at Darlinghurst; four to the Royal North Shore Hospital at St Leonards; four persons to Manly Hospital and one person was evacuated by helicopter to the Royal Prince Alfred Hospital at Camperdown.

3.23 A crew from the Mosman Fire Brigade arrived at 3:09pm and was subsequently augmented by three other crews, with their related fire fighting vehicles, two of which came from Neutral Bay, with the other coming from Crows Nest. These crews assisted in site management but were not required to extinguish any fires.

3.24 The Ambulance Service advised the Police of the accidents at 3:03pm and the first Police vehicle arrived at 3:08pm. The general duties Police controlled pedestrian and vehicular traffic and were subsequently augmented by specialist crash investigators, vehicle examiners and a Local Area Commander. The Local Area Commander coordinated the control of traffic and the activities of the emergency services and investigators.

3.25 A significant number of STA managers and technical staff attended the accident site. OTSI observed that not all of these personnel appeared to be gainfully employed and formed the view that STA was over-represented at the site. As described in Part 2 of this report (para 2.12), the internal STA accident notification process was not followed and the assignment and deployment of appropriate investigation staff to the scene was poorly coordinated. Consequently, STA's external notification process was untimely and provided insufficient detail about the severity of the accident.

[12] The location of the accidents was initially identified as being at the Spit Bridge

3.26 The section of Spit Road from Medusa Street to Upper Spit Road was littered with wreckage from the various collisions. In addition to those casualties who could be readily accessed, the emergency services were confronted with a severely injured person, the driver of the Peugeot, who was trapped inside her car. An hour later, they were also required to attend to a male teenage skateboarder who broke his leg, after being distracted by the accidents, when he fell from his skateboard.

3.27 All Spit Road lanes were closed by the Police immediately following the accident. Once emergency services were in place and the injured had been removed from the site, the Police acted to control the rapidly building-up peak-hour traffic. Southbound traffic was diverted via Parrawi Road, immediately South of the Spit Bridge. Two lanes of Northbound traffic were closed from Medusa Street to Ida Street, which allowed one lane of Spit Road to be opened. These traffic arrangements remained in effect until approximately 10:00pm by which time the area was cleared of damaged vehicles and debris and the Police and OTSI's on-site investigatory activity had been completed.

Road–related Issues

3.28 Spit Road is difficult to negotiate because it is steep and winding and is further restricted by adjacent properties. Vehicles exit these properties onto Spit Road with difficulty and in the process constitute, and are confronted with, traffic hazards. Statistics provided by the RTA indicate that there were 73 accidents on Spit Road between Medusa Street and Pearl Bay Avenue during the period 1996 to 2005. Two of these resulted in fatalities (1996 and 1999), 34 in injuries and in 37 instances one or more vehicles had to be towed from the scene. 30 of the accidents involved rear-end collisions and 14 were head-on collisions. A further 11 involved vehicles running off the road after failing to negotiate a bend and seven involved vehicles changing lanes. Significantly, 46 of the 73 accidents involved vehicles travelling South, or up Spit Road. 13 of the 14 head-on collisions occurred between 1996 and 2000, and all of the accidents that involved a vehicle running off the road occurred

between 1996 and 2001. This suggests that a range of measures implemented by the RTA on Spit Road in 2000, including the introduction of a speed camera, improved signage and flashing warning lights, did have a positive impact.

3.29 A safety audit undertaken on behalf of the RTA in 2000 described the road as being generally unforgiving, with poor sight lines on left hand curves, narrow lanes, footpaths and median strip, and high escarpments and walls at building lines. There is a large number of signs prior to the Northbound point at which Spit Road commences its descent and a 35km/h advisory sign with flashing lights is prominently displayed against a large red background. There is also a warning sign indicating the presence of concealed driveways and, as previously indicated in *Photograph 10*, a sign indicating that "trucks and buses must use low gear" at the Medusa Street traffic lights.

3.30 The median strip separating the Northbound and Southbound lanes on Spit Road can not be considered a 'barrier', as is obvious in the illustration at *Photograph 12.*

Photo 12: Median Strip on Spit Road

The RTA commissioned a number of reports which, in succession, considered the appropriateness of a different type of median barrier after each previous option considered had been found to be unsuitable for the location. The barrier types considered over time included a rigid concrete barrier, a movable barrier which could be altered to accommodate or facilitate increased traffic flow at different times and non-rigid barriers such as steel guard rails or wire rope barriers.

A summary of some of the related discussion is outlined below:

a. A report, completed in May 2000, examined the feasibility of replacing the median strip with a 600mm vertical concrete barrier. It proposed that the existing lanes remained at a minimum of 3.0m with an additional 300mm width added to the median lane to improve “driveability” and safety against the vertical concrete barrier. The report predicted that the installation of a vertical concrete barrier would reduce the number of cross-carriageway accidents but noted that it might increase the rate of rear-end and side-on accidents. It also noted that the distance at which drivers might see brake lights around a curve would also be diminished and expressed concerns relating to the narrowness of footpaths either side of the road.

b. Another report, completed in July 2001, examined the feasibility of installing a moveable lane barrier to eliminate or reduce head-on collisions. This solution would have reduced the number of lanes from six to five and increased the width of the lanes. It was envisaged that the moveable barrier would be adjusted at varying times of the day to regulate traffic flows and that this would more than offset the loss of a lane. It was observed in the report that vehicles were generally travelling at inappropriate speeds given the presence of concealed driveways, restricted sight lines, congestion and tight curves. The report also observed that advisory signs were generally disregarded and that it was difficult for enforcement action to occur given that drivers could travel within the mandated speed limit and still fail to drive at an

appropriate speed for the conditions. OTSI noted that the current 35km/h RTA speed signs in the vicinity of Medusa Street are advisory only and formed the view that if such signs are unenforceable, they are less likely to have the desired effect and as such, should be replaced by mandatory speed limits in critical areas, such as between Medusa and Ida Streets.

c. A computer simulation of the effectiveness of alternative median barrier profiles on Spit Road was also completed in 2001. The associated report concluded that an alternative barrier profile had to be considered due to the narrowness of the road. It recommended the installation of a British designed barrier, measuring 750mm in height and 250mm in width[13] and noted that this type of barrier has been successfully tested at impact speeds and angles of up to 115km/h and 20° respectively. Three low-height rigid barriers were assessed using 3D computer modelling. The barriers were intended to provide low-level containment and re-directive properties, whilst maintaining sight distance requirements. The computer simulation found that the barriers would be unlikely to contain a 4WD vehicle or bus and the barriers failed modelling tests. At the time, the RTA was unable to find any evidence of this type of barrier having been formally tested or used in any known location. For these reasons, the RTA decided to explore other treatment options.

d. A report into the relationship between lane widths, sighting distances and accidents was completed in November 2001. The final section of the report contained a risk assessment of the area of Spit Road between Medusa Street and Pearl Bay Avenue. After analysing the effect that the installation of a barrier might have on accident rates, it was concluded that the cost of installing a 750mm concrete barrier between the Northbound and Southbound lanes would be offset by a reduction in the nature of significant accidents within five years. Quite apart from the

[13] British 'VCB' Barrier is constructed of concrete, reinforced by steel and tapers from 250mm in width at the base to 200mm at the top.

reservations it has in relation to this and the other barrier options, the RTA believes that a halving of the crash rates in this area since the installation of a fixed digital speed camera in 2001, on the Western side of Spit Road approximately 136m before the Medusa Street traffic lights, renders the original cost-benefit analysis invalid.

3.31 The RTA advised OTSI it has considered a variety of types of barriers but was concerned that they would exacerbate rather than reduce problems on Spit Road. Steel guardrails or wire rope barriers were considered impractical due to the tight curves and their tendency to deflect, and therefore potentially impact with opposing traffic, when struck. The RTA also believed that the presence of such barriers might result in increased collisions as drivers shy away from the barrier and straddle the inside and centre lanes. The RTA also noted that these barriers were less robust than concrete barriers and that the requirement for their more frequent repair would impact on traffic flows. It was also concerned that the height of the barriers, coupled with the vertical grade and curvature of the road, would restrict drivers' visibility. A moveable barrier was discounted on the basis that it would require major road works at a prohibitive cost. A rigid concrete barrier, whilst unlikely to be displaced upon impact, was also considered likely to encourage drivers to enter the centre lane and increase the prospect of rear-end and side-swipe collisions. This option was also likely to have the most impact on visibility. A recent study concluded that in order for a concrete barrier to meet design requirements regarding sight-lines on Spit Road, traffic speeds would have to be reduced to 28km/h or the height of the barrier restricted to 0.6m. The RTA considers the former requirement to be impractical, and probably unachievable. It also believes that a barrier of such limited height would be unlikely to contain an out-of-control vehicle; indeed it might result in vehicles rolling over such a barrier. In sum, the RTA considers that existing barrier designs are unsuitable for use on

Spit Road but indicated that it will consider new barrier systems as they are developed.

Mitigation of Risk

3.32 OTSI notes that the following actions were undertaken in response to the accident:

a. STA issued a Safety Alert stating that "…by Medusa Street, all STA Buses will operate in the kerbside lane until Pearl Bay Avenue" and that "…at St Therese Church buses will select low gear."

b. STA posted new warning speed signs advising their drivers of a 35kp/h speed limit, as indicated in *Photograph 13.*

Photo 13: Newly installed STA signage along Spit Road

c. MoT suspended the Driver's Public Passenger Vehicle Driver's Authority pending the outcome of legal proceedings, initiated by the NSW Police, against the Driver in relation to the accident.[14]

[14] The Police charge is the subject of continuing court action and is outside the scope of OTSI's jurisdiction.

d. The RTA sought an independent medical assessment of the Driver's fitness to drive following the accident and, on the basis of the subsequent assessment, suspended his normal and HR licences on 4 September 2006.

3.33 OTSI noted that Clause 10 of the *Passenger Transport (Bus Services) Regulation, 2000* obliges operators to ensure that their drivers are properly qualified and hold a current Public Passenger Vehicle Driver's Authority. In the event that the MoT has cause to suspend or cancel a driver's Authority, the related Authority number is removed from a list of current Authority Numbers available to operators via MoT's website. In addition, the MoT periodically advises the details of any Authority Numbers that have been suspended or revoked to the bus industry. Operators who wish to check on the qualifications of a prospective driver can also contact the MoT directly. MoT advised OTSI that both the Police and RTA informed the MoT when a driver's medium or heavy vehicle licenses were either suspended or revoked. OTSI is therefore satisfied that provided operators exercise due diligence before engaging the services of a new driver, there is a system in place to ensure that drivers who have had their driver's licence or Public Passenger Vehicle Driver's Authority suspended or revoked, cannot simply move to another operator and re-commence employment as a bus driver.

3.34 OTSI noted that as part of its response to recommendations contained in the Report of the Special Commission of Inquiry into the Waterfall Rail Accident**,** MoT has recently engaged a specialist medical officer for a six month project to review its health-related policies and their application, and to review the files it holds on authorised public passenger vehicle drivers. The specialist will also conduct industry workshops to promote a greater understanding of MoT's health assessment requirements. MoT is anticipating that, by being represented by a medical practitioner, those conducting health assessments may be encouraged to be more forthcoming with their communications in relation to matters that have the potential to impact on drivers' ability to perform their duties safely.

OTSI sees considerable merit in this project because, in the absence of such in-house medical expertise, MoT is not well-positioned to interpret medical assessments provided to it if the assessments contain any form of qualified opinion.

PART 4 FINDINGS

4.1 As a result of its investigation, OTSI finds:

a. In the matter of **causation**, that the Driver lost control of the bus as it descended Spit Road.

b. In the matter of **whether the vehicle was being operated appropriately at the time of the accident**, that:

i. The bus was operated in an inappropriate gear and at a speed in excess of that required to safely negotiate a winding and descending section of Spit Road.

ii. The Driver exhibited signs of reduced concentration prior to the accident and may have suffered a micro-sleep as the bus descended Spit Road. This, in combination with speed, resulted in the Driver being unable to negotiate a sharp bend and the bus subsequently crossing over the median strip into the path of oncoming traffic.

iii. Throughout the journey from Wynyard, the Driver was not wearing a seat belt, which would have made it more difficult for him to regain control of the bus during the collision sequence.

c. In consideration of **whether mechanical functions and/or design features contributed to the cause of the accident**, that the bus had been regularly serviced, was in good mechanical condition and that design matters were not at issue.

d. In consideration of **whether there are any policy, organisational and/or administrative factors which relate to safety management and contributed to the cause of the accident**, that:

i. In 1996 and on two occasions in 1997, the Driver had collapsed in his seat whilst his bus was stationary, but that subsequent medical

examinations failed to identify any medical condition that might have triggered these collapses. Further medical examination following the accident on Spit Road also failed to identify any medical condition that might have induced fatigue or a collapse.

ii. MoT was aware of the three incidents where the Driver was found collapsed in his seat and had suspended his authority to drive a public passenger vehicle after the second and third instances, but lifted its suspensions following receipt of medical advice which indicated that the Driver was fit to perform his duties.

iii. The second restoration of the Driver's authorisation to drive a public passenger vehicle was conditional upon the Driver submitting to an annual, rather than a bi-annual, health assessment, but that MoT did not notify his employer (at the time, North & Western Services Pty Ltd) of this requirement.

iv. MoT did not insist on, nor follow-up, its own stipulation that the Driver be required to submit to an annual health assessment and that the assessments that were conducted in 1997, 1999, 2001 and 2004 were undertaken by the Driver's doctor. In each instance, that part of the health assessment documentation requiring the Driver to declare whether he had ever fainted or blacked-out was completed in the negative.

e. In the matter of **the adequacy of the emergency response and management, and the level of safety and protection offered to all involved at the accident site,** that:

i. Emergency services were initially alerted to the accident by a member of the public who called 000 at 3:00pm.

ii. Emergency services responded in a timely and effective manner within 10 minutes of the 000 call.

iii. Because STA staff at the Traffic Management Centre were not notified of the accident immediately by STA Depot staff at the

scene, official confirmation of the accident, and consequent notification to OTSI, did not take place until 42 minutes after the occurrence.

iv. STA was over-represented at the scene of the accident by staff who had no specific function to perform.

f. **Other matters**:

i. The CCTV security camera and VHS recorder installed in the bus failed to record key parts of the accident sequence because they were subjected to severe jolting at the onset of the collisions.

ii. STA could make greater use of the electronic data that can be obtained from the computing control systems onboard later model buses to further its understanding of matters that cause or contribute to accidents.

iii. The Driver's record of traffic violations, official warnings and episodes of collapse at the wheel of a bus, demonstrate his unsuitability for employment as a public transport bus driver.

PART 5 RECOMMENDATIONS

5.1 Implementation of the following remedial safety actions by the specified responsible entity is recommended:

a. State Transit Authority

i. Review its response to this accident in order to improve the timeliness of its internal and external incident notification processes.

ii. Promulgate the policies and procedures that are necessary to ensure that only its essential emergency response personnel attend bus accident scenes.

iii. Give priority to the replacement of all existing analog CCTV recording equipment with digital recording equipment which is not subject to extreme motion interference.

iv. Enhance its capability to access the electronic data from the computing systems that are onboard its later model buses.

v. Continue to reinforce the requirement for its drivers to wear seat belts and actively monitor compliance with that requirement.

vi. Actively monitor drivers' compliance with any newly imposed speed limits on Spit Road.

b. Roads and Traffic Authority

i. Impose a mandatory speed limit of 40km/h for buses and heavy vehicles on the Spit Road in the section between Medusa and Ida Streets, Mosman, and examine the feasibility of requiring those same vehicles to travel in the left-hand lane within that section.

c. Ministry of Transport

i. Review its system of monitoring adherence to the health assessment regime.

ii. Review its system of monitoring compliance with any special conditions attached to a driver's authorisation.

iii. Ensure that it maintains an independent capability to conduct thorough and timely reviews of medical assessments of drivers holding, or seeking to hold, a Public Passenger Vehicle Driver's Authority.

iv. Cancel the Bus Driver's Public Passenger Vehicle Driver's Authority and ensure he is not re-authorised.