



Office of Transport Safety Investigations

BUS OCCURRENCE – FACTUAL STATEMENT

BUS TV1175 LOSS OF CONTROL

TAMBORINE MOUNTAIN, NEAR WONGAWALLAN QLD

18 MARCH 2016



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Published by: The Office of Transport Safety Investigations
Issued: 25 November 2016
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Investigation Reference: 04720

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Established on 1 January 2004 by the *Transport Administration Act 1988 (NSW)*, and confirmed by amending legislation as an independent statutory office on 1 July 2005, OTSI is responsible for determining the contributing factors of accidents and to make recommendations for the implementation of remedial safety action to prevent recurrence. Importantly, however, OTSI does not confine itself to the consideration of just those matters that contributed to a particular accident; it also seeks to identify any transport safety matters which, if left unaddressed, might contribute to other accidents.

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Once OTSI has completed an investigation, its report is provided to the NSW Minister for Transport and Infrastructure for tabling in Parliament. The Minister is required to table the report in both Houses of the NSW Parliament within seven days of receiving it. Following tabling, the report is published on OTSI's website at www.otsi.nsw.gov.au.

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EXECUTIVE SUMMARY

What happened

On Friday 18 March 2016, the driver of bus TV 1175 lost control in the final stages of negotiating a steep downward grade (descent) on Tamborine-Oxenford Road, near Wongawallan in South Eastern Queensland.¹

The bus, a chartered double decker bus carrying 62 passengers, was returning to Lismore NSW from a school excursion, when the driver realised the brakes were heat affected and no longer provided effective braking to stop the bus at traffic lights at a major intersection. As a result, the bus passed through the intersection and travelled approximately 1.5 km before it stopped. The driver immediately evacuated the 62 passengers. There were no reports of any injuries or damage.

What was found

On 24 March 2016, NSW Roads and Maritime Services (RMS) conducted a heavy vehicle inspection of the bus at their Lismore facility. The inspection by RMS focused on the operation of the braking system and concluded that the bus was mechanically fit and met all safety requirements.

Two days prior to the incident, the driver undertook the same journey with the same, but unladen; during which the driver was able to descend the steep grade and control the speed of the bus using second gear. However, on the day of the incident, the bus was loaded with passengers and luggage. The increased mass of the vehicle was such that, in combination with the use of an inappropriate gear, the momentum was beyond the capability of the braking and speed retarder systems to maintain control of the speed throughout the entire descent.

Despite being familiar with the Tamborine-Oxenford Road, and having clear visibility of the grade warning signage throughout its steep descent, the bus driver did not engage a low gear in accordance with relevant road rules and signage. Because of this, the bus increased downhill speed requiring more brake applications to control

¹ Whilst this incident occurred in Queensland, it involved a NSW accredited bus, driver and operator and there were important learning and safety outcomes for the operator and wider bus Industry.

speed. This caused the brakes to become ineffective, due to brake thermal overload (heat affected).²

What's been done as a result

As a result of this incident, the Company has strengthened its practical driver training and accreditation framework to incorporate the operation of buses over steep ascent and descent.

Safety message

Fortunately, there were no adverse consequences for the driver, passengers or other road users from this loss of control. However, this incident highlights the importance that, on steep routes, bus and heavy vehicle operators must:

- mitigate against brake failure by adopting proper driving techniques;
- factor for the additional weight of the load;
- not exceed the total vehicle weight for the vehicle's braking capacity;
- select low gear prior to descending steep grades, to control the speed of the vehicle without the constant use of brakes;
- control the vehicle in accordance with regulatory road signs; and
- use driving techniques in accordance with relevant Road Rules or Heavy Vehicle Driver Handbook.

² Brake thermal overload is when the brake system can no longer dissipate heat energy created by friction elements during retardation.

PART 1 CONTEXT

The occurrence

- 1.1 At approximately 1020³ on Friday 18 March 2016, Simes Bros Coaches⁴ bus TV 1175 suffered brake failure in the final stages of descending the steep downward grade (descent) on Tamborine-Oxenford Road, near Wongawallan in South Eastern Queensland (Qld) (refer to *Figure 1*).

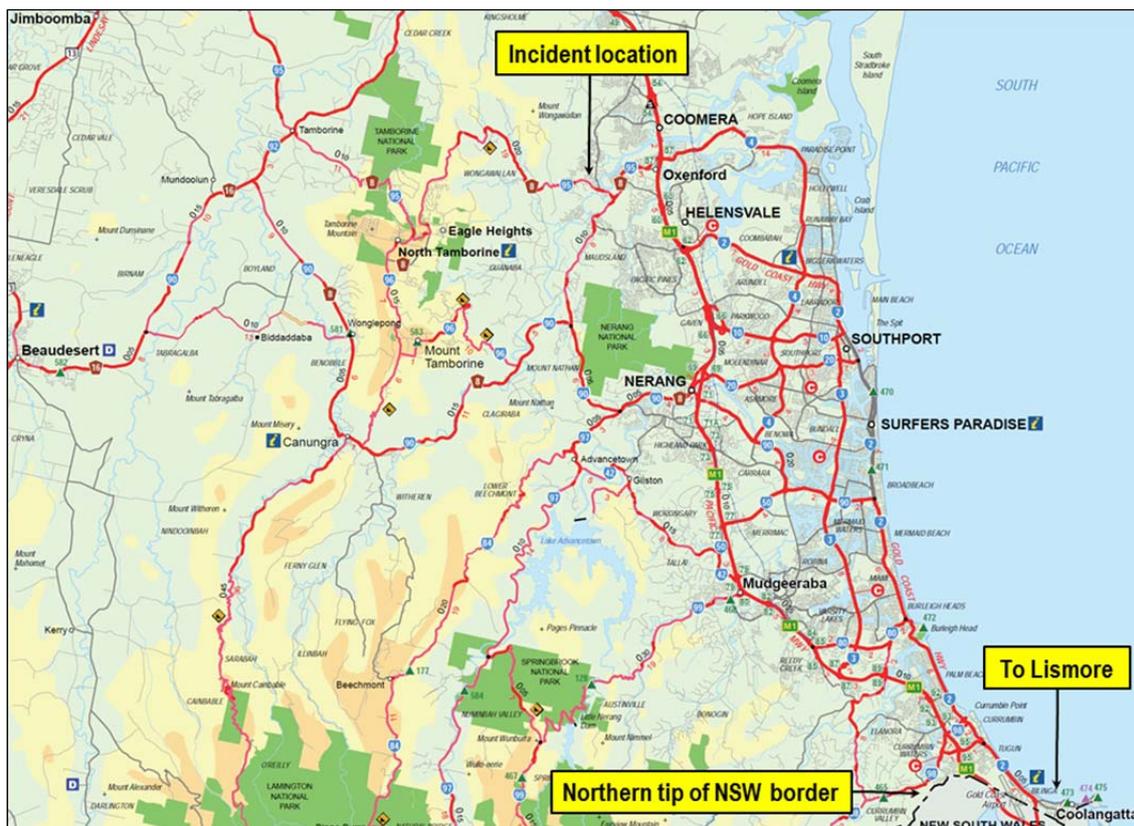


Figure 1: Road map of South Eastern Queensland

Image courtesy of *Old Road Guide 2014* (annotated by OTSI)

- 1.2 The chartered double decker bus carrying 62 passengers (58 Year 9 students and four adult teachers), was returning to Lismore in NSW from a school excursion at Thunderbird Park (on Tamborine Mountain), when the brakes

³ All times referred to in this report were Australian Eastern Daylight Saving Time, which was applicable for NSW. Daylight Saving Time is not used in the Northern Territory, Queensland and Western Australia.

⁴ Simes Bros Coaches operated as SB Coaches and were based at Lismore. They held the necessary NSW accreditation to operate up to 25 vehicles. They had a variety of buses, but this was the only double decker model bus in their total fleet of 13 vehicles.

became heat affected and unable to stop the bus at traffic lights at the intersection with Reserve Road, near Oxenford (refer to *Figure 2*).

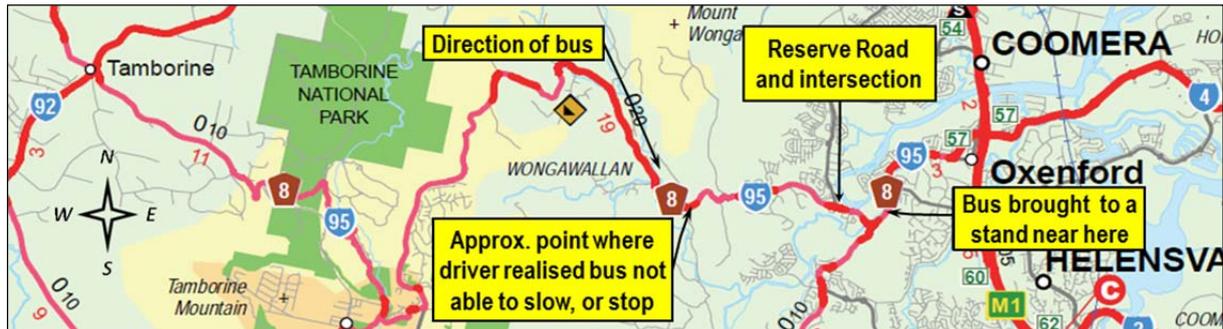


Figure 2: Incident location

Image courtesy of *Old Road Guide 2014* (annotated by OTSI)

- 1.3 To avoid stationary vehicles at the intersection, the driver steered onto the wrong side of the road, before passing through the intersection. The bus continued for approximately another 1.5 km before the driver was able to bring it to a halt. The driver immediately evacuated the 62 passengers and eventually they were able to continue their journey on another bus. There were no reports of any injuries or damage.

Incident location

- 1.4 The Tamborine-Oxenford Road is approximately 22 km long, starting at Tamborine, passing through Wongawallan and finishing at Oxenford. The mid-section of the road traverses the Tamborine National Park and Tamborine Mountain. Whilst the majority of the road is undulating, some sections are steeply ascending/descending and winding. The bus was travelling in an Easterly direction. The incident occurred in the later stages of a steep descent. (refer to *Figure 1*).

Road rules and signage

- 1.5 Both NSW and Qld adopt similar National road rules and signage applicable to the operation of buses and heavy vehicles.⁵ The Qld Department of Transport

⁵ *The Heavy Vehicle National Law* (HVNL) and regulations commenced in the Australian Capital Territory, New South Wales, Queensland, South Australia, Tasmania and Victoria on 10 February 2014. In addition to passing the HVNL, states and territories agreed to four regulations made under the national law. The Northern Territory and Western Australia have not commenced the HVNL at this time.

and Main Roads⁶ inspected the heavy vehicle signage positioned on the Tamborine-Oxenford Road. It noted that the signs were in a clean, reflective and legible condition. They also appeared consistent and compliant with relevant Australian Standards.⁷

- 1.6 Prior to, and throughout the downhill descent, the bus passed a number of *TRUCKS & BUSES MUST USE LOW GEAR* signs, *VERY STEEP DESCENT* signs and *STEEP DESCENT* symbolic signs (two examples shown in Figure 3)

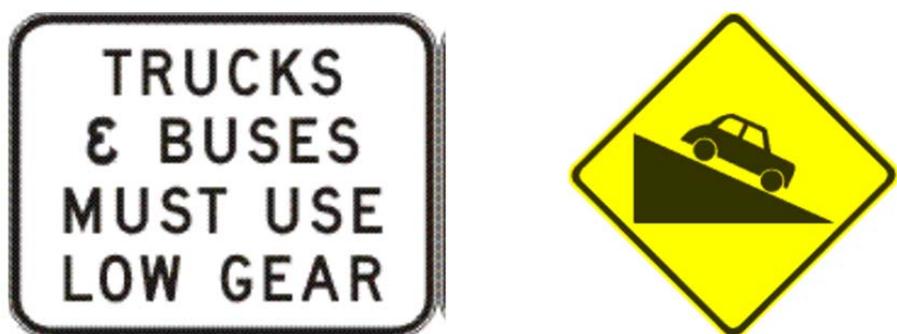


Figure 3: Traffic signage examples

- 1.7 The NSW RMS Road Users' Handbook⁸ defined white background signs as regulatory signs and yellow background signs as warning signs:
- **Regulatory signs** tell you about laws that must be obeyed. Most regulatory signs are rectangles and usually black on a white background.
 - **Warning signs** tell you that there may be dangers ahead. Most warning signs are diamond shaped and usually black on a yellow background.
- 1.8 At the *TRUCKS & BUSES MUST USE LOW GEAR* sign, it was a regulatory requirement for the driver to bring his vehicle under control in accordance with the relevant Road Rule 108⁹ which stated:

⁶ Old Department of Transport and Main Roads, South Coast Region, were the relevant road authority.

⁷ *Australia Standards AS 1742.1:2014 Manual of uniform traffic control devices, Part 1: General introduction and index of signs* and *AS 1742.2 – 2009 (Incorporating Amendment Nos 1 and 2), Part 2: Traffic control devices for general use, Clause 4.9.2(a)* for size, detail and design as well as height and positioning on their posts.

⁸ *NSW RMS Road Users' Handbook, Section 5, General Road Rules.*

⁹ In Qld: *Transport Operations (Road Use Management - Road Rules) Regulation 2009 (2015), Section 108 - Trucks and buses low gear signs.* In NSW, this section is replicated in: *Road Rules 2014, Division 3 Signs for trucks, buses and other large vehicles, Section 108 - Trucks and buses low gear signs.*

- **Trucks and buses low gear signs** (1) *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.....(4) In this section – **primary brake** means the footbrake, or other brake, fitted to a truck or bus that is normally used to slow or stop the vehicle.*

1.9 NSW also publish a handbook for heavy vehicles.¹⁰ Key principles in these sources which drivers of heavy vehicles and buses must consider include:

- mitigate brake failure by adopting proper driving techniques;
- factor for the additional weight of the load,¹¹
- not exceed the total vehicle weight for the vehicle's braking capacity;
- select low gear prior to descending steep grades, to control the speed of the vehicle without the constant use of brakes,¹²
- control the vehicle in accordance with regulatory road signs; and
- use driving techniques in accordance with relevant Road Rules or Heavy Vehicle Driver Handbook.

The bus

1.10 Bus TV 1175 was a single door Denning, 3-axle Landseer DD (double decker) model fitted with lap-sash seatbelts (refer to *Photograph 1*). It was built in February 1989 and was the only one of its particular model Denning bus in the SB Coaches fleet. The odometer reading at an inspection post incident (24 March 2016) was 835,663 kilometres. The bus had a tare weight of 16.37 tonnes.¹³

¹⁰ Qld did not have an equivalent handbook, however, information on *Heavy vehicle guidelines and class permits* could be found on their website at: <http://www.tmr.qld.gov.au/>.

¹¹ *NSW RMS Heavy Vehicles Driver Handbook, Section 4 Safe Driving.*

¹² *NSW RMS Heavy Vehicles Driver Handbook, Section 4 Safe Driving.*

¹³ When the *Heavy Vehicle National Law 2012* (the HVNL) commenced, it replaced existing laws governing the operation of all vehicles over 4.5 tonnes gross vehicle mass in Queensland, New South Wales, Victoria, South Australia, the Australian Capital Territory and Tasmania. Under the HVNL, a heavy vehicle is a vehicle that has a Gross Vehicle Mass (GVM) or Aggregate Trailer Mass (ATM) of more than 4.5 tonnes and a combination that includes a vehicle with a GVM or ATM of more than 4.5 tonnes. TV1175 had a GVM of approximately 23 tonnes.



Photograph 1: Bus TV 1175 Image courtesy of SB Coaches

1.11 The bus was fitted with combination pneumatic/hydraulic disc brakes on the front axle and pneumatic drum brakes on the two rear axles. It was also fitted with a 5-speed automatic transmission and an Allison T450 (R) two-stage speed retarder device. Both the gearbox and retarder were fully operational and used by the driver during the descent. According to the NSW Roads and Maritime (RMS) *Heavy Vehicle Driver Handbook*, speed retarders: ‘...*may be fitted to medium and large vehicles to supplement the vehicle’s service brake system. They will not stop the vehicles completely but may help to slow it down. They are not considered service brakes as they act on the engine or drive train*’.

1.12 The vehicle was in current registration with the RMS.¹⁴

Driver competency

1.13 The driver had driven heavy vehicles for 25 years and been employed as a casual driver with the Company since February 2014. The driver held the

¹⁴ Heavy vehicle operations are regulated under the *HVNL* and *National Regulations* by the National Heavy Vehicle Regulator (NHVR). To access the legislation as it applies in NSW go to the NSW Legislation website. Roads and Maritime Services (RMS) delivers services under a services agreement with the NHVR. Some matters are dealt with exclusively by the NHVR, for example, accreditation under the National Heavy Vehicle Accreditation Scheme. Other matters, such as registration, licencing and regulation of buses and coaches in NSW, are managed exclusively by RMS.

appropriate RMS heavy vehicle licence and driver authorities¹⁵ that were applicable to the operation of the bus TV 1175. There were no medical or fatigue issues identified that affected the driver.

¹⁵ All drivers of a public passenger bus, motorcycle and 4-wheel drive tour vehicles must be authorised under the *Passenger Transport Act 1990*. Heavy vehicle licences and drivers authorities, issued by RMS, show a driver's capability to operate a heavy vehicle (truck/bus/coach) and its passengers. It is a legislative requirement that a driver have accreditation and a relevant class of heavy vehicle licence before they can drive a heavy vehicle in Australia.

PART 2 ANALYSIS/FINDINGS

Examination of the bus

- 2.1 After the incident, the Company contracted a mechanic from another nearby bus operator to inspect and test the bus in situ. The mechanic diagnosed that the brakes had been heat affected. Once the brakes had cooled sufficiently, the bus was driven by the mechanic from the site to the contractor's depot for further inspection by the Company.
- 2.2 Later that same day, the Company representative retrieved the bus back to the Lismore Depot. The representative observed enroute that the gearbox, brakes and speed retarder had operated normally. Back at Lismore, mechanics subjected the vehicle to a more detailed brake inspection and road test. The brake inspection revealed that, although the braking system was within specification, the front brake disc rotors had blue discoloration, consistent with overheating. The rear pneumatic/drum brakes (incorporating spring brake chambers on the two rear axles) did not show any discoloration or signs of overheating. However, as a precaution, the Company arranged for replacement brake equipment for both front and rear brakes.
- 2.3 On 24 March 2016, at the request of OTSI, the bus was subjected to a full Heavy Vehicle Inspection Scheme (HVIS)¹⁶ examination by an RMS inspector, in the company of a representative from SB Coaches. The bus passed this inspection and conformed to all test requirements.
- 2.4 The maintenance records of the bus for the previous year were examined and showed no indication of defects or recent maintenance on the transmission or braking system. However, records indicated that the retarder system suffered from repeated electrical issues, which affected the operation. As a result, a new gearbox and Allison T450 (R) two-stage speed retarder device were fitted to the vehicle in June 2013. Since installation, there had been no further reported issues with the gearbox or retarder.¹⁷

¹⁶ This HVIS was undertaken at the RMS HVIS facility at Lismore during which the braking system was closely scrutinised. RMS's records indicate that it was evident that the braking components had been subjected to recent adjustment, rectification and replacement work.

¹⁷ The Allison T450 speed retarder device is widely used within the heavy vehicle (and bus) industry and was considered a reasonable replacement for the old HTB748R device.

Previous journeys over that route

- 2.5 The Company indicated that their buses had travelled that route 10 times in the previous three years. Then, just two days prior, the same driver undertook the same journey with the same bus, during which the driver used second gear to control the bus during the descent, albeit with the bus empty. However, on the day of the incident, the bus was loaded with passengers and luggage. The increased passenger and luggage load was such that, in combination with speed, the momentum exceeded the capability of the braking and speed retarder system to maintain control of the bus throughout the entire descent.
- 2.6 Calculations of the difference in load mass between the empty and loaded bus indicate that the change was a magnitude of approximately 22%. Also, that double decker model, when loaded, or with varying load distributions, would have had a higher centre of gravity and the change in dynamic forces would have affected its handling characteristics.
- 2.7 As all other factors remained the same between the two journeys, the only variation was the load mass and the most likely significant factor affecting the operation of the bus. It is also one of the main requirements for the driver of a heavy vehicle to factor an allowance for the weight of the load.¹⁸

Practical driver training

- 2.8 Company training records indicated drivers underwent biannual practical driver training and assessment through an external driver training provider. However, a review of the usual routes where the assessment took place showed that the provider rarely, if ever, incorporated bus operation on steep ascents, or descents. Following this incident, the Company reviewed its program to ensure the practical driver training and assessment were conducted annually and incorporated steep routes '*...to ensure drivers select the correct gear on a descent*'. The Company also issued internal alerts reminding drivers of the specific driving techniques required when operating the double decker bus on the Tamborine-Oxenford Road.

¹⁸ NSW RMS Heavy Vehicles Driver Handbook, Section 4 Safe Driving.

Contributing safety factors

2.9 From the evidence available, the following findings are made with respect to the loss of control and should not be read as apportioning blame or liability to any particular organisation or individual:

- The bus experienced a loss of control whilst descending the Tamborine-Oxenford Road as the driver had not selected a low enough gear, nor adequately considered the overall change in weight of the loaded bus when compared against a recent journey when empty.
- The increased passenger and luggage load was such that, in combination with speed, the momentum exceeded the capability of the braking and speed retarder system to maintain control of the bus throughout the entire descent.

Other safety factors

2.10 A review of the usual routes taken during biannual practical driver training showed that they did not incorporate bus operation on steep ascents, or descents.

Other key findings

2.11 There were no formal procedures or alerts issued to drivers for the specific driving techniques required when operating double decker buses on the steep terrain on the Tamborine-Oxenford Road.

2.12 Both NSW and Qld have adopted similar road rules and signage applicable to the operation of buses and heavy vehicles. There are key principles which are common in both states and which drivers must consider and implement for heavy vehicles, including buses.

Remedial Action

2.13 As a result of this incident, the Company immediately reviewed its biannual practical driver training and recertification program, as well as the procedures for bus operation on that route. The Company subsequently implemented the following:

- increased frequency of the practical driver training program – now annually;
- altered the usual practical training and assessment route/s to include a section/s where drivers are required to select the correct gear on a steep descent;
- issued an alert to drivers covering journeys using that specific bus on the Tamborine-Oxenford Road route. The alert focused on the selection of low (1st) gear prior to commencing the descent; and
- updating the Company's driver manual for the vehicle, alerting each driver to the requirement to select low (1st) gear prior to commencing the descent.

2.14 Further, the Company is evaluating the viability of a submission to the Qld Department of Transport for a review of the heavy vehicle signage in place. Specifically, the Company considered the installation of more 40km/h speed limit signs, may improve driver compliance to the speed limit.

PART 3 CONCLUSION

- 3.1 It is noted that this has been the fourth occasion where inappropriate gear selection/inadequate braking has been the major contributor, of a bus loss of control.¹⁹ Though there was potential for serious consequences from this occurrence, it was fortunate that no persons on the bus, or near the bus, were injured.
- 3.2 It was determined that the bus suffered brake failure because the braking technique did not:
- mitigate against brake failure by adopting proper driving techniques;
 - factor for the additional weight of the load;
 - not exceed the total vehicle weight for the vehicle's braking capacity;
 - select low gear prior to descending steep grades, to control the speed of the vehicle without the constant use of brakes;
 - control the vehicle in accordance with regulatory road signs; and
 - use driving techniques in accordance with relevant Road Rules or Heavy Vehicle Driver Handbook.
- 3.3 The increased passenger and luggage load was such that, in combination with speed, the momentum exceeded the capability of the braking and speed retarder system to maintain control of the bus throughout the entire descent.
- 3.4 The bus was maintained and suitable for service. RMS deemed the bus roadworthy on 24 March 2016.
- 3.5 The placement of relevant heavy vehicle road signage appeared consistent with the relevant requirements of the *Heavy Vehicle National Law, National Regulations* and Australian Standards.

¹⁹ Refer to OTSI bus safety investigation reports: *Coach Overturned, Jindabyne NSW, 11 June 2011* (21 passengers injured, four seriously); *Fatal Coach Accident, Barrengarry Nature Reserve NSW, 14 May 2010* and *Fatal Bus Accident – Jubo Travel, Jamberoo Mountain Road, 5 September 2005*. A copy of these reports can be found on the OTSI website at: <http://www.otsi.nsw.gov.au/bus/investigations.php>

- 3.6 The Company has implemented a number of remedial actions to mitigate against the risk of a similar loss of control.
- 3.7 In concluding its examination and investigation under the provisions of Section 46BA (1) of the *Passenger Transport Act 1990* of the circumstances surrounding this occurrence, OTSI has determined/concluded that it does not warrant the issue of any additional recommendations.
- 3.8 OTSI would acknowledge the assistance of SB Coaches, Qld Department of Transport and Main Roads and the NSW Roads and Maritime Services.

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