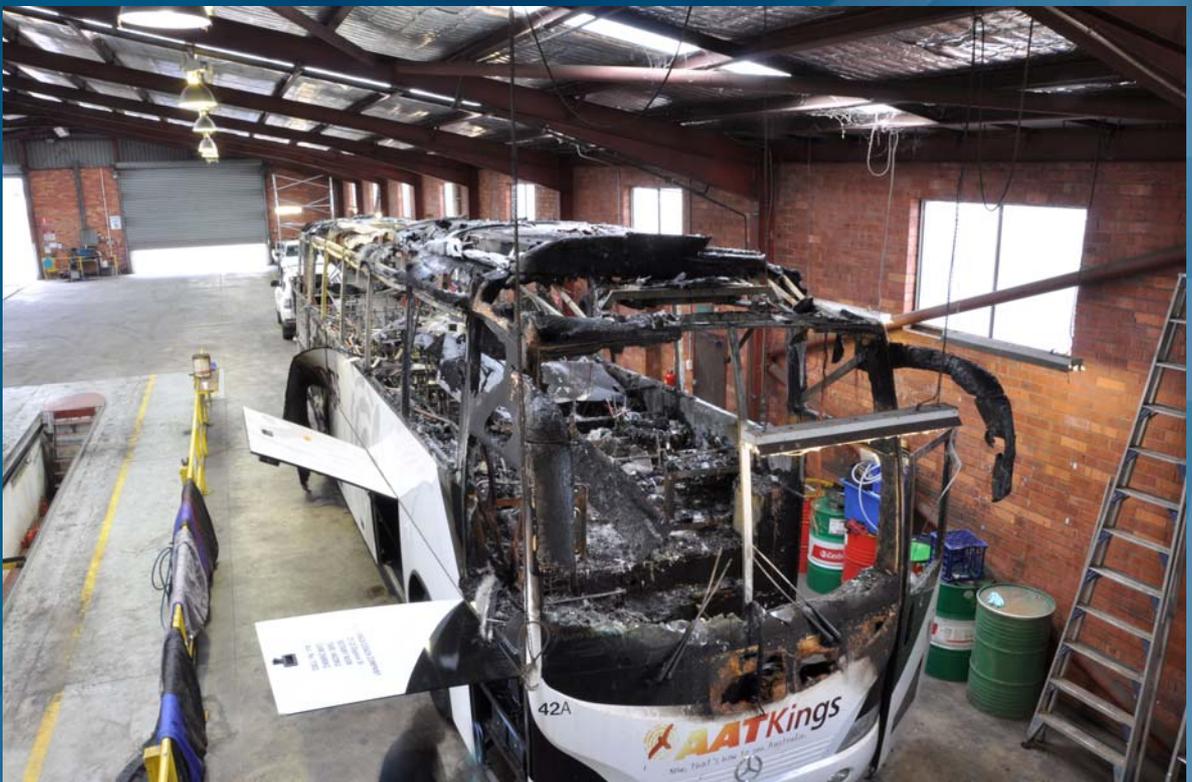




**Office of Transport Safety Investigations**



**OTSI Technical Inspection Findings  
Fire Involving AAT Kings Mercedes Tour Bus  
Gore Hill Freeway, Artarmon  
6 July 2010**

# TECHNICAL INSPECTION FINDINGS

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FIRE INVOLVING AAT KINGS MERCEDES TOUR BUS  
GORE HILL FREEWAY, ARTARMON

6 JULY 2010

*Released under the provisions of  
Section 45C (2) of the Transportation Administration Act 1988*

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# THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

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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.

OTSI's investigations are conducted under powers conferred by the Rail Safety Act 2008 and 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 strives 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**

On the evening of Tuesday 6 July 2010, an AAT Kings tour bus was returning from a day trip with 32 passengers on board when the driver saw what he assumed to be excessive smoke coming from the exhaust behind the bus. He pulled the bus over and checked the rear of the bus, however nothing unusual was noted and the smoke was only apparent while driving.

The driver communicated the problem to his manager, however as the bus appeared to be performing normally other than blowing smoke, it was decided that the priority was to continue the journey for the sake of the passengers. A replacement bus was put on standby in case of a mechanical breakdown.

The driver was able to continue South along the Pacific Highway before turning onto the Gore Hill Freeway at Artarmon. Once on the freeway, at approximately 6.25pm the driver observed an engine shutdown warning light on the dashboard, giving him approximately 20 seconds before the engine would automatically shut down. He pulled the bus over in a breakdown lane and it was at that point that he saw through his side mirror that flames were lapping out from underneath the rear of the bus.

All passengers were safely evacuated from the bus under the direction of the driver and two off duty police officers and moved well clear to the front of the bus while the driver went to the rear to investigate. The fire was concentrated in the engine compartment but rapidly increased in intensity, eventually engulfing the entire bus. After hearing an explosion, the driver moved to safety while he communicated with his base for emergency assistance.

## **Result**

The bus was destroyed by fire and many of the personal belongings of those on board were lost. There were no injuries to any of the passengers, however the driver was conveyed to hospital due to smoke inhalation.

## **OTSI Involvement**

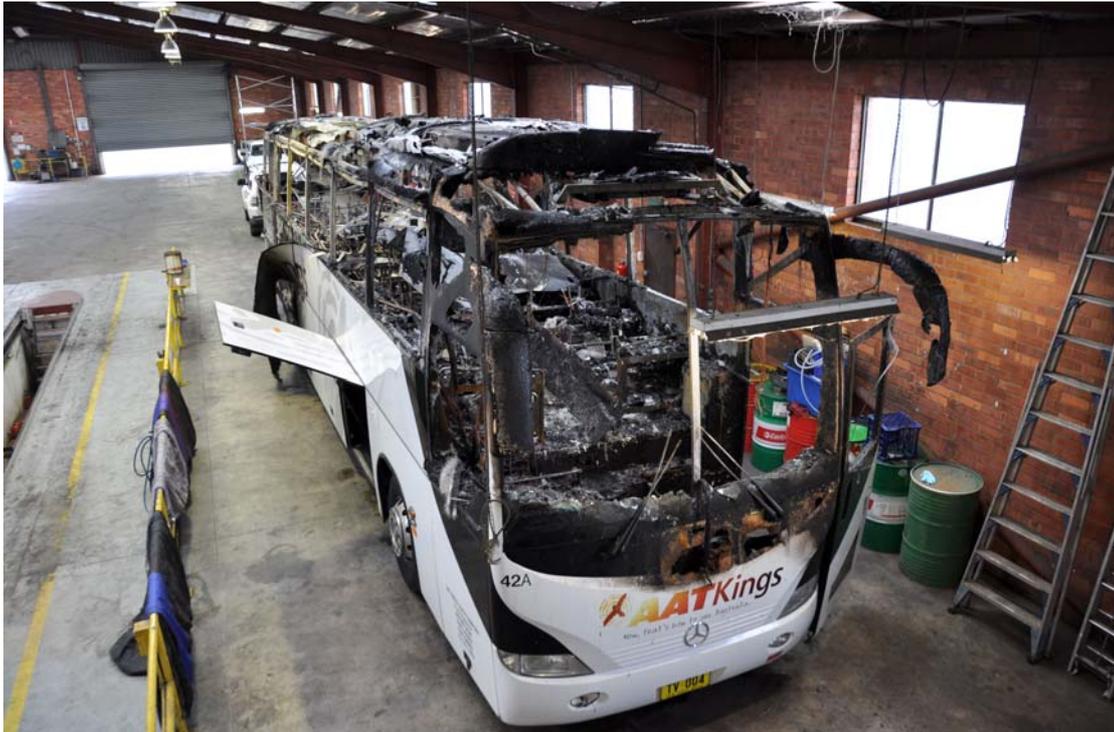
OTSI was notified of the incident through the 24 hour on-call incident reporting system. Since police were in attendance and the bus was to be recovered to its depot in Botany, arrangements were made to inspect the bus at that location the following day.

## **The Bus**

The bus was a five year old Mercedes coach, powered by a six cylinder, turbocharged diesel engine. The bus had travelled approximately 330,000 km since new.

## **Damage**

The bus was destroyed by fire, with only the front driver's side escaping complete incineration. Photographs 1, 2 and 3 depict the level of fire damage to the bus.



**Photograph 1: Top down view of bus from front.**



**Photograph 2: Side view of bus showing least damaged area.**



**Photograph 3: Rear view of bus showing fire damage to engine bay.**

## **Examination**

Based on the driver's account of seeing excessive exhaust smoke leading up to the incident, the examination concentrated on the fuel system of the bus. Due to the fire damage, all soft metal components and rubber fuel hoses were destroyed. Photograph 4 is taken from the driver's side of the engine bay, showing the level of fire damage sustained to the engine.



**Photograph 4. Engine damage caused by fire.**

One component of the fuel system that can lead to excessive smoke emissions is the turbocharger. On inspection of the turbocharger, it was found that the compressor housing had partially melted away. This indicated that extreme and unusual temperatures were encountered by that component of the turbocharger. Photograph 5 is a general shot of the turbocharger, while Photograph 6 shows a close up view of the compressor housing.



**Photograph 5. Turbocharger viewed from left of engine compartment.**



**Photograph 6. Close up of compressor housing, showing molten metal.**

The only way that the compressor housing could have suffered such damaged was through extreme temperatures generated inside the turbocharger. This was clearly the origin of the fire, as no other iron components of the bus had encountered that much heat; in effect, nothing could melt the turbocharger from the outside, and so the fire necessarily originated from a failure within the turbocharger.

The physical evidence together with the driver’s report of excessive smoke and the eventual engine management system shutdown of the engine indicates the cause of the failure within the turbocharger.

The turbocharger is lubricated by engine oil, with seals on the compressor and turbine side of the turbocharger preventing oil from escaping from the body of the turbocharger. If there is a failure of the bearings, seals or other components in this area of the turbocharger, engine oil can be fed into either the exhaust or inlet side of the fuel system.

If engine oil entered the turbine side and then caught fire while the turbocharger was still operational, this would explain the melted turbine housing. The engine management system would have detected when oil pressure was lost as the engine oil being burnt off eventually ran out.

The explosion heard by the driver as the fire developed was most likely due to one of the rear suspension air bags bursting as it burnt.

## **Outcome**

With the source of the fire determined to be the turbocharger, the reasons for its failure could only be determined by inspection of the completely disassembled engine and turbocharger.



**Photograph 7: Close up of one half of the shattered compressor wheel**

The insurer of the bus secured the services of a fire investigator who removed the turbocharger from the bus and dismantled it for inspection. It was found that the compressor wheel had shattered (Photograph 7) which confirmed a catastrophic failure of the turbocharger.

On 12 July 2010, an OTSI investigator examined the dismantled turbocharger unit and found that there was excessive movement in the bearings on the compressor side of the unit. This movement would have allowed lubricating oil to enter the turbocharger compressor housing, where the fire originated. Impact damage evident on the inside surface of the compressor housing showed that the compressor wheel had come into contact due to excessive shaft movement (Photograph 8). This would have generated excessive heat, setting fire to the oil entering the compressor side and leading to the eventual destruction of the compressor wheel.



**Photograph 8: Close up of damage to inside of compressor housing.**

## **Conclusion**

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 s46BA(1) of the *Passenger Transport Act 1990*.

Copies of these Technical Inspection findings have been provided to the NSW Police and AAT King's.