OTSI Office of Transport Safety Investigations

TECHNICAL INSPECTION FINDINGS

MAKEHAM'S COACHES BUS FIRE

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THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

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. OTSI investigations are independent of regulatory, operator or other external entities.

Established on 1 January 2004 by the Transport Administration Act 1988, and confirmed by amending legislation as an independent statutory office on 1 July 2005, OTSI is responsible for determining the causes and 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 caused or contributed to a particular accident; it also seeks to identify any transport safety matters which, if left unaddressed, might contribute to other accidents.

This OTSI investigation was conducted under powers conferred the Passenger Transport Act 1990. OTSI investigators normally seek to obtain information cooperatively when conducting an accident investigation. However, where it is necessary to do so, OTSI investigators may exercise statutory powers to interview persons, enter premises and examine and retain physical and documentary evidence.

It is not within OTSI's jurisdiction, nor an object of its investigations, to apportion blame or determine liability. At all times, OTSI's investigation reports strive to reflect a "Just Culture" approach to the investigative process by balancing the presentation of potentially judgemental material in a manner that properly explains what happened, and why, in a fair and unbiased manner.

The Incident

At approximately 1205[1] on Friday 4 January 2013, a Makeham's Coaches bus caught fire as it was travelling south on the Hume Highway, 22 kilometres south of Gundagai near a locality known as Tumblong (see *Figures 1 and 2).* The bus was completely destroyed by the fire and a small bushfire was started at the location where the bus pulled over. Both fires were eventually extinguished by the Rural Fire Service (RFS). Some passengers were slightly affected by smoke inhalation, but otherwise no injuries were sustained by passengers or the crew.

Figure 1: Incident location at Tumblong

The bus was crewed by a driver and a conductor. The bus started its journey from Tumbarumba at 0910 to commence its regular scheduled run to Wagga Wagga. It was due to arrive at Wagga Wagga railway station at 1240 after making a number of stops along the way. At 1145 at Gundagai, the bus made its final stop before the fire. Three passengers boarded the bus at Gundagai bringing the total number of passengers to 13. After leaving Gundagai the bus returned to the Hume Highway where the speed limit is 110 km/h. However, heavy vehicles such as this bus are limited under the Australian Road Rules to a speed of 100 km/h. According to the driver, the bus was travelling at about 75 km/h until just past the locality of Tumblong, when he received a call via UHF radio from a truck driver telling him: 'you've got smoke coming from the back of your bus'.

[1] All times referred to in this report are Australian Eastern Daylight Time, Coordinated Universal Time (UTC) +11 hours.

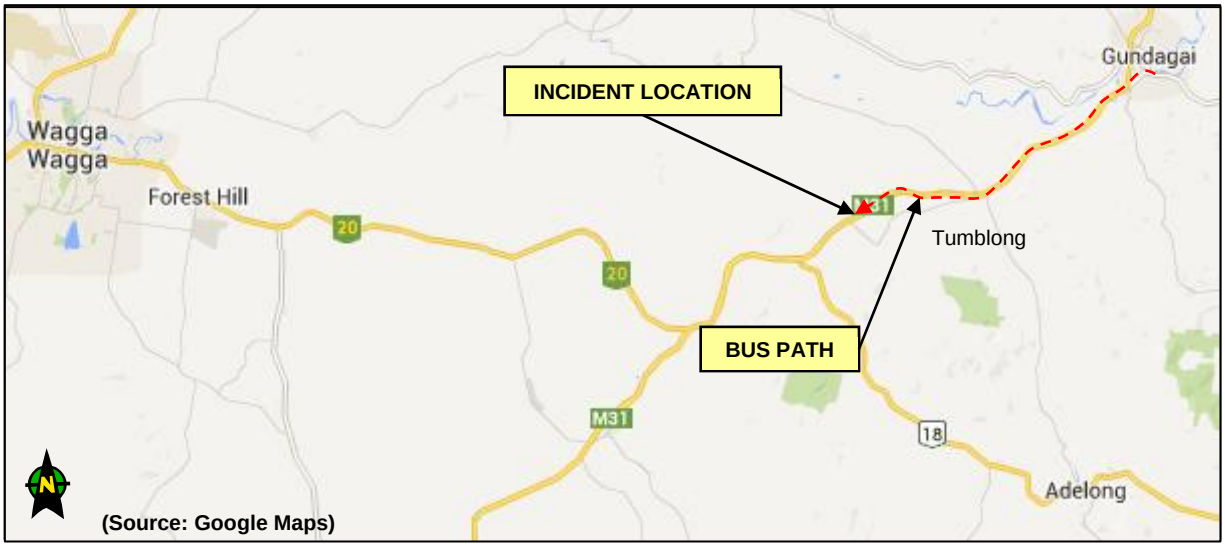

Figure 2: Path of bus from Gundagai

The driver said that the bus was at the top of a hill when he noticed the 'radiator cooling fan reduce' (in speed). A passenger spoke to the conductor who left her seat to attend to her. The conductor continued to the rear of the vehicle and noticed a heat haze above the floor at the rear. The conductor requested the passengers at the rear move towards the front of the bus. The conductor returned to inform the driver and told him to 'pull over, there's smoke'. The bus at this time was at the top of the hill and the driver said he did not want to stop the bus beside the Armco railing as there would not be enough space to work on the bus.

A witness driving in a car behind the bus said that there was black smoke and flames coming from the engine of the bus. She said:

> 'I couldn't see anything. The black smoke had just engulfed the bus. I couldn't see a thing. I pulled over ahead of the bus. Once I realised it had stopped I kept my distance; I didn't want to get near any explosion.'

The driver said he slowed the bus as quickly and safety as possible, decided on a suitable place to pull over, and pulled to the side of the Hume Highway where it was a lot wider and safer (see *Photograph 1).* He shut the engine down and noticed a fire alarm warning light illuminated on the dashboard.

Smoke started to enter the bus through an open roof vent. The conductor requested that everyone evacuate immediately and supervised them getting off the bus. The driver said, '…the bus was filled with thick acrid smoke and I could not see past the middle of the bus.' Once the passengers had left the bus, the driver took the fire

extinguisher from next to the driving compartment and went to the rear of the bus where he saw flames burning the fibreglass roof. He used the fire extinguisher on the flames but was unable to extinguish the fire. While he was using the extinguisher he tried to call 000 to report the fire to emergency services but his phone had no reception.

Photograph 1: Hume Highway incident location

The conductor retrieved passengers' luggage from the compartments located under the middle of the bus and moved the passengers further south away from the bus. Due to the proximity of the road to vegetation there was a concern that the fire would spread into the surrounding area.

The highway was blocked by semi-trailers which had stopped and created a barrier to prevent traffic passing the burning bus. The driver said he went back to the front of the bus, walked up the stairs and called out to check if anyone was still on the bus. There was no answer so he got back off the bus. The time was approximately 1210 and the driver said the bus was then engulfed in flames.

An RFS truck arrived approximately 15 minutes later at 1225 and the bus driver used a fire hose to spray water onto the fuel tank of the bus. Nearby vegetation also caught fire which led the fire crew to focus on that area.

Police and additional RFS units arrived to control the fire. The fire crews eventually extinguished the vegetation and bus fires and remained on-scene to ensure that the fires did not reignite. The bus was removed using a low-loader and taken to a holding yard at Wagga Wagga for subsequent examination.

Passengers' account. There were 13 passengers on board the bus and OTSI investigators attempted to speak to the 11 adult passengers. Five passengers were eventually interviewed, with the other six not able to be contacted or not returning calls. One of the five passengers interviewed did not have a good command of English and was unable to understand the questions put to him. The other four passengers gave a consistent account of the incident.

These four passengers all stated that just past Tumblong the conductor was notified of fumes affecting them. According to the passengers, the driver stopped the bus, got off and checked the engine. Upon returning he told them there was a problem but the bus was able to continue the journey. A short while after resuming the journey they said they informed the conductor of smoke and one passenger said that he could see smoke coming up from the engine floor hatch located in the aisle at the rear of the bus. The conductor opened two overhead hatches in an effort to improve ventilation; instead this drew in more smoke. The passengers said that the cabin started filling with black smoke and the driver stopped the bus for a second time and they were evacuated safely.

Result

The extent of damage to the bus can be seen in *Photograph 2*.

The fire intensity was such that most of the combustible components of the bus were damaged beyond repair. The front right tyre and wheel, and some surrounding panels, were the only areas that remained relatively intact.

Photograph 2: Post-fire condition of bus

OTSI Involvement

OTSI's Duty Officer was notified of the incident by the Independent Transport Safety Regulator Duty Officer who was informed by RailCorp[2] at 1305. RailCorp was involved as the bus was operating under contract to RailCorp as a Countrylink coach service between the railway stations of Tumbarumba and Wagga Wagga. Arrangements were then made after contacting the operator of the bus, Makeham's Coaches, for OTSI investigators to undertake an inspection and initial assessment of the bus as soon as practicable.

On the basis of the information obtained from the initial inspection of the bus at the holding yard, the Chief Investigator initiated further examination of the incident.

[2] From 1 July 2013 NSW TrainLink now manages RailCorp's Countrylink services. All NSW TrainLink services are provided by the NSW Government through an overarching entity: NSW Trains.

Examination of the Bus

Inspection process. The bus was inspected by two OTSI investigators on Wednesday 9 January 2013 at a secure holding yard in Wagga Wagga. A similar bus was also inspected at the Makeham's Coaches Wagga Wagga depot on the same day. OTSI investigators inspected the site of the fire initially on 6 January 2013 then again on 9 January 2013 in search of further evidence.

Bus details. The bus was registered in NSW as TV5604. It was a three axle coach-style bus designed by Bus and Coach International Pty Ltd (BCI) and built in China in 2008. For more details refer to *Appendix 1*. BCI is a Perth-based Australian owned bus company which has a bus manufacturing facility in China.

The body of the bus was constructed of a combination of fibre reinforced plastic body panels and sheet metal panels riveted onto a steel tube frame. The tubular steel framed seats used a fibre covered foam with a plywood base and back. Other interior combustible materials included electrical wiring, plastic signage, plastic wall lining and assorted plastic fittings.

Fire detection and suppression systems. Apart from one fire detector in the on-board toilet, there was no fire detection system or fire suppression system fitted to the bus, nor was there any regulatory requirement for them to be fitted. The bus was carrying two fire extinguishers in accordance with *Australian Standard 2444 - 2001: Portable fire extinguishers and fire blankets - Selection and location*. They were both 2.1kg 1A:30B:(E) dry powder type extinguishers. One fire extinguisher was located next to the driving compartment and the other inside the engine compartment at the rear of the bus.

Bus maintenance. The bus had travelled approximately 629,000 kilometres. An examination of the records revealed that in the six months prior to the fire it had been regularly serviced and maintained.

The most recent work on the bus had been carried out on 17 December 2012 when both windscreens were replaced following a Heavy Vehicle Inspection Scheme (HVIS) annual inspection conducted by Roads and Maritime Services (RMS). The areas inspected during the HVIS inspection included brakes, steering, suspension, wheels, tyres, hubs, bodywork, seats and seatbelts, lights and reflectors, mirrors,

windscreens and windows, engine and driveline, fuel system and exhaust system. All items other than the windscreens were given a pass grade.[3]

The driver of the bus said that prior to the incident the bus was operating normally with no indication of any problem.

General damage to engine. The engine was substantially damaged with many parts partially or completely burnt or melted (see *Photograph 3*). The insulation was burnt off the electrical wiring and the batteries were burnt and melted. All plastic and rubberised material and some alloy parts were also completely or partially melted.

Photograph 3: Engine compartment

Warning indicators. When the bus driver was interviewed, he stated that he had carried out a routine pre-departure check in Tumbarumba before starting the journey. Once underway, he did not encounter any faults, warning lights or abnormal operation en route, or during the stop at Gundagai approximately 15-20 minutes before the incident.

As part of the vehicle's diagnostic system, various warning lamps and gauges provide information to the driver on the overall condition of the brakes, including braking system air pressure, brake pad wear, high brake temperature and failure of the ABS. However, the driver stated that none of these were activated prior to the incident or while the bus was slowing and stopping from an estimated 75 km/h

[3] The three inspection checklist levels are: pass, fail and not applicable / not available.

highway speed. It was only after the bus was stopped and as the engine was being turned off that the driver said he noticed the fire alarm warning light.

Development of the Fire

All indications were that the fire was initiated in the engine compartment. The reports from all witnesses are consistent in that the first signs of smoke and fire came from this area. The inspection of the engine compartment post-fire focussed on likely initiating areas.

The electrical system was examined for signs of faults or damage. Indicators such as wires fusing together can often indicate an electrical initiator of a fire. No indicators of faults were found in the wiring looms or connections.

The turbocharger was another area which was closely examined. There was no visible evidence that the turbocharger was damaged before the fire.

All oil and fuel lines were examined for signs of fatigue or damage. There was no visible damage or breakage along any line.

A site inspection on the Hume Highway two days after the fire showed an oil trail for at least 100 metres leading to where the bus eventually stopped (see *Photograph 4*). The oil trail was in three separate lines of a continuous series of droplets, increasing in size as the bus slowed and eventually stopped. The oil trail ended at the centre rear of the engine compartment and followed the probable line of motion as the bus moved from the left lane into the breakdown lane of the highway. It is likely that this oil was leaking from an oil supply line, but not at such a rate as to cause engine failure, since the engine continued to run even as fire was consuming the flammable materials of the engine compartment.

Photograph 4: Oil trail

Also noticeable along the path of the bus was a trail of solidified melted alloy (see *Photograph 5*). These drips were visible for over 300 metres leading to where the bus eventually stopped. At the site where the bus stopped were larger amounts of the solidified melted alloy which came from alloy engine parts (see *Photograph 6*). This confirms that the temperature in the engine compartment was high for a considerable time before the bus stopped and that the fire had initiated well before the start of the alloy trail.

The evidence above indicates the probability that the fire was initiated by leaking oil coming into contact with a hot surface in the engine compartment.

Photograph 5: Solidified molten alloy on road

Photograph 6: Heat damaged alloy turbocharger

Inside the engine compartment there was a significant quantity of combustible material such as parts of the main electrical box and the hydraulic fluid reservoir. It is likely that these components provided a secondary source of fuel that assisted in the establishment and propagation of the fire. Once the fire became established in the engine compartment, it eventually spread into the passenger area. From the rear of the bus the fire moved rapidly, consuming flammable materials like seating, flooring and interior panels.

Conclusions

It is probable that the fire was caused by oil leaking from a supply line and coming into contact with a hot surface. The fire then developed in the engine compartment and spread to the interior of the bus.

OTSI has concluded its examination of the circumstances of this incident and has determined that it does not require further investigation by this Office under the provisions of Section 46BA (1) of the *Passenger Transport Act 1990*.

A copy of these Findings has been provided to Makeham's Coaches and Roads and Maritime Services (as the NSW Bus Regulator).

Appendix 1 – Bus specifications

Chassis and Body Manufacturer:	Jiangxi Kama Business Bus Co. Ltd Nanchang, China for Bus and Coach International Pty Ltd
Manufacture date:	2008
Model:	PK6127A
Body Construction:	Steel tubing Fibreglass front and rear header panels Fibreglass roof Zincaneal panels Aluminium lower skirt panelling
Length:	12.5 metres
Width:	2.5 metres
Height:	3.82 metres
Gross Vehicle mass:	21.7 tonnes
Fuel Tank Capacity:	800 litres (Diesel)
Wheelchair Lift Access	Centre, near-side
Toilet	Rear, Drivers side
Engine Make:	Cummins ISM11E5 440
Engine Type:	6 cylinders inline, diesel engine, water cooling, direct injection, turbocharged with intercooler.