



Office of
Transport Safety
Investigations

BUS

Safety Investigation Report



**Engine Bay Fire
Heatherbrae**

19 September 2019

BUS SAFETY INVESTIGATION REPORT

**Engine Bay Fire
Heatherbrae**

19 September 2019

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THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

OTSI is an independent NSW authority which contributes to the safe operation of bus, ferry and rail passenger and rail freight services in NSW by investigating safety incidents and accidents and transport safety risks, identifying system-wide safety issues and sharing lessons with transport operators, regulators and other stakeholders.

OTSI is empowered under the *Transport Administration Act 1988* to investigate rail, bus, and ferry accidents and incidents in accordance with the provisions of the *Passenger Transport Act 1990* and *Marine Safety Act 1998*. It also conducts rail investigations on behalf of the Australian Transport Safety Bureau under the *Transport Safety Investigation Act 2003* (Cth).

OTSI investigations are independent of regulatory, operator or other external entities. OTSI investigates using a 'no-blame' approach to understand why an occurrence took place and to identify safety factors that are associated with an accident and incident, to make recommendations or highlight actions that transport operators, regulators and government can take to prevent recurrence and improve safety.

Evidence obtained through an OTSI investigation cannot be used in any subsequent criminal or disciplinary action. However, a regulator can undertake its own investigation into an incident OTSI has investigated and coronial inquiries can obtain access to OTSI information.

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OTSI may request additional information from operators or review their investigation reports which may lead to a number of actions, such as the release of a Safety Advisory or Alert to raise industry awareness of safety issues and action.

OTSI investigators normally seek to obtain information cooperatively when conducting an investigation. However, where it is necessary to do so, OTSI investigators may exercise statutory powers to conduct interviews, enter premises and examine and retain physical and documentary evidence.

Publication of the investigation report

OTSI produces a written report on every investigation for the Minister for Transport and Roads, as required under section 46BBA of the *Passenger Transport Act 1990*.

Investigation reports strive to reflect OTSI's balanced approach to the investigation, explaining what happened and why in a fair and unbiased manner. All DIPs will be given the opportunity to comment on the draft investigation report.

The final investigation report will be provided to the Minister for tabling in both Houses of the NSW Parliament in accordance with section 46D of the *Passenger Transport Act 1990*. The Minister is required to table the report within seven days of receiving it.

Following tabling, the report is published on the OTSI website – www.otsi.nsw.gov.au – and information on the safety lessons promoted to relevant stakeholders.

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EXECUTIVE SUMMARY

On Thursday 19 September 2019, Port Stephens Coach TV9793 caught fire on the Pacific Highway near Heatherbrae, north of Newcastle in NSW. At the time, the coach was travelling with the driver and 22 passengers on board. Shortly after noticing smoke coming from the back of the coach in the rear vision mirror, the driver located a safe area off the road and secured the coach. The driver then evacuated the passengers, called for emergency services and unsuccessfully attempted to extinguish the fire with a portable extinguisher.

Fire and Rescue NSW attended the incident site and extinguished the fire. There were no reported injuries to the passengers or driver, however the bus was severely damaged by the fire.

OTSI found that there were two possible initiating sources for the fire; a fuel leak or a high amperage electrical short circuit. It also found that the location of the fire extinguisher in the engine bay made it difficult to access once the fire had started and that an engine bay fire suppression system may have extinguished the fire in its initial stages or reduced the consequences of the fire.

OTSI recommended that the bus operator incorporate ongoing inspection of fuel lines and high amperage electrical circuits into their maintenance regime to reduce the risk of fire and review the placement of fire extinguishers in engine bay areas.

Full details of the Findings and Recommendations of this bus safety investigation are contained in Parts 3 and 4 respectively.

PART 1 FACTUAL INFORMATION

The occurrence

- 1.1 At approximately 1300¹ on Thursday 19 September 2019, coach TV9793 operated by Port Stephens Coaches suffered an engine bay fire. The coach was conducting a rail replacement service for NSW Trains from Casino to Sydney. The driver and 22 passengers were on the coach at the time.



Source: Google, annotated by OTSI

Figure 1: Coach route and incident location

- 1.2 TV9793 was travelling towards Sydney along the Pacific Highway near Heatherbrae north of Newcastle, when the driver noticed smoke in the driver's side rear vision mirror. The driver turned into a side street and pulled to the side of the road (see *Figure 1*). Once the coach was stopped, the driver instructed passengers to disembark and walk to a safe place away from the coach.
- 1.3 The driver exited the coach and walked towards the rear of the vehicle to inspect the smoke. When the driver reached the rear of the coach and looked

¹ Times in this report are in 24-hour clock form in Australian Eastern Standard Time

into the engine bay, he saw flames. Following this, he repeated the instruction for the passengers to evacuate the coach. The remaining passengers disembarked in an orderly manner, moving to a clearing a safe distance from the front of the coach.

- 1.4 The driver and some passengers then began to unload the baggage compartment, located forward of the engine bay and away from the flames. The driver then re-entered the coach and retrieved a portable dry chemical fire extinguisher. The driver took the extinguisher to the rear of the coach where he emptied its contents into the engine bay through a grille in the engine hatch. The driver did not open the engine bay hatch as he feared this would allow more air into the fire.
- 1.5 Once the extinguisher was emptied the driver did not attempt to access the second fire extinguisher, located inside the engine bay, due to its proximity to the fire. The driver then used his mobile phone to call for emergency services assistance. NSW Police arrived at the scene and began to direct passing traffic safely past the burning coach.
- 1.6 Fire and Rescue NSW arrived and extinguished the fire while it was still contained mainly within the engine bay. The coach suffered extensive damage to the engine bay and rear exterior of the coach. The passenger cabin and luggage compartments suffered minor smoke and heat damage.
- 1.7 The second fire extinguisher was destroyed by the fire (see *Figure 2*).



Source: OTSI

Figure 2: Fire damaged engine bay and extinguisher

- 1.8 The driver said that the coach was performing normally up until he noticed the presence of smoke. When the driver turned off the engine, an alarm that was unfamiliar to the driver sounded from the coach's dashboard area. The driver could not recall if the batteries were isolated after shutting the engine down.

Environmental conditions

- 1.9 The afternoon of 19 September 2019 was sunny and dry, with a moderate easterly breeze blowing. The Bureau of Meteorology recorded a temperature of 18.5°C at 1500 hrs at Newcastle's Nobby Head, approximately 16 km from the incident location. OTSI determined that the environmental conditions played no part in the incident.

Driver information

- 1.10 The driver held a valid Transport for NSW (TfNSW) Bus Driver Authority, Heavy Vehicle licence and had approximately eight years of experience driving buses and coaches. The driver joined Port Stephens Coaches in March 2019.

- 1.11 The driver had completed all required company induction and familiarisation training. The driver said that he knew the location of the fire extinguishers fitted to TV9793, but had never operated one previously.

Port Stephens Coaches

- 1.12 Port Stephens Coaches was a family owned and managed bus and coach hire business that has been operating in the Port Stephens area since 1957. The company operated regular timetabled bus and coach routes, school runs and charter services in Port Stephens and the Hunter Valley.

Coach information

- 1.13 The coach was a Volvo B12B, registered in NSW as TV9793, and was fitted with an Autobus body. The coach was manufactured in 2004 and was acquired by Port Stephens Coaches P/L in July 2019. It was authorised to carry 55 seated passengers and was fitted with seat belts. The coach was powered by a six cylinder turbo charged Volvo diesel engine. The odometer read 429,225 km when the incident occurred.
- 1.14 The coach was not fitted with an engine bay fire suppression system² (EBFSS) or a Tyre Monitoring System³ (TMS). These were not required by TfNSW for this type of accredited operation.
- 1.15 Shortly following the arrival of TV9793 at Port Stephens Coaches, company mechanics conducted routine maintenance to prepare the coach for operation. Port Stephens Coaches had recently purchased the coach from an operator in Queensland. Once TV9793 successfully passed a NSW Heavy Vehicle Authorised Inspection on 22 July 2019 it was given NSW registration and placed into service.

² An EBFSS monitors the engine bay for thermal events, and automatically deploys a fire suppressant. The system also automatically activates an alarm on the driver's dash panel.

³ A TMS is designed to monitor tyre pressure, temperature and alert the driver of any faults.

PART 2 ANALYSIS

Introduction

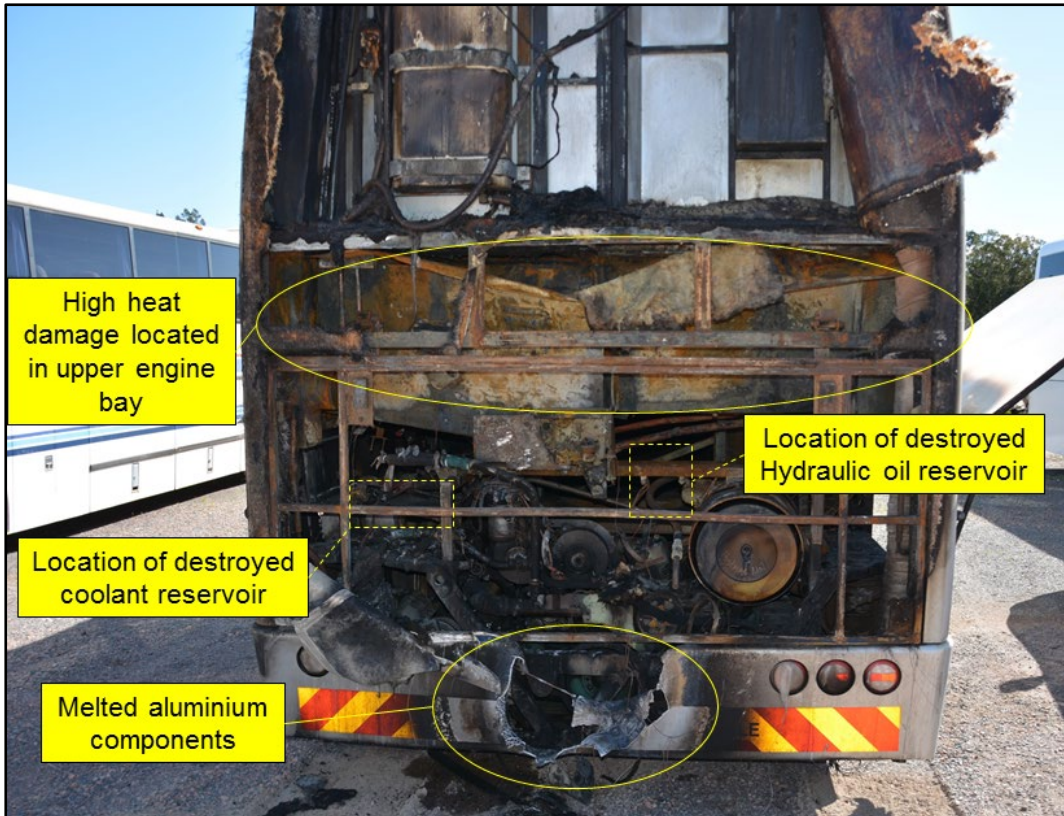
2.1 The investigation focused principally on the factors that contributed to the initiation of the fire, evacuation of passengers, and the condition and maintenance of the bus.

Initiation of the fire

2.2 OTSI inspected the coach after the fire and found that the passenger cabin was relatively undamaged. The cabin suffered minor heat and smoke damage in and around the toilet and rear bulkhead. The fire was extinguished before it breached the integrity of the main passenger cabin.

2.3 Externally, the coach body panels remained undamaged along the sides and front. The body panels in the immediate vicinity of the engine bay were damaged or destroyed by the fire. The aluminium rear engine bay hatch skin was almost totally destroyed, leaving only the hatch frame. The centre section of the rear bumper was heavily damaged, most likely due to burning fluids escaping from the melted plastic hydraulic oil and coolant reservoirs.

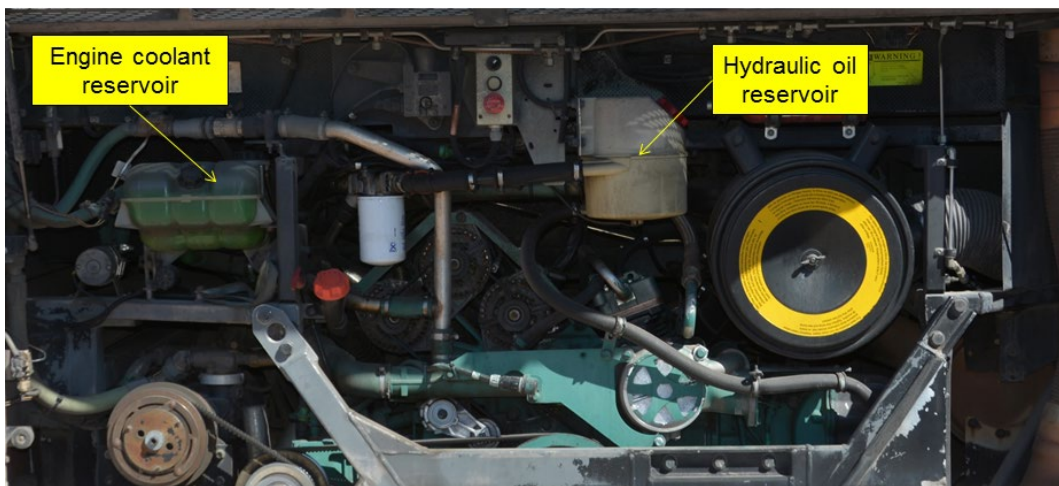
2.4 Inside the engine bay, most electrical wiring insulation, fuel lines and componentry above the engine were heavily damaged or destroyed. Evidence of intense heat was found in the upper side of the engine with far less damage evident in the lower engine bay (*see Figures 3 & 5*).



Source: OTSI

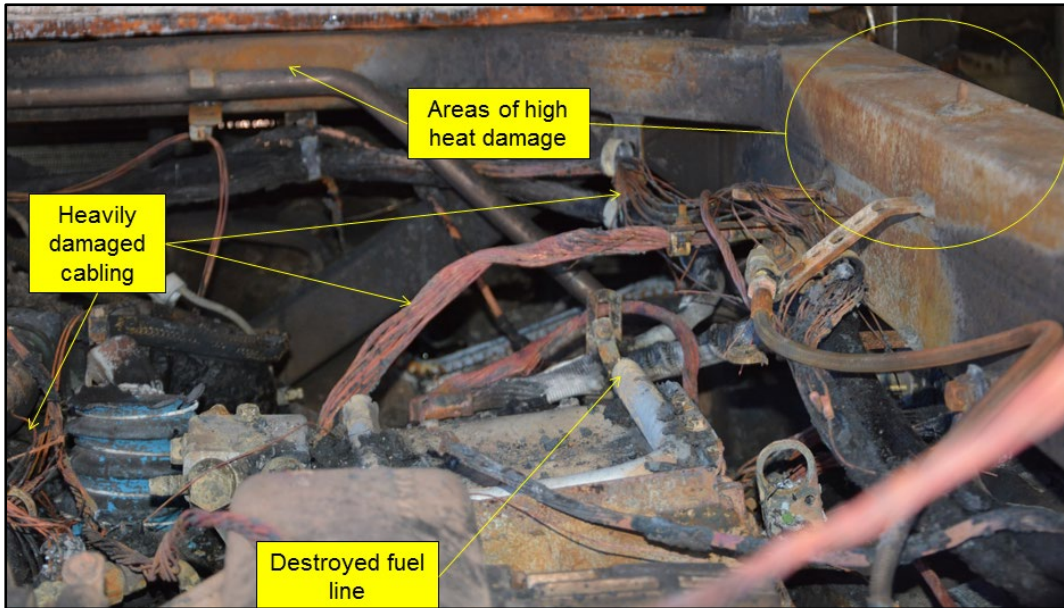
Figure 3: Damaged rear of TV9793

2.5 For comparison, a similar model bus is pictured in *Figure 4*.



Source: OTSI

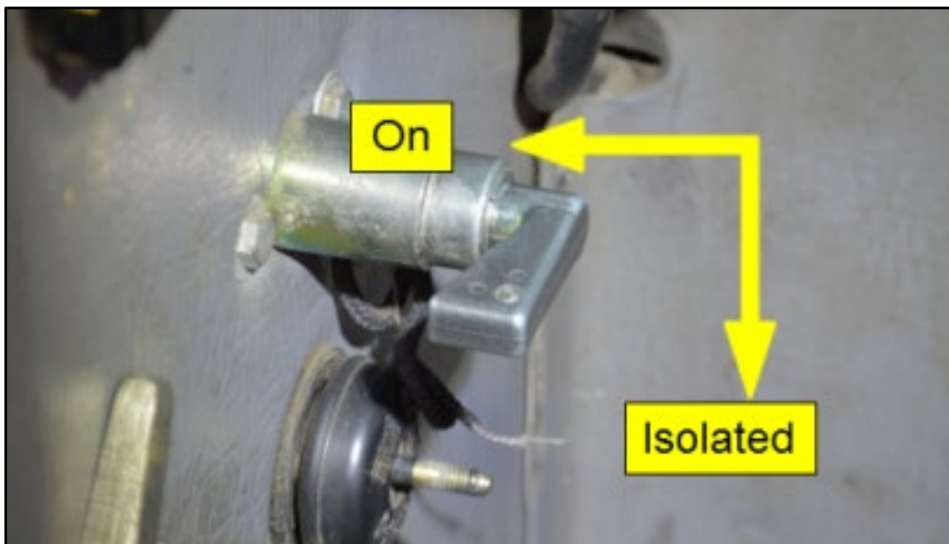
Figure 4: Engine bay of similar model bus



Source: OTSI

Figure 5: Fire damage to upper engine bay

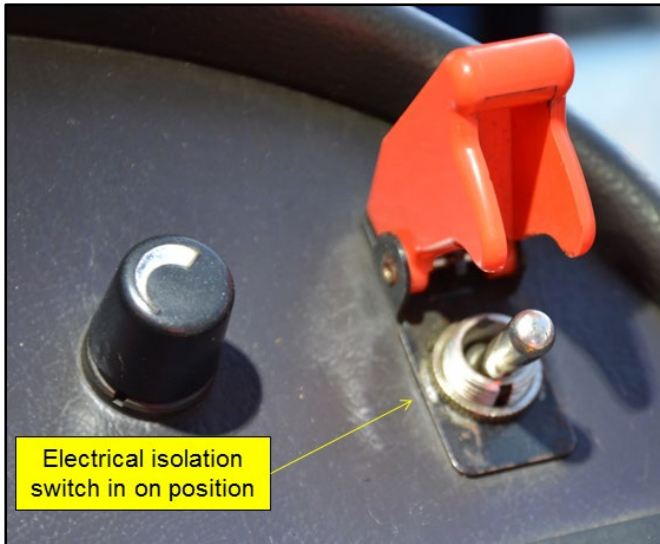
2.6 The electrical and battery isolation switches in the driver's console area were found in the engaged position (see Figures 6 & 7). This created an unfused circuit from the batteries to the starter motor and alternators. Figure 8 shows evidence of electrical arcing of the B positive feed to the alternators due to short circuiting⁴. This cable is part of the unfused circuit.



Source: OTSI

Figure 6: Under console battery isolation switch

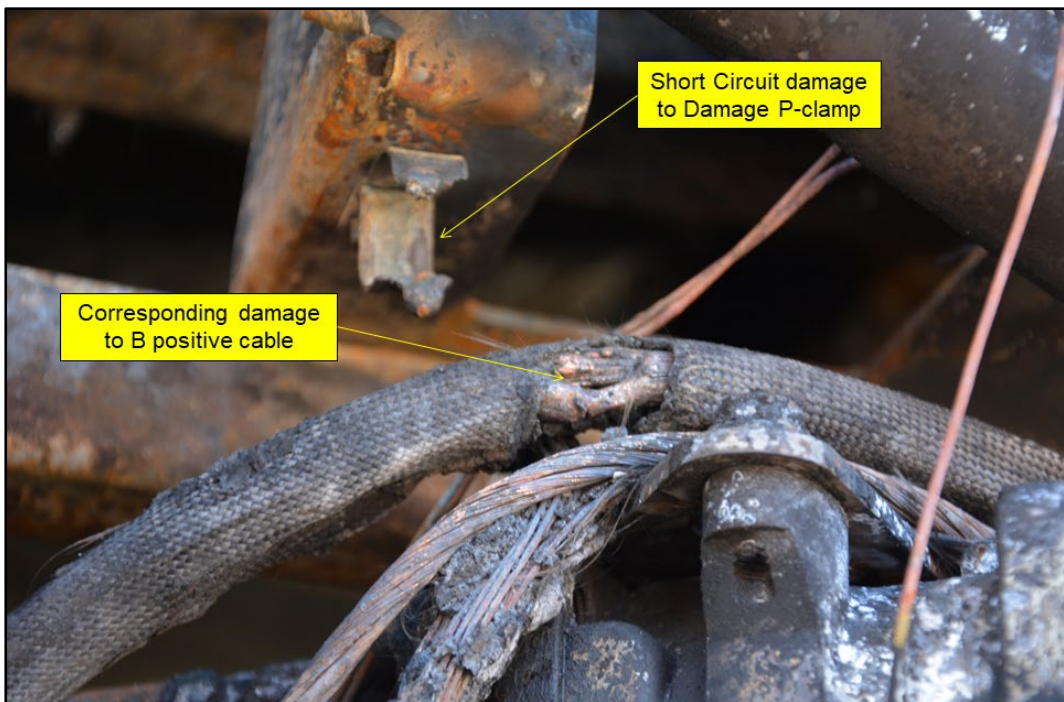
⁴ A short circuit is when there is direct contact between a current carrying conductor and another conductor.' - Kirk's fire investigation (2012) DeHaan. J.D.; Icove.D.J, 7th Ed. p.79.



Source: OTSI

Figure 7: Drivers console isolation switch

- 2.7 Further investigation of the engine bay revealed damaged cabling from electrical arcing due to short circuits (see *Figure 8*). This likely indicates a continuous supply of power to this circuit during the fire.



Source: OTSI

Figure 8: B positive cable damage from short circuit

- 2.8 Photographs taken on the day of the incident show a trail of diesel fuel leading from the rear of the coach along the road (see *Figure 9*). The driver reported that, except for white smoke, the coach operated normally up to and including

when he stopped. This indicates that the fuel leak most likely originated in the return circuit of the fuel system.



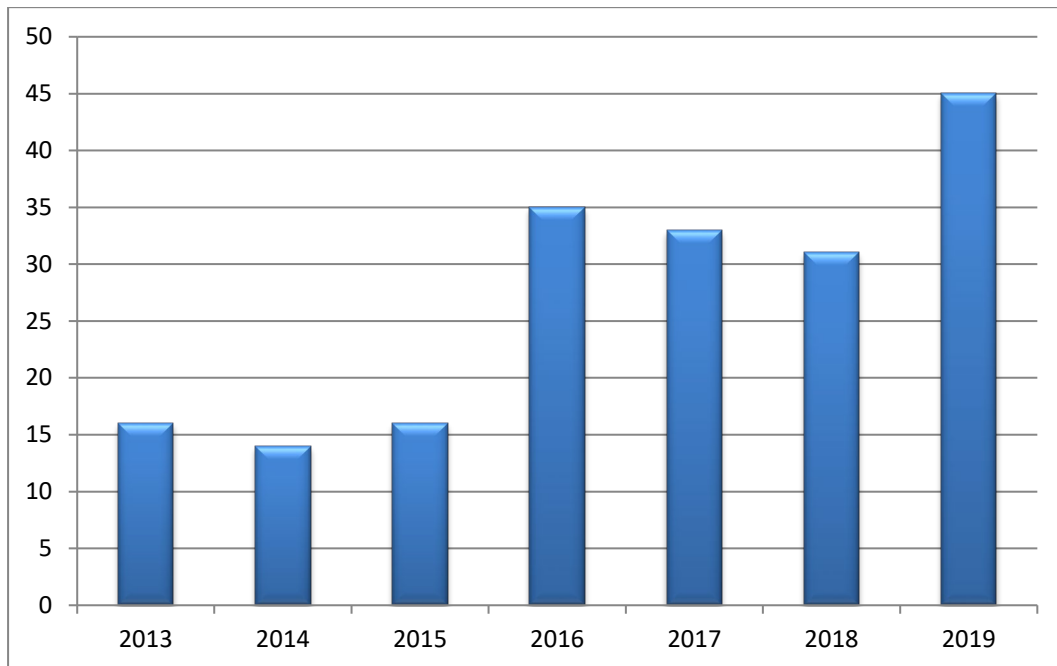
Source: Port Stephens Coaches annotated by OTSI

Figure 9: Diesel fuel leak leading to rear of coach

Location of fire extinguishers

- 2.9 Australian Standard AS 2444-2001 and Australian Design Rule ADR 58/00 set out the number of fire extinguishers required to be fitted to a bus or coach. They also require that extinguishers be located where they are readily accessible, with one to be mounted near the under-floor area or engine. However, in this incident and several other similar bus fire investigations, OTSI found that engine bay mounted extinguishers could not be accessed. This was attributed to a combination of their proximity to and the intensity of the fire.
- 2.10 The 2018 OTSI Bus Fire Summary highlighted instances of fire extinguishers stowed in engine bays being destroyed following fires. The drivers in each case determined it to be unsafe to attempt to open the engine hatch and access the extinguishers.

- 2.11 OTSI made recommendations that consideration be given to position the extinguishers in a readily accessible location in compliance with applicable standards, but not within the confines of the engine bay area.
- 2.12 The number of fires and thermal incidents initiating in the engine bay for the period 2013-2019 is shown below (*Figure 10*).



Source: OTSI

Figure 10: Number of engine bay fire incidents 2013 to 2019

- 2.13 In 2019, 45 incidents (39% of all incidents) originated in the engine bay. This is a significant increase from previous years.⁵
- 2.14 The biggest cause of the engine bay incidents in 2019 was mechanical malfunction (58% of incidents), followed by electrical malfunction (22%) and fluid leakage (13%), and unknown (7%).

Engine bay fire suppression systems

- 2.15 The installation of engine bay fire suppression systems (EBFSS) on buses and coaches offers an effective option for reducing the consequences of an engine fire. Successful operation of such systems may eliminate or at least mitigate risks associated with the use of portable extinguishers. In coaches with only one passenger entry/exit door, such as in this investigation, an EBFSS supplies

⁵ OTSI Bus Safety Investigation Report, *Bus Fires in NSW 2019*, available at www.otsi.nsw.gov.au

an early warning of a fire to the driver to assist in the safe evacuation of passengers. However, TfNSW did not require EBFSS to be fitted on this vehicle under its operational accreditation.

Remedial actions

- 2.16 Port Stephens Coaches has put in place a number of operational changes following this incident. When buses and coaches are first received into the fleet, they now undergo a major service prior to being accepted for operations. This service is carried out regardless of whether the vehicle has a service history from the previous company.
- 2.17 All newly commissioned vehicles are now subjected to a commissioning procedure which must be completed prior to the vehicle entering service. This includes decontamination of the engine bay to remove road grime and oil residue.
- 2.18 An additional 4kg fire extinguisher is now to be carried by buses fitted with a luggage compartment.
- 2.19 All buses in the fleet are to be fitted with an access portal in the engine bay hatches to allow the discharge of a fire extinguisher from outside the engine bay.
- 2.20 All new buses supplied to the fleet are being fitted with EBFSS. The existing fleet is being retrofitted with EBFSS, with priority given to high risk vehicles.

PART 3 FINDINGS

From the evidence available, the following findings are made with respect to the coach fire involving a Volvo B12B, registered in NSW as TV9793, which occurred near Heatherbrae, NSW on 19 September 2019. In this instance, the cause of the fire could not be identified conclusively as the level of damage in the engine bay was extensive.

Contributory factors

3.1 The following are the two likely scenarios that contributed to the initiation of the fire. Firstly, that of diesel fuel escaping under pressure from the fuel return circuit. Fuel leaking from the return line likely contacted heated engine components, vaporising the fuel. Vaporised diesel fuel can appear as white smoke as identified by the driver. Vaporised fuel can ignite when exposed to ignition sources. Secondly, energised cables forming an unfused, high amperage electrical circuit, which short circuited igniting surrounding combustible materials.

Other findings

3.2 The location of the fire extinguisher in the engine bay was difficult to access once the fire had started.

3.3 If installed, an engine bay fire suppression system may have extinguished the fire in its initial stages or reduced the consequences of the fire.

PART 4 RECOMMENDATIONS

It is recommended that the following safety actions be undertaken by the specified responsible entities.

Bus and coach operators

- 4.1 Incorporate into their maintenance regime ongoing inspection of fuel lines and high amperage electrical circuits to reduce the risk of fire.
- 4.2 Review the placement of fire extinguishers within engine bays with a view to extinguishers being readily accessible during emergencies.
- 4.3 Incorporate into their maintenance regime the periodic cleaning of engine bays to reduce any potential build-up of combustible material.

Transport for New South Wales

- 4.4 Consideration be given to the inclusion within TfNSW operational accreditation a requirement to include all buses/coaches be fitted with EBFS.

PART 5 APPENDICES

Appendix 1: Sources and References

Sources of information

- Port Stephens Coaches
- TfNSW

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