MOVING PEOPLE

Industry Advisory

Bus Fire Evacuation Protocol Advisory

Bus Industry Confederation

Bus Fire Evacuation Protocol Advisory

BIC
Bus Industry Confederation
moving people

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Bus Fire Evacuation Protocol Advisory

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Preface

The Bus Industry Confederation (BIC) makes no representation and provides no warranty that the information and recommendations contained in this Industry Advisory (Advisory) are complete or without exception. Reliance or use upon the information or recommendations is voluntary and the user accepts all risks and responsibility for any such reliance or use.
To the maximum extent permitted by law the BIC excludes all liability to any person arising directly or indirectly out of any such reliance or use.

This Advisory makes no endorsement of products or services.

Acknowledgement

This Advisory was developed under a government sponsored project that was overseen by a Working Committee comprised of:

- *Queensland:* John Hatchman, Fleet Engineer - Transport for Brisbane, Brisbane City Council.
- *New South Wales:* Nicole O'Neill, Principal Manager Service Delivery - TfNSW; Dan Leavy, Transport for NSW and NSW Centre for Road Safety - TfNSW; Ian Satchell, Manager Fleet Operations - State Transit Authority NSW
- *Western Australia: Paul Burke, Fleet Manager - Transperth, Regional & School Bus Services, Public Transport Authority of Western Australia.*
- *Victoria:* Shaun Rodenburg, Acting Director- Bus Safety Bus Safety Victoria A branch of Transport Safety Victoria.
- *South Australia:* Alan Castree, Unit Manager Fleet Operations - Department of Planning, Transport and Infrastructure.
- *National:* Michael Apps, Executive Director - Bus Industry Confederation; Luke Hardy, Technical Manager - Bus Industry Confederation.
- *Industry Representative:* Neil Dyson - Managing Director - Dyson Group of Companies.

Special thanks for Luke Hardy, Technical Manager, Bus Industry Confederation, as the author and Madonna Woodhead, National Operations & Marketing Manager, Bus Industry Confederation as the editor of this Advisory.

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IMPORTANT READING

1.1 Executive Summary

This Advisory has been developed as part of a safety project funded by the federal government through the Heavy Vehicle Safety Initiative Funding Agreement, administered by the National Heavy Vehicle Regulator (NHVR). The lead entity in delivering this project is the Bus Industry Confederation (BIC), overseen by a Working Committee and by representatives from the NHVR.

The objective of this Advisory is to assist bus and coach operators in the delivery of tangible improvements in heavy vehicle safety with the adoption of a bus fire evacuation protocol including associated training packages that can be used to train bus drivers on how to reduce the risks associated with bus fires.

1.2 Working Committee

The Working Committee played a vital role in the development of a bus fire evacuation protocol and were required to collaborate on a number of key objectives.

> Develop and agree to the Terms of Reference for the project.

> Monitor the progress of the safety project against the agreed Terms of Reference.

> Oversee the findings of the review on an ongoing basis and provide input into any such findings plus the developed and negotiated recommendations.

> Provide input into the review and support the key technical sub-groups as required.

> Ensure active input from the appropriate stakeholders into the contents and any recommendations in this safety project.

> Review and agree to the final report.

> Agree upon a Working Committee meeting schedule based on the key milestones.

> Develop and agree on the final protocol and training package.

The Working Committee was comprised of experienced professionals in the management of bus fleets and service operations.

> ***Queensland:*** John Hatchman, Fleet Engineer - Transport for Brisbane, Brisbane City Council.

> ***New South Wales:*** Nicole O'Neill, Principal Manager Service Delivery - TfNSW; Dan Leavy, Transport for NSW and NSW Centre for Road Safety - TfNSW; Ian Satchell, Manager Fleet Operations - State Transit Authority NSW

> ***Western Australia:*** Paul Burke, Fleet Manager - Transperth, Regional & School Bus Services, Public Transport Authority of Western Australia.

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> ***National:*** Michael Apps, Executive Director - Bus Industry Confederation; Luke Hardy, Technical Manager - Bus Industry Confederation.

> ***Industry Representative:*** Neil Dyson - Managing Director - Dyson Group of Companies.

1.3 Background to this Advisory

The Australian bus and coach industry is pleased to be involved in the Heavy Vehicle Safety Initiative 2017-18 and the subsequent development of this Bus Fire Evacuation Protocol Advisory and its associated training packages. The BIC sees that the release of this Advisory will improve bus and coach safety for both the driver, passengers, pedestrians and other road users.

Part of the development of this advisory was to:

- review the current emergency response practices used by Australian bus and coach operators particularly in relation to bus fire incidents
- research international experiences regarding fires on buses and coaches focusing on operational emergency response practices including driver training
- review bus and coach fire causation both in Australia and internationally to identify the common causes of bus and coach fires, including where on the vehicles the fires are most likely to occur and how this could affect passenger evacuations
- review bus and coach passenger injuries and fatalities both in Australia and internationally to determine if fires are a major contributor and if so how these occurred including what other factors may need to be considered in any evacuation protocol
- development of a standard operating protocol for emergency response and passenger evacuations
- development of training materials and associated training packages that can be used by all bus and coach operations
- develop a driver emergency response information sheet
- distribute this safety training package to all bus and coach operators via an on-line package.

1.4 Background to the Australian Bus Industry

The Australian bus and coach industry services more than 1.5 billion passenger trips per year.[1] This equates to the bus industry providing 1.5 billion urban public transport passenger trips per year and the coach sector of the industry moving more than 1.6 million domestic travellers per year.[2]

The industry is worth more than $10 billion a year to the Australian economy and employs more than 50,000 people.[3] The value of the bus and coach industry is made up of its economic contribution through the financial benefits of passenger transport, tourism and the Australian bus manufacturing sector.

The total contribution of the bus industry's passenger transport task can be measured in:

- the congestion reductions achieved by bus public transport
- economic growth related to increased mobility and access to opportunity
- savings in the cost of traffic accidents
- reduction in the health-related costs of pollution.

The Bus Industry's passenger task is expected to double by 2050.[4]

There are around 85,000 registered buses in Australia that seat 11 passengers or more and around 42,000 of those buses can be considered as large buses with a gross vehicle mass (GVM) above 4.5 tonne.[5] These buses are operated by more than 3,000 bus companies across the country.[6] Bus services are delivered by a combination of government owned and operated fleets and by private bus companies.

1 Cosgrove, D. 2011, *Long Term Patterns of Australian Public Transport Use*, Australasian Transport Research Forum 2011 Proceedings 28 - 30 September 2011, Adelaide, Australia. Accessed online: https://bitre.gov.au/publications/2011/sp_006.aspx
2 Bus Industry Confederation, 2010, *Bus Industry Survey*, Canberra, Australia.
3 Ibid.
4 Bureau of Infrastructure, Transport and Regional Economics and CSIRO, 2009, *Modelling the Road Transport Sector, Treasury,* Canberra, Australia
5 Hardy, L., Bus Industry Confederation, 2017, *Bus Fleet Statistics Review,* National Technical and Suppliers Summit 28 February 2017, Canberra, Australia.
6 Bus Industry Confederation, 2010, *Bus Industry Survey,* Canberra, Australia.

1.5 Safety in the Australian Bus and Coach Industry

The Australian bus industry provides safe services to the public and this is shown in the following key statistics.

- Between 2000 and 2017 approximately 0.45 per cent of the total road fatalities were suffered by bus and coach passengers in Australia.[7]
- Since 2000 there have been a total of 25,330 road fatalities across Australia and only 436 of these fatalities related to buses and coaches (ie., a bus was involved in some form and the resulting fatality could have been either on the bus, outside the bus, in another vehicle or it involved another party such as a pedestrian or cyclist).
- Only 58 of the 436 fatalities occurred inside the bus and effected either the driver or passenger(s).
- More than one quarter, or 128 of the bus related fatalities were suffered by pedestrians and over 40 per cent were suffered by drivers and passengers in other vehicles or cyclists.[8]
- Considering only the 58 fatalities that occurred inside the bus, the frequency of such fatalities has reduced over time. Figure 1 shows the number of fatalities per year for bus passengers or bus drivers in a single vehicle accident. Figure 1 shows that the numbers have reduced over the period 2000 to 2016. This reduction is significant considering that the total number of buses in Australia has increased by approx. 2.2% per annum over the same period.[9]
- To understand the conditions in which these on-bus fatalities occurred, Figure 2 considers all 58 on-bus fatalities compared to the posted road speed limit at the location of the fatal crash. Figure 2 shows that 55 % of the fatalities occurred on roads where the speed limit was either 90, 100 or higher at 110km per hour.
- Considering the off-bus fatalities for all crashes where a bus was involved in some form over the period 2000 to May 2017, as shown in Figure 3, then 20% of the fatalities were in 90, 100 or higher at 110km per hour speed zones.[10]
- Given the smaller number of bus operations and passenger trips that have occurred in higher speed zones, the 55% and 20% figures are significant and supports the notion that as the speed the bus is travelling increases, the more potential there is for injury for people both on and around the bus.
- No passenger fatalities were recorded due to bus or coach fires, however there has been one driver fatality on a Brisbane City Council bus on 28th October 2016. This incident was due to the actions by a member of the public and not caused by an issue with a bus.
- Given the number of passengers carried in a single bus one major incident can affect fatality statistics significantly. For example, 6 of the 9 fatalities in 2009 occurred in the same crash.

These fatality statistics highlight that although bus and coach travel in Australia is safe, incidents and accidents not related to bus fires do occur, and any emergency evacuation protocol needs to consider these other types of incidents. In addition, due to the relatively high percentage of incidents that have occurred on roads with higher posted speed limits, the evacuation protocol needs to consider the impacts of evacuations on such roads.

Bus travel is safe in Australia, but it only takes one major incident to change this. Any bus fire has the potential to result in a number of either injuries or fatalities if passengers are not evacuated quickly and safely. However incidents and accidents not related to bus fires do occur, and any emergency evacuation protocol needs to consider these other types of incidents.

Importantly, the evacuation protocol also needs to consider the impacts of evacuations on roads with higher speed limits.

7 Bureau of Infrastructure, Transport and Regional Economics, Department of Infrastructure and Regional Development, May 2017. Bus Industry Confederation, 2010, *Bus Industry Survey,* Canberra, Australia. Access online at: https://bitre.gov.au/statistics/safety/fatal_road_crash_database.aspx

8 Bus Industry Confederation, 2010, *Bus Industry Survey,* Canberra, Australia.

9 Hardy, L., Bus Industry Confederation, 2017, *Bus Fleet Age Review,* National Technical and Suppliers Summit 28 February 2017, Canberra, Australia.

10 Bureau of Infrastructure, Transport and Regional Economics Department of Infrastructure and Regional Development, May 2017. *Australian Roads Death Database: Fatalities.* Access online at: https://bitre.gov.au/statistics/safety/fatal_road_crash_database.aspx

Figure 1. Number of fatalities per annum for bus passengers and or the bus driver in single vehicle bus crashes.

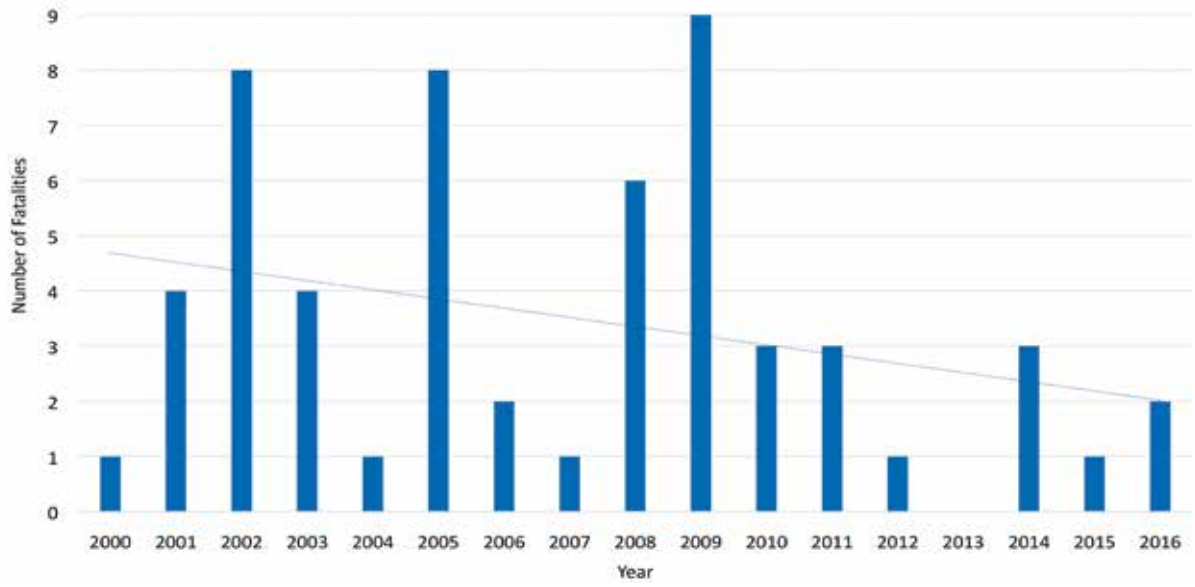


Figure 2. The number of on-bus fatalities compared to the posted road speed limit at location of the fatal crash for the period 2000 to 2016.

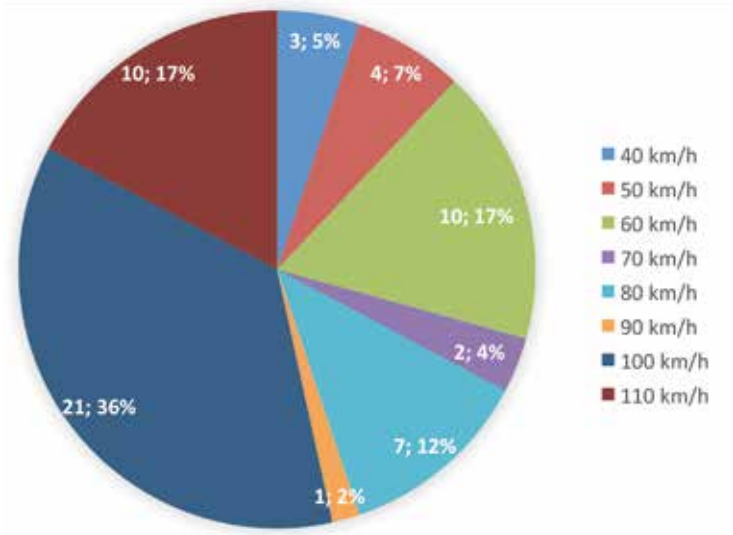
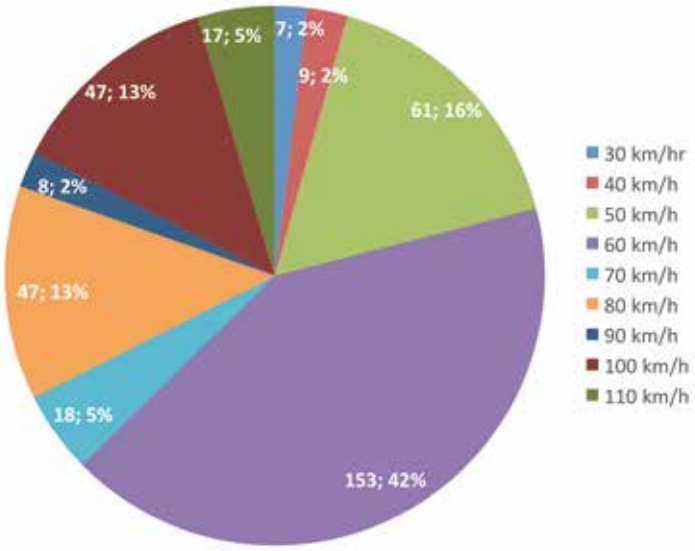


Figure 3. Number of off-bus fatalities where a bus was involved in some form is compared to the posted road speed limit at location for the period 2000 to 2016.



Source: Bureau of Infrastructure, Transport and Regional Economics.

1.6 Safety in the Bus and Coach Industry Internationally

This review of bus safety internationally has been taken from available bus crash data from the United States, Canada and the European Union (EU) with the view to provide an overview of what type of bus accidents are occurring internationally and in what circumstances they are occurring.[11]

Bus Related Fatalities European Union

The rates of bus crashes and associated fatalities in the EU is not dissimilar to the Australian data. As shown in Figure 4, buses accounted for 0.6% of the total EU road fatalities in 2013 and as shown in Figure 5, this statistic has been reducing since 2004.

However unlike Australia, there have been a number of fatalities due to bus fires in the EU.

Bus Related Fatalities Canada and the United States

In Canada and the United States (US), the bus fleets are segregated into three distinct types comprising school buses, urban or transit buses and cross country intercity buses. This latter group, known more generally as Motorcoaches, are the equivalent to the Australian coach or high floor type bus. Therefore, the following reviews the safety records for Motorcoaches in the US and Canada.

In the US in 2014 there were 32,744 fatalities related to motor vehicles and only 283 of these fatalities involved all bus types, or 0.86% of the total fatalities. Specifically, 32 of the 283 bus related fatalities occurred in crashes involving Motorcoaches.[12] Again, this figure, although higher than the Australian and EU figure, is still of a similar order being less than 1% of all road fatalities.

In Canada, a 2016 report into motorcoach safety[13] found there has been a small reduction in motorcoach related fatalities over time. As shown in Figure 6, the number of serious crashes involving Motorcoaches in Canada has reduced but only at a rate of 0.4% annually.[14]

Furthermore, the Canadian report analysed the causes into the serious crashes and found that 80% of the crashes were driver related, specifically the report stated:

> *….Based on the statistical research and reporting, a significant portion of the first contributing factors are driver-related at approximately 80%. Road conditions represent 20% with vehicle condition not factoring as a lead cause in any of the crashes….* [15]

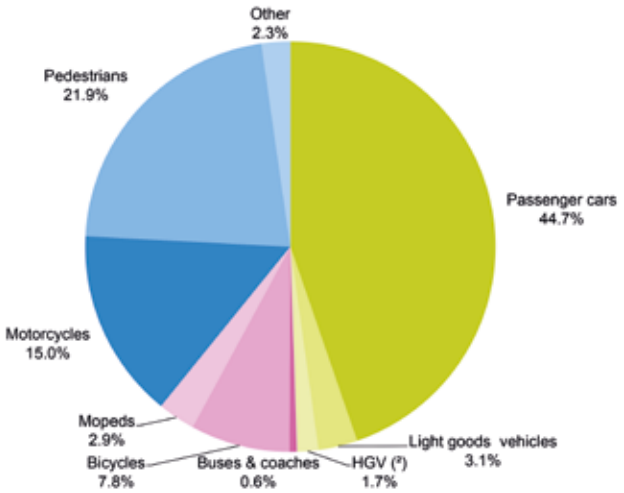
The report then detailed the contributing factors that lead to the crashes and a copy of this is provided in Figure 7. As shown, driving too fast or driver inattention in various forms were the major causes.

This Canadian crash contributing factors data supports other findings in the EU and Australia[16] where the most common cause of heavy vehicle accidents is related to driver error, by either the bus driver or other vehicle drivers (noting that it is generally accepted that driver error rates increase with fatigue[17]).

Given the high rates of accidents due to driver error, any evacuation protocol needs to consider the situation where the driver is either incapacitated, incoherent or injured. In this situation the passengers need to be somewhat self-sufficient and evacuate the bus via their own means.

This supports the US based processes required by the Transportation Federal Motor Carrier Safety Administration that include some level of passenger training and awareness in regard to how to effectively evacuate a bus.

Figure 4. Road accident fatalities by category of vehicles, EU-28, 2013[18] (Note: HGV means Heavy Goods Vehicle).



Source: The European Commission.

11 A bus in the United States and Canada is defined as a motor vehicle designed for carrying 10 or more passengers and used for the transportation of persons and in the EU a bus is a motor vehicle carrying more than 8 passengers and the driver.

12 Federal Motor Carrier Safety Administration, Department of Transport (US), *Large Truck and Bus Crash Facts 2015.* Accessed online: https://www.fmcsa.dot.gov/safety/data-and-statistics/large-truck-and-bus-crash-facts.

13 Ministry of Transport and Infrastructure (British Columbia), 2016, *Motor Coach Safety Review Final Report: A Safety Review of Motor Coach Transportation in British Columbia,* British Columbia. Accessed online: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/reports-and-reference/reports-and-studies/planning-strategy-economy/motor-coach-safety-review.pdf

14 Ibid.

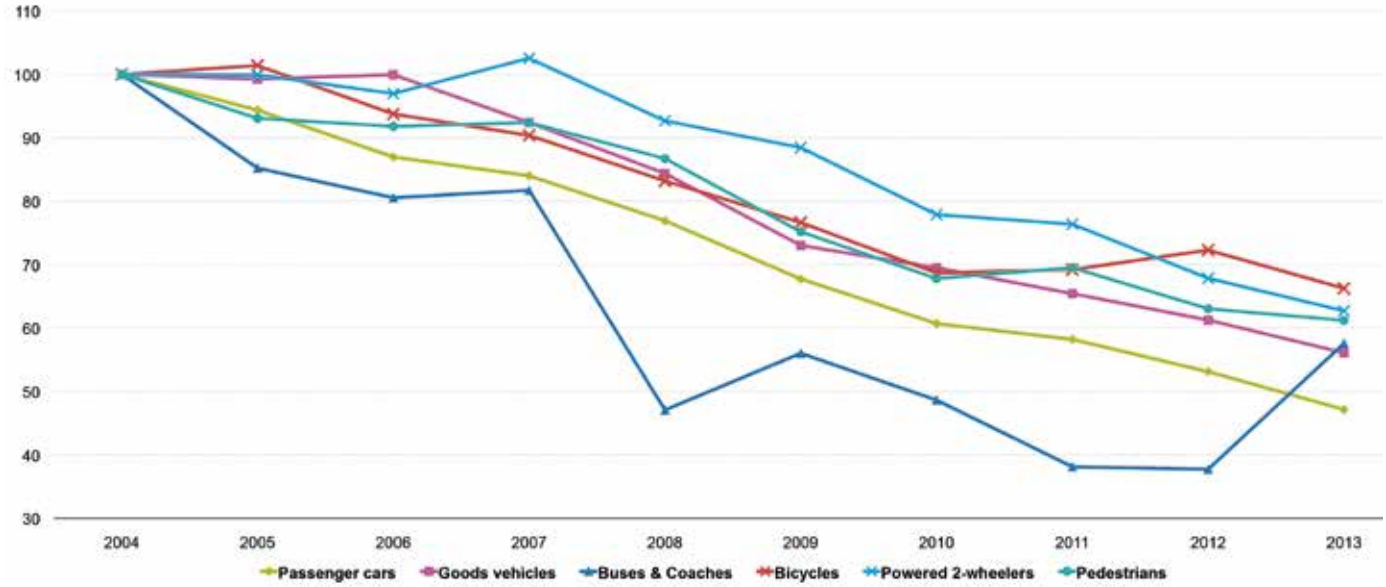
15 Ibid.

16 Centre for Road Safety, Transport for NSW, January 2014, *Heavy Truck Fatal Crash Trends and Single Vehicle Heavy Truck Crash Characteristics.* Accessed online: https://roadsafety.transport.nsw.gov.au/downloads/crashstats2014.pdf

17 Centre for Road Safety, Transport for NSW, *Road Traffic Crashes In New South Wales Statistical Statement For The Year Ended 31 December 2011.* Accessed online: https://roadsafety.transport.nsw.gov.au/downloads/crashstats2012.pdf

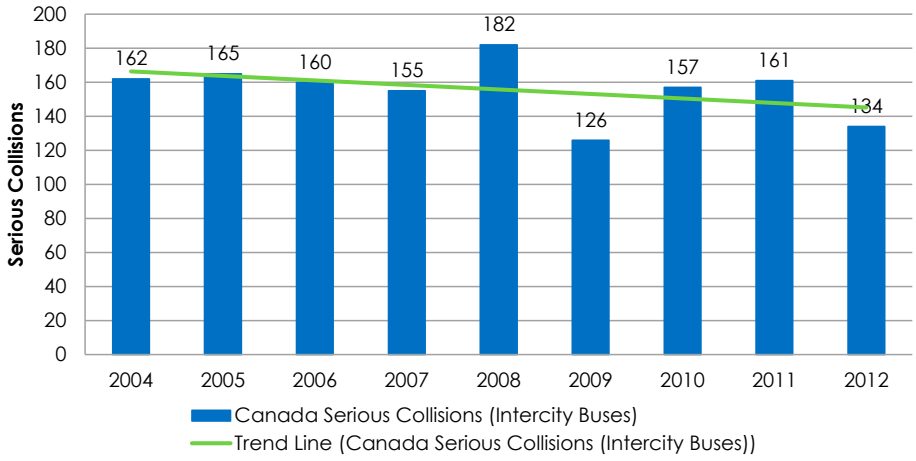
18 The European Commission, *Road Accident Fatalities*. Accessed online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Road_accident_fatalities_-_statistics_by_type_of_vehicle

Figure 5. Evolution of the number of fatalities between 2004 and 2013, index base 100=2004 in the EU[19]



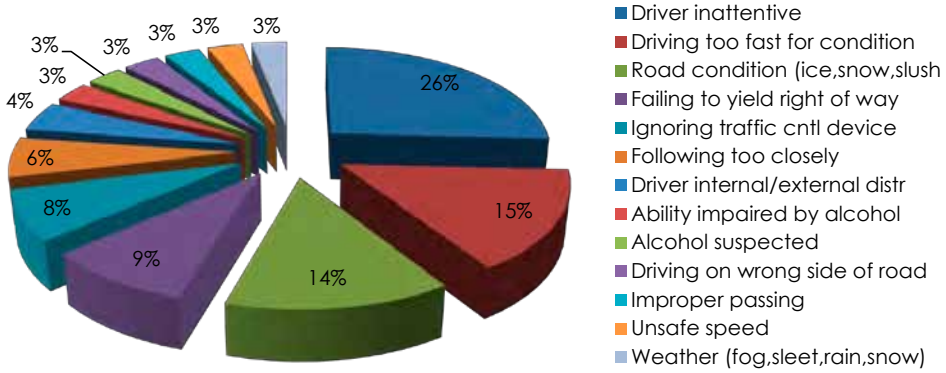
Source: The European Commission.

Figure 6. Serious collisions for intercity buses in Canada



Source: Ministry of Transport and Infrastructure (British Columbia).

Figure 7. First vehicle contributing factors for serious collisions involving intercity buses on British Columbia numbered highways 2003-2015[20]



Source: Ministry of Transport and Infrastructure (British Columbia).

19 The European Commission, *Road Accident Fatalities*. Accessed online:https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Road_accident_fatalities_-_statistics_by_type_of_vehicle

20 Ministry of Transport and Infrastructure (British Columbia), 2016, *Motor Coach Safety Review Final Report: A Safety Review of Motor Coach Transportation in British Columbia*, British Columbia. Accessed online: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/reports-and-reference/reports-and-studies/planning-strategy-economy/motor-coach-safety-review.pdf.

SECTION 2

Bus Fires –

CAUSES

RISKS

AWARENESS

2.1 Frequency of Bus Fires in Australia

Data provided by various representatives from the Australian Insurance Industry determined that:

- there are up to 70 bus fires per year (or more than 1 per week) in Australia in which the bus is either partially or totally destroyed and,
- the projected losses from bus fires for 2012 alone were estimated at $16 Million.[21]

As significant as these figures appear to be, with the increased focus on fires, new figures from industry and the various state authorities indicate that the real number of fires is more likely to be several times this figure.

A review of the NSW Office of Transport Safety Investigations (OTSI) reports shows that the rate of bus fires has actually increased since 2012, OTSI found that:

> *…In 2017 there were a total of 90 reported incidents: 21 fire incidents and 69 thermal incidents. This was an increase in total incidents of 16% from 2016.*
>
> *The growth appears to be a result of a combination of increased reporting by operators and a rise in thermal incidents. There appears to be an increased awareness among bus operators of the importance of reporting incidents…* [22]

Figure 8 taken from this OTSI report, shows a graphical representation of this growth in reported fire and thermal incidents in the years 2013 to 2017.

If we consider the 90 fire and thermal incidents reported to OTSI in NSW involved buses that were in operational service, we can extrapolate this into an indicated national figure for fire and thermal incidents[23] based on fleet size.

Figure 9 shows the total number of operational buses in Australia for buses over 4.5 tonne GVM and up to 26 years of age by State.

As shown in Figure 9, NSW has around 30% of the national bus fleet therefore the assumption could be made that the 90 incidents in NSW could equate to around 260 reported incidents nationally per annum.

OTSI in NSW provides the most accurate and comprehensive bus fire data out of all of the states in Australia. It should be noted however that due to various differences in data definitions and reporting methods adopted in each state, providing a conclusive statistic on bus fires is not feasible.

For example, Victoria publishes summarised bus fire data in their quarterly and yearly statistics report for buses.[24] Figure 10 shows the number of fires on buses in Victoria that occurred in each quarter from 2015 to 2017 and the three-year moving average and for 2017 this equated to around 15 bus fires in total. This Victorian figure is vastly different to the NSW 2017 figures of 21 fire and 69 thermal incidents. Taking into account reporting errors, the fire related incident rate in NSW seems very high, even when considering that there are 12,920 buses in NSW and 8,233 buses in Victoria.

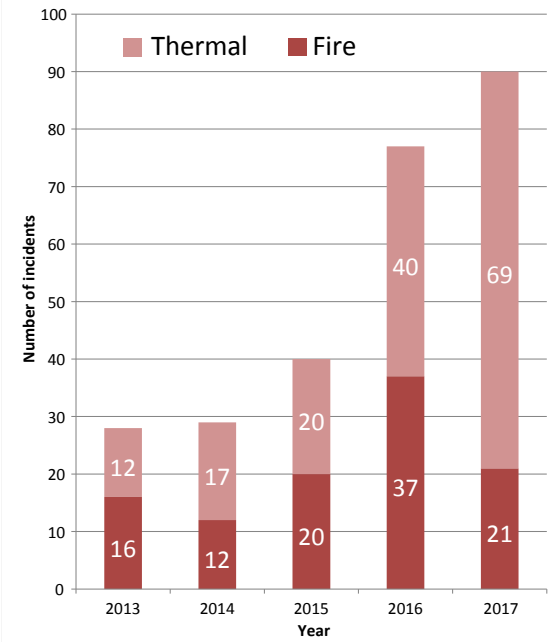
21 Hardy, L, 2013 Collated Insurance Data, Bus Industry Confederation, Canberra, Australia.

22 Office of Transport Safety Investigations, Transport for NSW, 2016, *Bus Safety Report: Bus Fires in New South Wales In 2016*. Accessed online: http://www.otsi.nsw.gov.au/bus/Bus_Fires_Summary_Report%202016_FINAL.pdf

23 OTSI define a Fire incident as Visible fire seen by driver, passengers or witnesses. Fire or flames are mentioned in the report. Flaming combustion has occurred (Rapid oxidation of gases and vapours that generate detectable heat and light.) The level of damage was such that it was likely that an actual fire occurred. Whereas a Thermal incident is No Mention of fire or flames seen by driver, passengers or witnesses. An excessive heat event, possibly accompanied by smoke. A likely precursor to a fire.

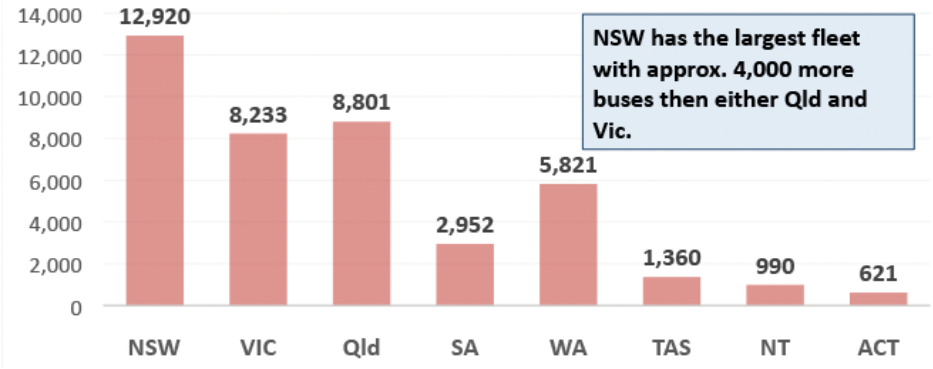
24 Transport Safety Victoria, May 2018, *Quarterly incident statistics for BUS 2017-4th Quarter.* Accessed online: https://transportsafety.vic.gov.au/bus-safety/regulation-and-investigation/investigations/bus-incident-statistics

Figure 8. Fire incidents from 2013 to 2017 for NSW only.



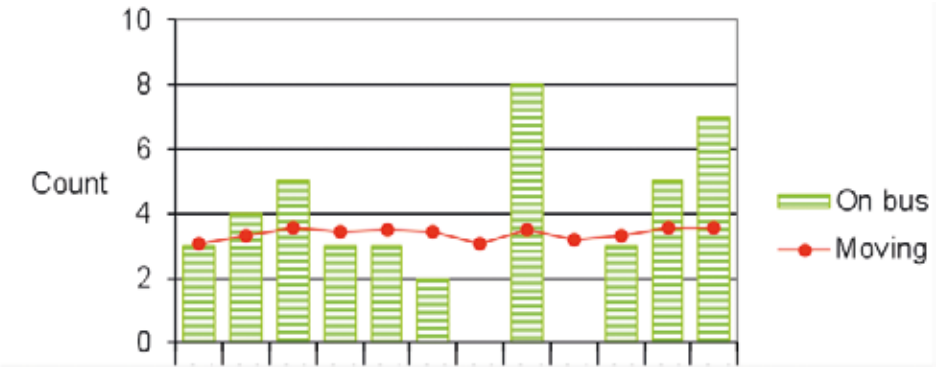
Source: Office of Transport Safety Investigations (NSW)

Figure 9. Total Number of Buses up to 26 Years of Age[25]



Source: Bus Industry Confederation.

Figure 10. Number of fires on buses in Victoria that occurred in each quarter from 2015 to 2017 and the three-year moving average[26]



Source: Transport Safety Victoria.

25 Hardy, L., Bus Industry Confederation, 2017, *Bus Fleet Statistics Review,* National Technical and Suppliers Summit, February 2017, Canberra, Australia.

26 Transport Safety Victoria, May 2018, *Quarterly incident statistics for BUS 2017-4th Quarter.* Accessed online: https://transportsafety.vic.gov.au/bus-safety/regulation-and-investigation/investigations/bus-incident-statistics

2.2 Frequency of Bus Fires Internationally

Early studies of bus fire frequency conducted in the US in 2009 and 2012 found that:

- between 1993 and 2003 there was an average of six bus fires every day[27] and
- between 2003 and 2007 that bus fires occurred 10 times more often than truck fires per vehicles in service.[28]

A Swedish study on bus and coach fires found between 1999 and 2004 there was an average of 49 bus fires were reported in Norway per year and 122 per year in Sweden and that this equated to buses being 5 to 10 times more likely to catch fire than trucks. [29]

A US study conducted by the National Fire Protection Association in 2010, determined that bus fires were a serious and common occurrence, and that a large number of bus fires were not reported, hence the real numbers were much higher.[30]

Despite increased focus and added safety fire protection features, this trend of high rates of bus fires has continued in the US. A 2016 report that provided an update on the bus fire situation stated:

> *…Bus fires remain a serious safety issue in the USA. There appears to be little change in the number of fires even with the availability of fire suppression systems and greater awareness of the problem…*[31]

Due to the acknowledgement that bus fires remain a serious safety issue even with the availability of fire suppression systems, the assumed general practice in the US focuses more on training of drivers and passengers in emergency evacuation procedures so that if a fire does occur, the evacuation process can be made as safe as possible.

2.3 Causes of Bus Fires in Australia

In 2014, the BIC undertook a study of the causes of bus fires in Australia by reviewing various reports from media and data collated by transport authorities and various industry bodies. The BIC first published its findings in an industry advisory titled Fire Mitigation Advisory. [32] The Advisory provided the following primary causes of bus fires.

- The majority of fires are engine compartment type fires. Anecdotal evidence and industry experience suggest that engine bay fires are the most common form of bus fire in Australia.
- The causes of engine compartment fires include mechanical, electrical, fuel fires or coolant, or insulation related fires.
- Tyre fires on the rear axles are not uncommon.
- The driver is often not aware that the bus is on fire. Review of bus fire incidents, shows that the driver was made aware of the fire by passengers, other motorists or passers-by.
- The time for the fire to progress from the engine compartment to the passenger area could be as quick as 3 to 4 minutes (this is comparable with overseas data).[33]

Studies undertaken by the BIC also suggest that in the instance where the driver is unaware of the fire, the fires are more likely to result in a complete burn out of the bus.[34]

OTSI in NSW also reports:[35]

- in 2016 that 77 fire and thermal incidents occurred, and most fire incidents originated in the engine bay at 45% of the total, in the wheel well at 43% of the total and only 10% originated within the body. One fire originated outside the bus, caused by radiant heat from another burning bus, as shown in Figure 11.
- in 2017, there were 90 fire and thermal incidents reported to OTSI, which represented a 16% increase from 2016.
- there was a significant decrease (43%) in fire incidents, from 37 fire incidents in 2016, to 21 fire incidents in 2017. But this may or may not be due to the change in reporting methods that now include thermal incidents.[36]
- the age of the buses involved in these fire incidents and found that the buses involved ranged between 2 and 31 years of age and the majority of incidents involved buses between 5 and 10 years old, and
- this age profile correlated approximately to the number of buses manufactured in each year operating in NSW, as shown in Figure 12.

27 Volpe National Transportation Systems Center and Federal Motor Carrier Safety Administration, 2009, *Motorcoach Fire Safety Analysis*. Accessed online: https://rosap.ntl.bts.gov/view/dot/9463

28 Smyth, S. and Dillon, S., 2012. *Common Causes of Bus Fires, SAE Technical Paper 2012-01-0989.* Accessed online: INSERT URL

29 Hammarstrom, R., et al., SP Technical Research Institutes of Sweden, Department of Fire Technology, 2008, *Bus Fire Safety.*

30 Ahrens, M., National Fire Protection Association, 2010, *U.S. Vehicle Fire Trends and Patterns.* Accessed online: http://tkolb.net/FireReports/US_VehFirTrePat2003-2007.pdf

31 Crescenzo, R A., 2016, *Bus Fires in the United States Update: Passenger and Driver Evacuation Training*, Fourth International Conference on Fire in Vehicles, October 5-6, 2016, Baltimore, US. Accessed online: http://firesinvehicles.com.loopiadns.com/wp-content/uploads/2016/11/Table-of-contents-FIVE-2016.pdf

32 Bus Industry Confederation, 2014, *Fire Mitigation Advisory*, Canberra, Australia.

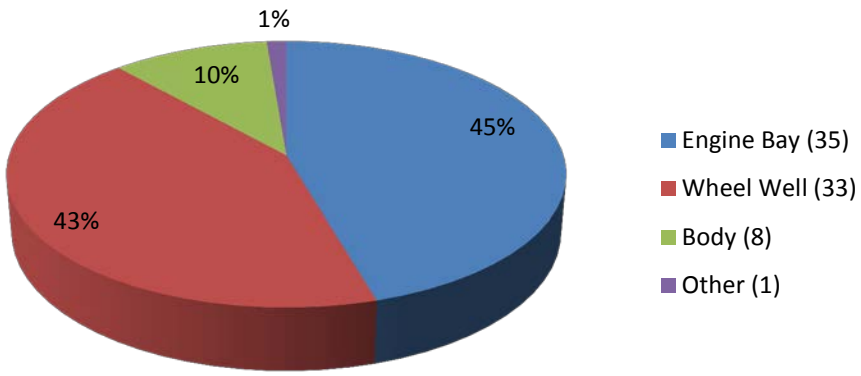
33 Fire progressions times based on a Bus Safety Investigation Report from the Office of Transport Safety Investigations (NSW), 2011. Accessed online: http://www.otsi.nsw.gov.au/bus/120405_Hillsdale_Final_Report.pdf.

34 Bus Industry Confederation, 2014, *Fire Mitigation Advisory,* Canberra, Australia.

35 Office of Transport Safety Investigations, Transport for NSW, 2017. *Bus Safety Report: Bus Fires in New South Wales in 2016.* Accessed online: http://www.otsi.nsw.gov.au/bus/investigations.html

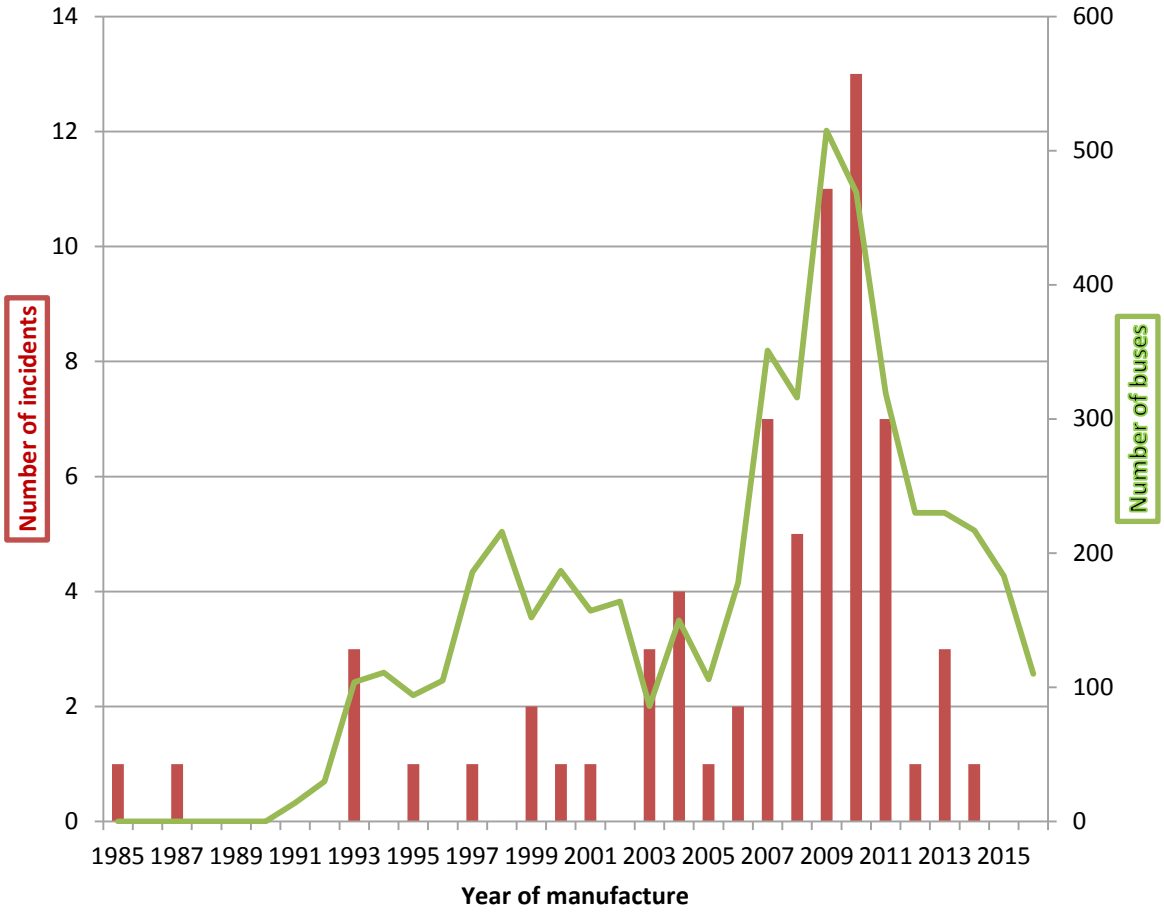
36 OTSI define a Fire incident as Visible fire seen by driver, passengers or witnesses. Fire or flames are mentioned in the report. Flaming combustion has occurred (Rapid oxidation of gases and vapours that generate detectable heat and light.) The level of damage was such that it was likely that an actual fire occurred. Whereas a Thermal incident is No Mention of fire or flames seen by driver, passengers or witnesses. An excessive heat event, possibly accompanied by smoke. A likely precursor to a fire.

Figure 11. Causes of 77 NSW bus fires in 2016[37]



Source: Office of Transport Safety Investigations (NSW).

Figure 12. Year of manufacture and incidents NSW 2016[38]



Source: Office of Transport Safety Investigations (NSW).

37 Office of Transport Safety Investigations, Transport for NSW, 2017. *Bus Safety Report: Bus Fires in New South Wales in 2016.* Accessed online: http://www.otsi.nsw.gov.au/bus/investigations.htm

38 Ibid.

2.4 Specific Bus Components Causing Bus Fires

Combining the data from published overseas studies and hands-on industry review of a number of local bus fires, there are 3 distinct categories under which bus fires generally occur.

1. **Electrical Wiring** – Typically in the engine bay, battery box, or at a high electrical load generator or user such as the Alternator(s) or A/C connection. Also, electrical harnesses appear to be degrading at a higher rate in the later model (post Euro 3) buses that typically have higher engine bay temperatures.
2. **Friction** – Typically at the wheel level and due to tyre failure, wheel bearing failure or excessive brake heat due to brake dragging or disk calliper failures.
3. **Engine Bay Components** – Typically fuel, oil or coolant leaks, exhaust or turbocharger failure, overheated components or combinations thereof.

Each of these bus components are typically external to the passenger compartment and normally there is some period of time before smoke and or fire enters the passenger compartment. However there have been instances where fires initiate within the passenger compartment, these are rare in Australia, but such situations can cause smoke and or flame to directly impact on passengers and or the driver immediately.

The principal areas where a bus fire is likely to occur are in the:

- engine bay (oil, fuel or electrical fire)
- wheel well (due to a tyre failure or dragging brake)
- battery box area (electrical fire).

In these types of fire, typically there is a period of time available to evacuate the bus before fire and smoke enters the passenger compartment.

But fires can also occur inside the bus in locations such as:

- Passenger area (passenger ignited materials within the bus)
- Under dash
- A/C ducting
- Luggage Bin
- Toilet

These internal type fires could generate smoke and or flame in a very short period, or even inhibit evacuation by the front door of a bus.

These issues also need to be considered in any evacuation protocol.

2.5 Risks Associated with Bus Fires

The risk associated with (or the outcome) of a bus fire varies greatly depending on a range of issues, however the main areas of risk can be categorised into 3 areas.

1. **The Passengers and Driver** – A fire event in 2018 in Queensland[39] where accelerant was thrown over a bus driver who subsequently died, only highlights the need for the evacuation protocol to consider all potential fire events.
2. **The Bus** – The degree of damage to the bus. Typically buses that experience engine bay type fires are either severely or totally burnt out. An added risk that now needs to be considered is the effects of alternative fuelled buses such as CNG, hybrid, electric and even hydrogen fuel cells.
3. **The Surrounding Environment** – the effect the fire has on the surroundings. This issue is critical as a bus left burning on a rural highway is a totally different scenario to a bus burning in the middle of a city street or worse case, in a tunnel. Any bus fire in a congested urban environment will at best cause traffic chaos and has potential to cause multiple fatalities.

For a fire evacuation protocol, the key aim must be to evacuate the bus and to transfer the passengers to a safe location, this has to be the primary role of the driver.

The protection of the asset, in this instance the bus, needs to be a secondary concern.

39 McCosker, R. September 7 2018. *"Man who killed Brisbane bus driver 'untreated' and 'unsupported'".* Brisbane Times. Accessed online: https://www.brisbanetimes.com.au/national/queensland/man-who-killed-brisbane-bus-driver-untreated-and-unsupported-20180907-p502d5.html

2.6 Bus Fires in Tunnels

A bus or coach fire in a tunnel is seen as potentially the most devastating of the possible bus or coach fire scenarios. A modelling study undertaken in 2007 by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) on Road Tunnel Fire and Life Safety Issues considered a bus fire in a road tunnel and one of the findings in relation to the bus fires was that:

> *….the people in the immediate upstream section of the fire will not have sufficient time to evacuate and will be at risk of losing their lives. The first 120 m between exits, as shown previously, has about 100 people. Just using this section, one single accident involving a moderate fire will result with an expected death of at least 100 people…*[40]

Bus fires in tunnels do occur and a study undertaken by the Transportation Research Board in Washington, D.C. in 2011, provided data for 26 road tunnel fires that occurred between 2000 and 2010.[41] This data is summarised in Table 1.

The key results show that of the 26 tunnel fire tunnel incidents initiated by a vehicle, 8 of those incidents (or 31%) involved buses. Of those 8 incidents:

- injuries accounted for 25% of total injuries
- fatalities accounted for 62% of total fatalities.

A reasonable assumption for the higher percentage of fatalities related to bus fires in tunnels could be the time required to evacuate the burning bus. A further finding from the study undertaken by the Transportation Research Board suggests that:

> *…[time] is especially important when considering evacuation from a bus. A German study,* Fire Protection in Vehicles and Tunnels for Public Transport[42] *cites 2 min as the maximum period of time acceptable for evacuating a bus. Other studies report that 3 min is the expected time to fully empty a loaded transit bus….*

Evacuating a bus within a tunnel is a high-risk event in that it is highly likely that the passengers and driver will be affected by smoke. Therefore, if a bus does experience a fire situation when travelling within a tunnel, the driver's focus should be to exit the tunnel before stopping and evacuating the bus. This may not always be possible and if not, then the driver needs to consider the locations of emergency exits within the tunnel and locate the bus so that passengers can reach the tunnel emergency exit.

Table 1 – Statistics for recorded Vehicular Tunnel Fires Between 2000 and 2010

Statistic	All Recorded Vehicular Fires in Tunnels between 2000 and 2012	Fires in Tunnels involving buses between 2000 and 2012	Fires in Tunnels no bus involvement between 2000 and 2012	Percentage involving buses
Number of Fire Incidents	26	8	18	31%
Injuries from Fire Incidents	138	34	104	25%
Deaths from Fire Incidents	85	53	32	62%

Source: Transportation Research Board (Washington, D.C.)

40 Yunlong L., et al. 2007, Fire Science and Technology Laboratory, CSIRO, *Road Tunnel Fire and Life Safety Issues, NSW Australia.* Accessed online: http://www.yunlong.com.au/pdf/JFPE_Liu_2007.pdf.

41 Transportation Research Board Washington, D.C. 2011, *National Cooperative Highway Research Program (NCHRP) Synthesis 415: Design Fires in Road Tunnels.* Accessed online: http://www.trb.org/main/blurbs/165793.aspx

42 Verband Deutscher Verkehrsunternehmen (Association of German Transport Companies), 2005. *Fire Protection in Vehicles and Tunnels for Public transport,* Dusseldorf, Germany.

2.7 Driver Awareness Reduces Risk

A common issue stated by drivers is that they were not aware that a bus fire incident was occurring. Drivers are typically told that their bus is on fire by others. The BIC's Fire Mitigation Advisory[43] found that:

> *…of the 31 fire incidents reviewed, in 25 of these incidents the driver was not aware that the bus was on fire. Instead the driver was made aware of the fire by passengers, other motorists or passers-by….*

Or the driver was made aware of the fire by a related alarm, such as low air pressure, or the buses engine losing power or stalling, or passenger seeing smoke entering the passenger compartment.

This is not unexpected given that the majority of bus and coach fires start in the engine compartment, which is well away from the driver's position, at the rear of the bus and outside of the insulated passenger compartment.

In the scenario where the driver is not aware of an engine bay fire, any such fire can typically propagate to the point where the fire can result in a full burn out of the bus. The key issue here is that the passengers need to be evacuated from the bus noting that the time for the fire to progress from the engine compartment to the passenger area could be as quick as 3 to 4 minutes, but more likely that such transfer of fire could take up to 20 minutes in a well-maintained bus that has a well encapsulated engine bay and wheel arches.

Although this issue is addressed on buses that have fire protection systems and or alarms fitted, the driver's initial and immediate reaction to the fire event is key to reducing the risk of passenger and or bystander injury.

Not only does the driver need to stop and secure the bus, they need to quickly assess the severity of the situation, evacuate the passengers in a safe and timely manner, seek emergency assistance and then try to address the fire itself. Noting that this may or may not involve the actual fighting of the fire. In certain instances, the best outcome may be to forget the asset and focus on the safety of the passengers themselves. In other instances, to ensure passenger safety, it may be necessary to fight the fire itself.

The safe evacuation of the passengers will involve the driver assessing the surroundings and determining where the passengers can be evacuated to, for example is the bus on a single lane road with ample space away from the bus, or is the bus on a multilane road and surrounded with moving traffic, or is the bus located in a tunnel?

Therefore, regular and focused training of drivers, operational staff and emergency service providers, is a key part of reducing the risks associated with bus fire incidents.

43 Bus Industry Confederation, 2014, *Fire Mitigation Advisory,* Canberra, Australia

A bus fire emergency evacuation protocol needs to consider that the bus driver may not have any pre-warning that the bus is on fire. The driver may be notified by a passenger or a passer-by, therefore the protocol needs to be as simple as possible so that the driver can make the decisions needed quickly and take decisive action.

2.8 Definite and Potential Bus Fire Risk Indicators

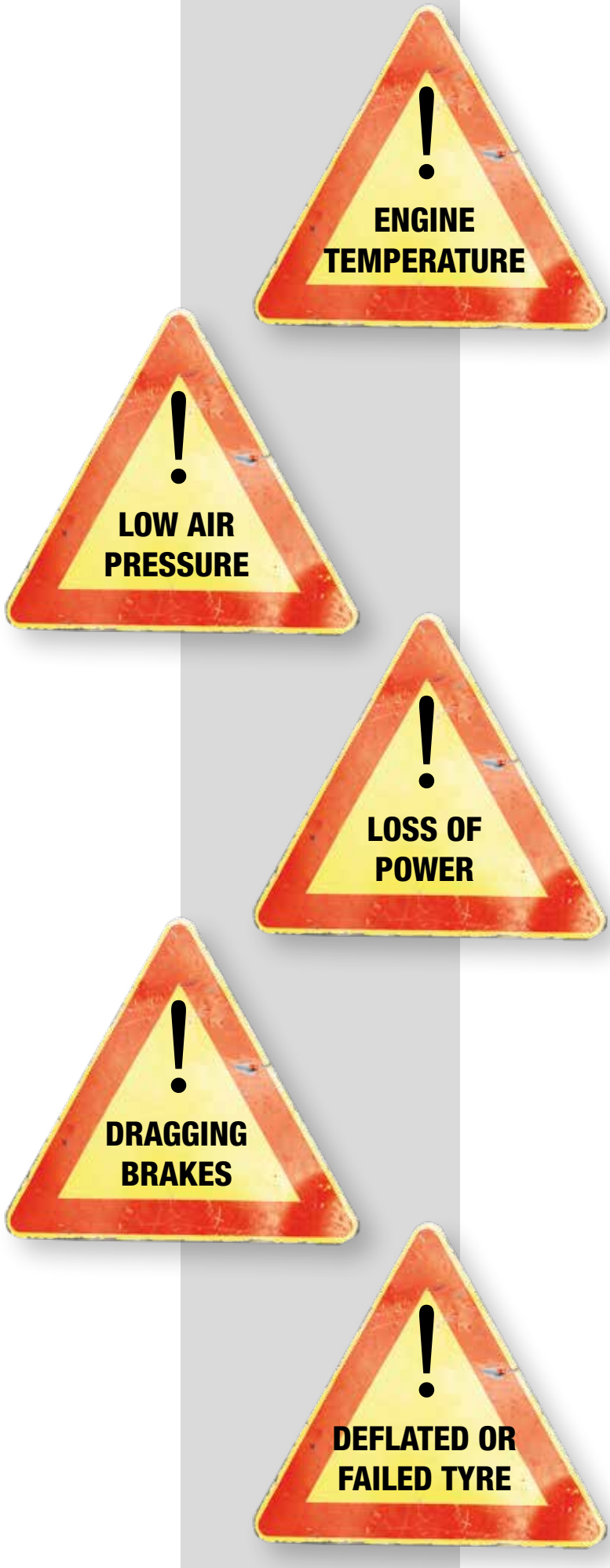
There are 7 definite indicators that a bus is on fire or in imminent danger of catching fire. There are also a range of other scenarios that may or may not indicate that the bus is in danger of catching fire, and in these instances the driver will need to assess the situation and then decide if the bus is to be evacuated. This Advisory refers to these indicators as potential indicators.

The 7 Definite Bus Fire Risk Indicators

1. Any visible open flame.
2. Any form of smoke coming from under, behind or around the bus.
3. Any other indication of possible fire on or under the bus (such as smell).
4. Any visible smoke inside the bus.
5. Any object in flames, or in danger of catching fire, that is close enough to a stationary bus to cause concern.
6. Any combustible material or fuel susceptible to fire that is leaking from a stationary bus or close enough to cause concern.
7. Any fire alarm where the bus is fitted with a fire alarm or fire protection system.

The 5 Potential Bus Fire Risk Indicators

1. The case where alarms have activated such as high engine temperature, low air pressure, this could indicate a major issue within the engine bay.
2. Where the bus loses power, the cause of which could be a straight mechanical issue through to a failure of a fuel line for example, that has a high potential for fire.
3. Where the brakes are dragging, there is a heavy brake smell or there is evidence of excessive brake heat.
4. Where a tyre has deflated or failed.
5. Any other situation such as the bus losing fluid.



SECTION 3

EVACUATION PROTOCOLS

3.1 When to Evacuate the Bus

Evacuation of a bus is a very difficult situation. The bus driver must consider the fact that the safest place for the passengers may be on the bus. In an actual emergency, the decision to evacuate the bus is the initial step and one of the most important that the driver will have to make. That decision will initiate a chain of events to result in the safest possible situation for the passengers under the existing circumstances.

The decision to evacuate the bus must be made as quickly as possible based on all the facts at hand. The bus should be evacuated if there are any indications that the bus is on fire or in danger of catching fire.

It should be noted that there may also be situations where the driver has to move the bus away from a dangerous situation and in such situations the safest place for the passengers, and any passengers that may be outside of the bus is inside the bus that can be driven away. For example, a bus is on fire in a tunnel and the bus travelling behind is able to pick up passengers from the disabled bus and transfer all passengers out of the tunnel and away from danger.

There may also be times where the driver sees or is near another bus that is on fire, in this instance the mobile bus may be useful as a traffic barrier by parking the bus at a safe distance from the disabled bus and have all passengers contained within the mobile bus.

Ultimately the driver needs to react accordingly based upon an assessment of a range of physical indicators of a bus fire and then safe evacuation options. Given the range of possible scenarios, any evacuation protocol needs to be as simple as possible so that the driver can make the decisions needed quickly and take decisive action.

But it should be reinforced that if there is any doubt then the bus must be evacuated, and the passengers moved to as safe a location as possible.

3.2 Where to Stop the Bus for Evacuation

Once the driver decides that the bus must be evacuated, the issue then becomes where the bus should be stopped and how soon it needs to be stopped. Circumstances may dictate that the bus is stopped immediately, or the bus stops itself, but again the driver is in the situation where decisions need to be made quickly and decisively.

The risk profile for a bus that is stopped well off the road and in an area where passengers can easily move away from the bus is totally different to a situation where the bus stalls in the middle of the road and passengers have to traverse a lane or several lanes of traffic.

In these situations, the driver needs to quickly assess a number of factors which is not necessarily limited to the following questions.

1. Can the bus be driven for a period so to access a safe location to stop?
2. Does the bus need to be stopped immediately?
3. Is there sufficient room to stop the bus on the shoulder of the road, away from the traffic lane?
4. Are there any members of the public or public facilities that could be effected (e.g., shops or schools)?
5. Are there corners, bends or intersections that may hide the bus from oncoming traffic?
6. Is there a suitable area where the passengers can disembark and be located away from the bus?
7. Is there room for emergency services to access the bus?
8. If the bus is in a tunnel can it be driven out of the tunnel and to a safe location?
9. If the bus is in a tunnel and cannot be driven, can it be located near a tunnel emergency exit?

Passing traffic is the single greatest risk in terms of passengers being injured, or other vehicles impacting with the stopped bus. Ideally the bus should be located to allow three metres of clearance from passing traffic. If three metres clearance is not possible, the bus should be stopping in a location where approaching vehicles are visible, and the vehicle doesn't encroach onto the roadway, if at all possible.

It is also important to note that national Road Rule 165(c) allows for drivers to stop a bus in an emergency situation as per the National Transport Commission (Road Transport Legislation Australian Road Rules) Regulations 2006[44], which states:

> *It is a defence to the prosecution of a driver for an offence against a provision of this Part if:*
>
> *a. the driver stops at a particular place, or in a particular way, to avoid a collision, and the driver stops for no longer than is necessary to avoid the collision; or*

44 National Transport Commission (Road Transport Legislation — Australian Road Rules) Regulations 2006 No. 13 as amended.

b. *the driver stops at a particular place, or in a particular way, because the driver's vehicle is disabled, and the driver stops for no longer than is necessary for the vehicle to be here the driver is permitted to ark the vehicle under the Australian Road Rules; or*

c. *the driver stops at a particular place, or in a particular way, to deal with a medical or other emergency, or to assist a disabled vehicle, and the driver stops for no longer than is necessary in the circumstances; or*

d. *the driver stops at a particular place, or in a particular way, because the condition of the driver, a passenger, or the driver's vehicle makes it necessary for the driver to stop in the interests of safety, and the driver stops for no longer than is necessary in the circumstances; or*

e. *the driver stops at a particular place, or in a particular way, to comply with another provision of the Australian Road Rules or a provision of another law, and the driver stops longer than is necessary to comply with the other provision.*

Therefore, in an emergency, the driver is able to locate the bus in the best location option without fear of breaking a road or parking rule.

3.3 Development of Evacuation Protocols

The generic format for evacuation protocol documentation is to keep it clear, brief and to the point. The main reason being that drivers are faced with a range of potential situations and an evacuation protocol that attempts to cater for all potential situations will be unworkable.

As such, a set of suggested evacuation protocols have been developed to cover the two main bus types plus two additional protocols that deal specifically with school and special needs children.

The four protocol categories are:

- High Floor buses or coaches
- City buses
- School buses
- Special Needs School buses.

These four protocol categories were selected as they cover common configurations of buses, which are:

- buses or coaches with one door and access steps
- buses with low floors, one access step and
- buses with one or two doors.

The category of school bus was added as it was seen that the process of evacuating children needed specific consideration. As a sub-set of the school bus, a category of special needs school bus was added to highlight the additional considerations needed in this area.

The protocols were based on existing procedures used by the larger government operators in Australia including those in Perth, Adelaide, Sydney and Brisbane and a range of private bus operators in Queensland, NSW and Victoria. The protocols also considered existing procedures obtained from Canada and the US.

Although there is a large range of variables and that any protocol cannot address every specific instance, bus operators need a basis from which they can train their staff. Such training is intended to pre-prepare a bus driver, so they have a basic understanding of what should be done in the event they have to evacuate a bus.

Regardless of the situation, or variables, the basics principals are still the same, such as stopping in a safe location, applying the park brake, opening the doors, making clear announcements, directing passengers to the safest location away from the bus, plus what to do if they have to stop in a tunnel. Attempts to safe the bus should only occur once the passengers are safe.

In the original scope for this safety project, the BIC had proposed that these protocols be physically tested on buses, but what has become obvious is that there are so many variables involved that simple physical testing would not assist in the ratification of the protocol. This position was recently supported by TfNSW who conducted a weeklong series of workshops on bus evacuation protocol and the main outcomes of these workshops were that there is no one right answer and that there are too many variables to put in place one specifically designed protocol, plus that testing or role playing could only assess a specific set of circumstances.

However, there needed to be some form of confirmation that the developed protocols were both practical and useable. Therefore, the protocols were reviewed by all members of the Working Committee including representatives from the large public bus operators from Brisbane, Sydney, Adelaide and Perth. The protocols were also reviewed by the various bus operator associations around Australia, private bus operators and all feedback was considered, and the protocols were adjusted accordingly.

3.4 Implementation of Evacuation Protocols

The extensive work undertaken by in this safety project resulted in the development of four Bus Fire Evacuation Protocols. These protocols are intended to be used by operators as a basis for their own emergency evacuation protocols or procedures. When reviewing these protocols, Operators are encouraged to adapt their own protocols based on their operating conditions, such as:

- type of services provided
- customer base
- bus types.

It is also considered that to get the most benefit from the use of these evacuation protocols, these should form part of a more complete training package that educates drivers and operational staff in all aspects associated with emergency response and evacuation. Some of the other aspects to be considered for driver and staff training include:

- Driver Bus Familiarisation Course – Understanding Dash Warnings and Instruments
- Use of Fire Extinguishers
- Use and function of On-bus Fire Protection systems if fitted.
- Radio Communications
- Pre-Departure Checks with a fire mitigation focus.

Additionally, there is merit in providing passengers with basic information in relation to evacuating a bus in an emergency. A passenger, or group of passengers, that have a basic understanding on how to effectively and safely evacuate would be a great assistance to a driver if the need arises. Therefore, it is also recommended driver and staff training programs also be supported by distribution of information that can educate passengers in emergency procedures.

3.5 Step By Step Evacuation Protocol Guides

This Section provides the templates for implementing a step by step guide for Bus Fire Evacuation Protocols in a bus or coach operation. There are four protocol guidelines based on bus type.

1. High Floor buses or coaches.
2. City buses.
3. School buses.
4. Special Needs School buses.

EVACUATION PROTOCOLS STEP BY STEP

HIGH FLOOR | CITY | SCHOOL | SPECIAL NEEDS

12-Step Evacuation Protocol for High Floor Bus or Coach

The following is a 12-step guide that provides a starting point for drivers to learn and practice bus evacuations. The time to practice evacuating a bus is long before a fire happens. The same holds true for a fire suppression system or fire extinguisher.

The time to learn to use this protocol is before the event when drivers have time to think about and integrate the learning process.

1. Pull over as quickly and safely as possible.
2. If possible avoid stopping in tunnels, interchanges, bus stations, outside service stations, schools, hospitals, congested areas or in the middle of an intersection.
3. If the fire is getting out of control, you will have to pull over immediately.
4. If you have to stop in a tunnel, try to stop before one of the emergency exit doors. This is so your passengers will not have to walk past the burning part of the bus to exit the tunnel.
5. Once stopped, apply the park brake, put the bus in neutral, and turn on your hazard lights, open the passenger doors and turn off the ignition and or battery isolated switch and activate any fuel isolation system if fitted.
6. Make an announcement over the intercom system and/or by standing up and in a loud voice telling the group there is a problem and they need to:

> EXIT THE BUS VIA THE FRONT DOOR AS QUICKLY AS POSSIBLE....LEAVE ALL LUGGAGE....ASSIST ANYONE AROUND YOU.
>
> If the front door exit is blocked: THERE ARE EMERGENCY EXIT WINDOWS ON EITHER SIDE OF THE BUS...LIFT THE HAMMERS OUT AND SMASH THE GLASS, PUSH OUT THE BROKEN GLASS AND EXIT THE BUS, HELP OTHERS...LEAVE ALL LUGGAGE.

7. Drivers should assist with the evacuation by not being in the doorway but either assist passengers (from the driver's area) or at the base of the door step(s) assisting and directing passengers to the safest spot to gather (preferably 200 m away from the bus).
8. If passengers are attempting to exit via the emergency windows, anyone outside of the bus who is able should be asked to help those using the emergency window exits. (The driver should be trained in how the height of the bus and weight of the windows may be difficult to manage and practice using the windows). The driver should ask for passenger(s) assistance with the evacuation via emergency windows.
9. The driver should assist every passenger out of the bus to the best of their ability and not exit the bus until the evacuation is complete (within reason of the circumstances).
10. The driver should continue to make the announcement as noted in point 6 throughout the evacuation because people in the back, people sleeping, hard of hearing or disabled may not recognise the danger.
11. If there are disabled passengers, generally there is not time to use the lift so "lift and carry" may be an option if you engage other passengers. (Drivers should have some training on the best methods of "lift and carry" if there is a lift door on the bus and it is operable, the driver should open it as soon as possible because it provides another means of escape).
12. Move passengers away from the bus to the safest available location, contact the bus depot and or emergency services.

> ONLY ONCE THE PASSENGERS ARE SAFELY AWAY, AND IT IS SAFE TO DO SO, SHOULD YOU TRY TO EXTINGUISH THE FIRE, BUT NEVER OPEN ANY HATCHES TO ACCESS THE FIRE EFFECTED AREA.

12-Step Evacuation Protocol for City Bus

The following is a 12-step guide that provides a starting point for drivers to learn and practice bus evacuations. The time to practice evacuating a bus is long before a fire happens. The same holds true for a fire suppression system or fire extinguisher.

The time to learn to use this protocol is before the event when drivers have time to think about and integrate the learning process.

1. Pull over as quickly and safely as possible.
2. If possible avoid stopping in tunnels, interchanges, bus stations, outside service stations, schools, hospitals, congested areas or in the middle of an intersection.
3. If the fire is getting out of control, you will have to pull over immediately.
4. If you have to stop in a tunnel, try to stop before one of the emergency exit doors. This is so your passengers will not have to walk past the burning part of the bus to exit the tunnel.
5. Once stopped, apply the park brake, put the bus in neutral, and turn on your hazard lights, open the passenger doors and turn off the ignition and or battery isolated switch and activate any fuel isolation system if fitted.
6. Make an announcement over the intercom system and/or by standing up and in a loud voice telling the group there is a problem and they need to:

> EXIT THE BUS VIA THE FRONT AND (if fitted) REAR DOORS AS QUICKLY AS POSSIBLE ASSIST ANYONE AROUND YOU.
>
> If the door or doors are blocked: THERE ARE EMERGENCY EXIT WINDOWS ON EITHER SIDE OF THE BUS...LIFT THE HAMMERS OUT AND SMASH THE GLASS, PUSH OUT THE BROKEN GLASS AND EXIT THE BUS, HELP OTHERS....

7. Drivers should assist with the evacuation by from the driver's area and direct passengers to the safest spot to gather (preferably 200 m away from the bus).
8. If passengers are attempting to exit via the emergency windows, anyone outside of the bus who is able should be asked to help those using the emergency window exits. (The driver should be trained in how the height of the bus and weight of the windows may be difficult to manage and practice using the windows). The driver should ask for passenger(s) assistance with the evacuation via emergency windows.
9. The driver should assist every passenger out of the bus to the best of their ability and not exit the bus until the evacuation is complete (within reason of the circumstances).
10. The driver should continue to make the announcement as noted in point 5 throughout the evacuation because people in the back, hard of hearing or disabled may not recognise the danger.
11. If there are disabled passengers, generally there is not time to use the lift so "lift and carry" may be an option if you engage other passengers. (Drivers should have some training on the best methods of "lift and carry" if there is a lift door on the bus and it is operable, the driver should open it as soon as possible because it provides another means of escape).
12. Move passengers away from the bus to the safest available location, contact the bus depot and or emergency services.

> ONLY ONCE THE PASSENGERS ARE SAFELY AWAY, AND IT IS SAFE TO DO SO, SHOULD YOU TRY TO EXTINGUISH THE FIRE, BUT NEVER OPEN ANY HATCHES TO ACCESS THE FIRE EFFECTED AREA.

10-Step Evacuation Protocol for School Bus

The following is a 10-step guide that provides a starting point for drivers to learn and practice for controlled front door school bus evacuations. The time to practice evacuating a bus is long before a fire happens. The same holds true for fire suppression systems or fire extinguisher.

The time to learn to use this protocol is before the event when drivers have time to think about and integrate the learning process.

As this process is based on evacuating a bus full of school children, the process involves the driver taking formal control of the evacuation process.

1. Pull over as quickly and safely as possible.
2. If possible avoid stopping in tunnels, interchanges, bus stations, outside service stations, schools, hospitals, congested areas or in the middle of an intersection.
3. If the fire is getting out of control, you will have to pull over immediately.
4. If you have to stop in a tunnel, try to stop before one of the emergency exit doors. This is so your passengers will not have to walk past the burning part of the bus to exit the tunnel.
5. Once stopped, apply the park brake, put the bus in neutral, and turn on your hazard lights, open the passenger doors and turn off the ignition and or battery isolated switch.
6. Stand and face the students. Give the following command:

> REMAIN SEATED. THIS IS AN EMERGENCY FRONT DOOR EVACUATION. AS STUDENTS LEAVE THE BUS, THEY ARE TO PROCEED IN AN ORDERLY MANNER BEHIND THE LINE LEADER STUDENT TO A DISTANCE OF AT LEAST 200 METRES FROM THE SIDE OF THE SCHOOL BUS. LEAVE ALL BAGS BEHIND.

7. Move backwards to the first occupied seat and starting with either the left or the right seat:
    - Touch the shoulder of the student nearest to the aisle, tell the student they are the line leader and point to the outside area where the student needs to walk to, indicate that the student in that seat is to move off.
    - Keep the students in the seat opposite in their seat by holding the hand palm out in a restraining gesture until the aisle is clear.
    - Move out the students in the opposite seat, using the same signal as above.
    - Move backwards down the aisle, repeating this procedure at each seat until the bus is empty.
    - Check the bus from the very back seat to the front, making sure it is empty.
8. The driver should remain claim and provide clear directions to students and repeat the direction:

> DON'T RUN, FOLLOW THE LINE LEADER AND LEAVE ALL BAGS BEHIND.

9. If there are disabled students, generally there is not time to use the lift so "lift and carry" may be an option if you engage other students to assist. (Drivers should have some training on the best methods of "lift and carry" if there is a lift door on the bus and it is operable, the driver should open it as soon as possible because it provides another means of escape).
10. Move students away from the bus to the safest available location, contact the bus depot and or emergency services.

> ONLY ONCE THE PASSENGERS ARE SAFELY AWAY, AND IT IS SAFE TO DO SO, SHOULD YOU TRY TO EXTINGUISH THE FIRE, BUT NEVER OPEN ANY HATCHES TO ACCESS THE FIRE EFFECTED AREA.

Evacuation Protocol for Special Needs School Bus

There is no doubt that any school bus evacuation can be traumatic. Drivers must rely on their training and knowledge of what action to take during a crisis. The key is to stay calm and focused. Don't let the fear of the evacuation distract you.

Concentrate on the task at hand and not on the negative consequences of the evacuation. Be prepared.

Do your pre-trip inspections. Know your students' disabilities. Commit to memory the seating locations of the students as well as the location of each exit in case visibility becomes an issue during an evacuation. Know the order in which you may have to evacuate the students from your bus.

Concentrate on the task at hand and not on the negative consequences of the evacuation.

FOCUS AREAS FOR SPECIAL NEEDS EVACUATION	
Student Information	Know your students- physical ability, cognitive, medical, behavioural, communication, equipment. Some students are physically disabled, other students are mentally challenged. Learn everything you can about your students so that during an evacuation you can make decisions that will minimize risks to these students.
Health Concerns	Physical condition of student – Which students can assist, who needs assistance exiting.
Behavioural	Student fears, crying, refuses to leave bus, run away, will they hide under seats.
Exit Preparation	Be prepared to exit from primary exit points; front, rear or side doors of bus. Pre-determine the order students would leave the bus, if an incident occurred.
Wheelchair Students	Is lift operational? Is there time to use? Priority for removal? Heaviest? Lift not working? Remove non-ambulatory students from chairs; small students may be lifted and carried, and heavier students dragged to nearest exit.
Disabilities of Students	Students as helpers - Some of your students can act as helpers and some of your non-ambulatory students can assist themselves during an evacuation.
Location of Exits and Seats	Response time is critical to the outcome of an evacuation. The driver must know the location of each exit as well as the seating locations of the students. For example, when smoke limits visibility, the driver must have these locations committed to memory.
Order of Evacuation	The order in which you evacuate students is an important consideration. • Ambulatory Students - It's quicker and easier to first evacuate ambulatory students. • Wheelchair students - Next evacuate your wheelchair students. **PLEASE NOTE:** IF YOUR AMBULATORY STUDENTS HAVE BEHAVIOURAL DISORDERS, DO NOT EVACUATE THEM FIRST UNLESS THEY ARE ACCOMPANIED BY AN AIDE OR A DRIVER.

SECTION 4

PRACTICAL TOOLS AND GUIDES

www.ozebus.com.au/bus-fire-evac

4.1 Protocol Templates and Training your Drivers and Staff

This Section provides practical hands-on templates for Operators to assist in the development of evacuation protocols and required training plans to address all of the recommendations provided in this Advisory.

These templates, have been sourced from both government and private industry operators and are available on the BIC web site OzeBus (ozebus.com.au/bus-fire-evac) as downloadable Microsoft Word documents.

Document 1 (Appendix 1)	In Bus Emergency Response Procedure Sample adapted from Brisbane City Council protocols. This template is a generic example of a one-page sheet accessible to the driver as a reminder of what to do in an emergency.
Document 2 (Appendix 2)	Vehicle Emergency Evacuation Procedures provided by Crown Coaches. This template is a more detailed example of a double-sided sheet to be accessible to the driver that details the emergency evacuation procedures.
Document 3 (Appendix 3)	Evacuation of Accessible Passengers provided by Crown Coaches. This template is a more detailed example of a training document accessible to the driver that details the emergency evacuation procedures to be used when evacuating passengers that may need to be physically carried from the bus.
Document 4 (Appendix 4)	On Road Emergency Procedure provided by the Dyson Group of Companies. This template is a more detailed example of a double-sided sheet to be accessible to the driver that details the emergency evacuation procedures.
Document 5 (Appendix 5)	Bus Fire and Evacuation Procedure Refresher Handout provided by Brisbane City Council. This template a handout aimed at providing refresher training for drivers in fire and evacuation procedures.
Document 6 (Appendix 6)	Generic Driver Pre-Departure and Operational Check Sheet designed by the Bus Industry Confederation in consultation with bus and coach industry representatives when developing an industry advisory on fire mitigation in 2014. This template provides a list of the items that a driver should check before departure so as to mitigate the fire risk.
Document 7 (Appendix 7)	Use of a Fire Extinguisher (Sample) provided by Clark's Logan City Bus Service.[45] This template is a generic instruction sheet for drivers on how to use a fire extinguisher.
Document 8 (Appendix 8)	Fire Extinguisher Standards and Approved Examples designed by the Bus Industry Confederation in consultation with bus and coach industry representatives when developing an industry advisory on fire mitigation in 2014. This template provides the size and type of portable fire extinguisher required for buses, rating and classification standard and maintenance tags.
Document 9 (Appendix 9)	Bus Inspection Sheet designed by the Bus Industry Confederation in consultation with bus and coach industry representatives when developing an industry advisory on fire mitigation in 2014. This template is a list of the items to be checked by maintenance staff so as to mitigate the fire risk.
Document 10 (Appendix 10)	Bus Engine Bay Fire Suppression Equipment provided by Brisbane City Council. This template is an example of suppressions systems and functions.
Document 11 (Appendix 11)	Training Needs Analysis Spreadsheet designed by the Bus Industry Confederation in consultation with bus and coach industry representatives when developing an industry advisory on fire mitigation in 2014.
Document 12 (Appendix 12)	Verbal Assessment Operator Refresher General Evacuation provided by Brisbane City Council.
Document 13 (Appendix 13)	Sample Section from Driver Bus Familiarisation for a Specific Bus Type provided by State Transit Authority NSW. A template that shows an example of driver training/information on the features and operation of a type of bus, highlights emergency systems and bus security.

45 Adapted from TAFE Queensland, 2014. *How to use a fire extinguisher,* FS 123 R Version 1.0.

4.2 Video Materials to Support Training Documentation

In addition to the 13 practical templates, six videos are available for download from the BIC website OzeBus (ozebus.com.au/bus-fire-evac) to assist in the development of training templates.

Video 1. Bus Evacuation Video provided by State Transit Authority NSW. A 12 minute video on bus evacuation for incidents from breakdown, accident, passenger medical incident, passenger threat, or fire emergency, Four evacuation scenarios are covered In this video:

- Scenario 1: Engine oil pressure failure on single lane non-emergency evacuation and passenger changeover, passengers unloaded onto curb.
- Scenario 2: Engine stall in centre lane of multilane road, passengers can stay on the bus and processes to unload on to curb or another bus.
- Scenario 3: Tunnel electrical fire in the A/C inside the bus, full emergency shutdown and evacuation.
- Scenario 4: Engine fire on harbour bridge, emergency evacuation, dealing with traffic and fire.

Video 2. Use of Portable Fire Extinguisher provided by State Transit Authority NSW. A 5 minute video on the use of the on-bus mobile fire extinguisher showing:

- examples of what may cause a fire
- description of the portable fire extinguisher
- when you could use the extinguisher to fight a fire
- how to fight a fire.

Note: This video contemplates opening the rear engine door to fight a fire, the other option is to not open the rear engine door and instead aim the extinguisher from under the bus and into the engine bay.

Video 3. Engine Bay Fire Suppression System and Alarm provided by State Transit Authority NSW. A 3 minute video that explains how the State Transit fire protection systems operate:

- explains safe shutdown and bus security
- what to do following the fire system's deployment.

Video 4. Emergency Bus Evacuation Demonstration provided by Brisbane City Council. A 4 minute video to train passengers on how to evacuate the bus if the driver is incapacitated showing:

- explains use of door emergency exits
- explains use of window emergency and if required roof hatch exits.

This video would also be useful to train drivers on the use of emergency exits and passenger evacuation.

Video 5. School Bus Evacuation – US Version. A 12 minutes US video but deals with different bus types and also deals with various scenarios following the same process provided in the recommended Evacuation Protocol for School Bus in Section 3 of this Advisory.

Video 6. Special Needs School Bus Evacuation. A 5 minute video on evacuating a special needs school bus:

- follows the same processes listed in Special Needs School Bus Evacuation protocol.

SECTION 5

APPENDICES

www.ozebus.com.au/bus-fire-evac

Appendix 1 - In Bus Emergency Response Procedure[46]

EMERGENCY RESPONSE PROCEDURES FOR BUS OR COACH FIRES

S STOP **A** ALERT **F** FINALISE **E** EVACUATE

If the fire alarm or pressure monitor activates, or you see, smell or are advised of smoke or flames, you must adhere to the following procedures to ensure the safety of both yourself and any passengers in or around the vehicle.

Step 1 Remain Calm.

Step 2 Pull vehicle over immediately to the near side lane/kerb ensuring that it is safe and out of danger from other road users, trees and buildings.

Step 3 Secure vehicle by applying the park or handbrake.

Step 4 Open all doors and SHUT down engine as soon as practicable.

Step 5. Instruct passengers to disembark in an orderly and safe manner and move away to the side to a safe location.

Step 6 Instruct passengers to disembark in an orderly and safe manner and move away to a safe location.

Step 7 If vehicle is fitted with master isolator switch, this must be switched off.

Step 8 If vehicle is fitted with a fuel isolator switch, this must be switched off.

Step 9. Access vehicle fire extinguisher and attempt to contain fire (if the fire is contained to the engine bay or luggage compartment, you must NEVER open the engine hatch to attempt to extinguish fire).

Step 10. If access to exit doors is restricted due to fire, then instruct a responsible person to utilise emergency window hammers to break emergency windows to allow access from the side of the vehicle.

Step 11. Check the welfare of your passengers and assess any injuries.

46 Adapted from protocols provided by Brisbane City Council in the development of the Fire Mitigation Advisory, 2014, Bus Industry Confederation

Appendix 2 – Vehicle Emergency Evacuation Procedures[47]

If you are involved in any type vehicle incident that requires the immediate evacuation of passengers you must adhere to the following procedures to ensure the safety of those passengers are central to your evacuation.

Vehicle Fire

1. Pull vehicle over immediately to the near side lane/kerb ensuring that it is safe and out of danger from other road users, trees and buildings.
2. Open all doors and SHUT down engine as soon as practicable. If vehicle is fitted with master isolator switch then this must be switched off.
3. Instruct passengers to disembark in an orderly and safe manner and move away to the side to a safe location.
4. Access vehicle fire extinguisher and attempt to contain fire *(if the fire is contained to the engine bay, you must NEVER open the engine hatch to attempt to extinguish fire).*
5. If access to exit doors is restricted due to fire, then instruct a responsible person to utilise emergency window hammers to break emergency windows to allow access from the side of the vehicle.
6. Check the welfare of your passengers and assess any injuries.
7. Contact Emergency Services on “000” to seek assistance.
8. Contact Crown Coaches Operations to notify of incident and seek guidance.

Vehicle Accident

1. Pull vehicle over immediately to the near side lane/kerb ensuring that it is safe and out of danger from other road users.
2. Check the welfare of your passengers and assess any injuries.
3. Instruct passengers to disembark in an orderly and safe manner and move away to the side to a safe location.
4. If access to exit doors is restricted due to vehicle damage, then instruct a responsible person to utilise emergency window hammers to break emergency windows to allow access from the side of the vehicle.

5. Check the welfare of your passengers and assess any injuries.
6. Contact Emergency Services on “000” to seek assistance.
7. Contact Crown Operations to notify of incident and seek guidance.

47 Provided by Crown Coaches

Appendix 3 – Evacuation of Accessible Passengers [48]

Accessibility *is the degree to which a product, device, service or environment is available to as many people as possible. Accessibility can be viewed as the "ability to access" and benefit from some system or entity. The concept often focuses on people with disabilities or special needs and their right of access, enabling the use of assistive technology.*

If you are involved in any type of vehicle incident that requires the immediate evacuation of accessible passengers, you must adhere to the following procedures to ensure the safety of those passengers are central to your evacuation.

Extreme Emergency Evacuation

> **Extreme Emergency Evacuation**
>
> **Emergency evacuation** is the immediate and rapid movement of people away from the threat or actual occurrence of a hazard. Examples range from vehicle fire, vehicle accident, evacuation due to a bomb treat, to the large scale evacuation of a district because of a flood, bombardment or approaching weather system.

In an event of an incident where all passengers must be evacuated, the accessible passenger/s must only be removed if it is more dangerous to leave the passenger/s on the vehicle.

The driver must evacuate all accessible passenger/s using the following methods *(in order of preference):*

1. Use the wheel chair hoist as per normal operation;
2. Use the emergency ramp (if fitted);
3. Lift the wheel chair passenger (while still in the chair) with the help of others available and carry off the vehicle via the exit door. You must always carry the wheel chair backwards;
4. Lift the passenger (without the chair) with help of others available and carry off the vehicle via the exit door. You must always carry the passenger backwards;
5. Lift the accessible passenger, with the help of others available and evacuate via an emergency window (use emergency hammer to break window).

Accessible passenger evacuation with no help available

In the event a driver is alone and unable to engage the help of others, the evacuation of an accessible passenger is best accomplished by:

48 Provided by Crown Coaches

1. Checking with the passenger for the best way to carry him/her and proceeding accordingly;
2. If the passenger is unconscious, the best technique to use is the “Fireman’s Carry”. This technique if done properly, will enable to you move a passenger who may be larger than you while ensuring the lift does not cause any injury to the lifter.

How to do a Fireman’s Carry

1. Lift the injured or unconscious person into a standing position. Squat down in front of him, grasp him under the arms and lift him against your own body and raise to a standing position so that you are now both on your feet face to face;
2. Support the person around the waist with one hand and raise her arm closest to you with the other hand. Raise the arm until it is fully extended over your head;
3. Maintain your hold on the person's lifted arm and bend at the knees and slightly forward. Allow the person to fall across your shoulders;
4. Return to a standing position. Use your legs and not your back to stand and support the person's weight across your back;
5. Hold the person during a fireman carry by wrapping one arm around the backs of his knees and holding his arm down across the front of your body.

Tips and Warnings

1. Always lift with your legs and not with your back to avoid injury;
2. Be sure to support the person across both shoulders and not just over one shoulder. A true fireman carry uses both shoulders to transport an injured or unconscious person.

Appendix 3 – Evacuation of Accessible Passengers

Vehicle Accident

1. If there is no imminent danger resulting from the accident, accessible passengers must remain on board until such time as the vehicle can continue on, or a replacement vehicle is available;
2. If there has been injuries sustained, wheel chair passengers must remain on board until Emergency Services have arrived and administered first aid as required. Passengers are only to be removed under instruction from Emergency Services.

Vehicle Wheel Chair hoist breakdown

1. Follow procedure in Company handbook and switch controls on hoist from automatic to manual and operate hoist manually to unload wheel chairs.
2. If the manual operation is not available then exiting the vehicle via the emergency ramp at the rear/side of the vehicle is required (where fitted);
3. If the vehicle is not fitted with an emergency ramp then the wheel chair passengers must remain on board until the hoist has been repaired or until the next accessible vehicle becomes available and a *vehicle to vehicle* passenger transfer can occur *(vehicle to vehicle transfer is possible by aligning both wheel chair access doors and transferring passengers across to replacement vehicle).*

Emergency Evacuation Summarisation

- Use lift;
- Use emergency ramp;
- Lift wheel chair through doors;
- Lift passenger through doors;
- Lift passenger through window;
- Carry passenger off using fireman's carry.

Appendix 4 – On Road Emergency Procedure Refresher Handout[49]

1. **PURPOSE**

This document details the procedure for drivers to follow in the event of an on road incident or accident.

2. **REFERENCES**

- Injury / Incident Report Form
- Accident Form
- Notification of Vehicle Damage Form
- Defect Notice
- OHS Concern Report
- Handling Suspicious Items Guidelines

3. **PROCEDURE**

- Ensure the safety of yourself and others by ensuring the vehicle is as safe and secure as possible. eg. handbrake applied, hazard lights on, ignition off, check for fuel leaks, put out emergency triangles
- Check all passengers to see if anyone is injured
- Contact depot immediately on the two-way radio and contact emergency services on ***000***

Management will contact emergency services if the driver is unable to do so.

- Describe the situation
  - o severity of accident
  - o No. of people involved
  - o No. of injured
  - o types of injuries
  - o any other Vehicles involved
  - o extent of vehicle damage
  - o location
  - o immediate needs
  - o what has been done
  - o if emergency services have been contacted – and if so which ones have been contacted
- Evacuate the bus and assist all passengers to a safe area
- Give assistance to injured passengers - do not move casualties unless in a life threatening situation
- Check and assist people from the other vehicle (if another vehicle is involved in the accident).
- Wait for emergency services and Dysons representative to arrive on the scene.

At no time is a Dysons team member to talk to the press or make a statement except to the Police.

A “No Comment” statement should be made to anyone other than the Police. Refer any media enquiries back to management.

4. **WHAT TO DO IF YOU FIND AN UNIDENTIFIED PACKAGE OR LETTER**

Refer to Handling Suspicious Items Guidelines

5. **FOLLOWING AN INCIDENT**

A driver may be required to complete the following forms if relevant to the event:

- Injury / Incident Report Form – for all injuries no matter how small and for all incidents company wide
- Accident Form – if there is damage to a vehicle
- Notification of Vehicle Damage Form – for reporting any damage to any vehicle’s body whether caused by the driver or noticed while walking the yard
- Defect Notice – for any problems with a vehicle
- OHS Concern Report – for any near miss, hazard

or concern Following an incident a driver may be required to:

- Participate in professional counselling
- Participate in operational debrief about incident and its management.
- Contribute to improve incident management procedures
- Complete any additional paper work.

49 Provided by Dyson Group of Companies

Appendix 5 – Bus Fire and Evacuation Procedure Refresher Handout[50]

Bus Operator Refresher Fire and Evacuation Procedure

Bus Engine Bay Fire Suppression Equipment

Commence the evacuation procedures immediately

Stop the Engine but leave the ignition on

Pull over as quickly and safely as possible. If possible avoid stopping in tunnels, interchanges, bus stations, outside service stations, schools, hospitals or congested areas. If the fire is getting out of hand, you will have to pull over immediately. If you have to stop in a busway tunnel, try to stop before one of the yellow exit doors. This is so your passengers will **not** have to walk past the burning engine bay to exit the tunnel. Once stopped, apply your park brake, put the bus in neutral, and turn on your hazard lights. Stop the engine but leave the ignition on so that you can still operate the radio and doors. Stopping engine also stops fuel from being pumped to the engine. If you are driving a gas bus pull the emergency gas shut off handle. It will isolate the gas supply from the engine.

Alert your passengers and NCC

Inform your passengers and open both front and rear doors and evacuate them to a safe location, preferably at least 200m forward of the bus if possible. Be mindful of your location, any dangerous goods in the area, structures etc.

You will need to give clear directions to your passengers, don't panic, remain calm and be assertive. You may need to consider other evacuation alternatives including breaking windows or using roof hatches.

If it is safe to do so call NCC by pressing "1" on the radio and advise them of the situation. Do not put yourself in danger, if it is not safe, leave the bus and try to advise NCC from another bus radio or mobile phone. Give NCC as much information as possible regarding your location and the severity of the fire. NCC will contact emergency services immediately. Help will be on the way.

Finalise, turn off ignition

If safe to do so physically check the bus is empty. Turn off your ignition and main switches. This will further reduce a fuel source for the fire. If the automatic detection system has not activated there will be no beeping alarm or flashing red LED lights on the monitoring unit. If you are certain that there is a fire in the engine bay, manually activate the powder delivery at this time.

Exit the bus and stay clear

Collect the fire extinguisher and evacuate the bus, making a final check all passengers have exited. You may need to render assistance to slower passengers. eg. disabled or elderly passengers.

Move at least 200m away from the front of the bus. If it is safe to do so (and the fire is contained) attempt to extinguish the fire by using the fire extinguisher or any other means available to you at the time. i.e. fire hose or garden hose.

50 Provided by Brisbane City Council

Bus Operator Refresher Fire and Evacuation Procedure

Opening the rear hatch may mean a burst of fire on your face and body

Risk

If it looks too big to you or the fire is already outside the engine bay zone… **it is too big.**

If you cannot approach within 2-4 metres because of heat… **it is too big.**

Observe

Where is the fire and how will you attack it?

You may be able to use the extinguisher through the vents or under the body skirt. You will get blow back from the powder if you get too close to a surface. A 2.5 KG extinguishing will discharge in 10 – 15 seconds, so consider your approach

Prepare

Pick up the extinguisher, invert and shake briefly to loosen the powder.

Start the PASS method

1. Pull (Pin)
Pull pin at the top of the extinguisher, breaking the seal. When in place, the pin keeps the handle from being pressed and accidentally operating the extinguisher. **Immediately test the extinguisher. (Aiming away from you)** This is to ensure the extinguisher works and also shows the operator how far the stream travels.

Act

2. Aim
Approach the fire standing at a **safe distance, (3-4 metres).** Aim the nozzle or outlet towards the base of the fire.

3. Squeeze
Squeeze the handles together to discharge the extinguishing agent inside. To stop discharge, release the handles.

4. Sweep
Sweep the nozzle from side to side as you approach the fire, directing the extinguishing agent at the base of the flames. After a fire is extinguished, probe for smouldering hot spots that could reignite the fuel.

Do not attempt to restart the bus.

Bus Operator Refresher Fire and Evacuation Procedure

Fire Suppression System
Normal day to day operation with ignition turned on

Normal Operation

On most days you will not be required to do anything other than monitor the audio alarms and warning lights. The system will alert you to any fires or faults by activating the audio alarms and warning lights. After the bus has been standing with the ignition off for 30 minutes, the system will turn itself off. There will be no LED lights visible on the Monitoring Unit.

When the ignition is turned on, there will be two short beeps and two green LED lamps will be displayed.

A steady audio alarm and Amber Lamp on indicates a fault

Fault Detected

The system also has an alarm to alert the driver of a fault. If the tone is **steady** and an **amber** light is displayed on the monitoring unit, it simply means that there is a fault and there is no need to evacuate the bus. You cannot clear this fault. Contact NCC for assistance. The position of this monitoring unit will in most cases be above the driver's head. In a small number of buses however, it will be in the lower dash.

Fire or Fault a long continuous alarm

Two red lights must evacuate

It is important to understand the operation of the LED lamps on the monitoring unit if you hear an alarm, look at the unit to see if there is a fire or a fault with the system. If the alarm is continuous and there is **one red LED** lamp displayed then it could be a fault or fire. You will need to investigate and act. If the alarm is **beeping** and there are **two red LED** lamps displayed on the monitoring unit, there is a fire and the system will deliver the powder in 30 seconds.
Remember, a loud beeping alarm with corresponding red LED lamps displayed always means a fire and you will need to evacuate your passengers immediately.

Bus Operator Refresher Fire and Evacuation Procedure

Manual Release point

The Manual Release Point consists of two items: a yellow decal with instructions and a red Manual Release Point box labelled “Activate Fire Suppression” located in most buses above the drivers head. There are a small number of buses where this unit is in the lower dash.

To operate the system manually, the driver will need to lift the clear plastic lid, and then press the dot in the centre between the two arrows until the glass breaks. This will activate the system.

The glass can be broken safely with the driver’s thumb. As the glass is covered with plastic, it will not cut the driver’s thumb when it breaks.

It is important to note that this process will almost certainly never be required as the system should activate automatically in the event of an engine bay fire.

Don’t forget, fires in other areas of the bus will not be extinguished by this system. You will need to use the fire extinguisher in the driver’s compartment.

If you are not certain that there is a fire, do NOT activate the system manually by breaking the glass. Wait and monitor the system and if a fire becomes evident, you can then manually activate the system by breaking the glass.

On any fire alarm and red light on the monitoring unit, or any indication of smoke and/or fire you should evacuate your passengers immediately.

When the bus is shut down

The system has a safety feature which allows for the monitoring for engine bay fires to continue until 30 minutes after the bus has been shut down.

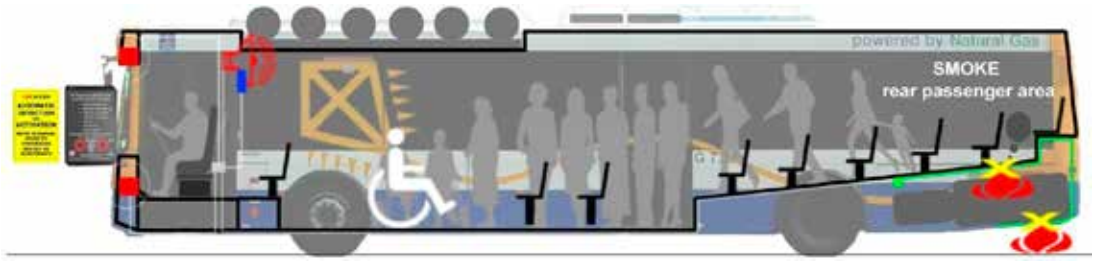
The engine bay will therefore be monitored for fires as the engine cools. The system will then shut down after 30 minutes.

Don’t be alarmed if a green LED lamp remains on the monitoring unit after you completely shut down the bus.

Additionally if you arrive at a bus and you see a green “Battery Power On” lamp displayed on the Monitoring Unit, it means that the bus was last shut down less than 30 minutes ago and can still be used as normal.

Bus Operator Refresher Fire and Evacuation Procedure

Fire Suppression System Layout



Fire detected

If fire originated in your bus

- Stop the bus
- Alert your passengers and advise NCC of the situation
- Isolate the gas supply and turn off ignition
- Evacuate forward of the bus and stay clear

If fire originated from an external source in QSBS, KGBS or Busway

- Remain on alert, wait for and act on instructions from NCC
- Receive all clear
- Return to normal service

Appendix 6 – Driver Pre-Departure and Operational Check Sheet

Table 14 Driver Pre-Departure and Operational Check Sheet Pro-Forma

Driver Pre-departure and Operational check sheet Pro-Forma			
Items to be checked or observations required		**Requires Rectification**	
		Yes	**No**
A	***Driver Pre-Departure Checks***		
1	Look for tyres that are flat or partly flat.		
2	Check that tyres on dual wheels are not touching one another.		
3	Make sure that no liquids are leaking onto the road, or into the engine compartment.		
4	Water coming from the air conditioning system is okay – any other dripping, spray or misting is not.		
5	Check that the exhaust brake is working correctly if your vehicle has one.		
6	Check that the brakes release properly and that the air gauges are all in the normal position.		
7	Check that there is no oil coming from the exhaust pipe and no debris in the pipe.		
8	Check for excessive blue smoke from the exhaust – this could indicate the turbocharger is burning oil.		
9	Check that the vehicle has an unexpired fire extinguisher.		
B	***Checks When Operating the Bus***		
1	Check the temperature gauges for overheating.		
2	Check the low tyre pressure monitor if your vehicle has one.		
3	Check the air pressure gauge and/or warning light. Low air pressure can cause spring brakes to apply and bind.		
4	Check the ABS warning light.		
5	Check that the retarder is working properly.		
6	Check for any alarms or alerts on the instrument panel, if in doubt seek advice on what the issue is.		
C	***End of Shift Checks***		
1	Record any problems in the vehicle's defect card/sheet.		
2	Tell a mechanic or the next driver if there are problems that require attention.		

Appendix 7 – Use of a Fire Extinguisher

Use of a Fire Extinguisher Sample

As fire emergencies can occur without warning it is thus very essential to be prepared for a fire emergency. One of the primary things that all individuals should know is how to use a fire extinguisher to fight small fires and limit their reach before they become too big and engulf a whole area. In addition, fire extinguishers are like the first line of defence and can be very efficient too. Therefore, it is very important that you know exactly how to use a fire extinguisher.

There are several different types of fire extinguishers that work on a variety of principles. However, all of them essentially work in the same way. You need to be proficient in using a fire extinguisher as you may need to use it on a very short notice in a quick manner during an emergency.

The first thing to do is to read the instructions. You will not have the time to read the fine print when you most need it in an emergency, so it is important that you are prepared beforehand. Essentially, you may like to follow the PASS principle, which is simple to remember and should be kept in mind while using a fire extinguisher.

- **P**ull: The pin at the top of the fire extinguisher should be pulled to release the locking mechanism and make the fire extinguisher ready for use.
- **A**im: The fire extinguishing action should be aimed at the base where the fire is present and not at the flames, which are merely manifestations of the underlying cause.
- **S**queeze: The lever needs to be squeezed slowly to release the extinguishing agent. Without this, the extinguishing action will simply stop.
- **S**weep: The extinguisher should be moved in a sideways manner or front to back in a sweeping motion.

These should be kept in mind before using a fire extinguisher. It is also important that you be careful while using a fire extinguisher and **maintain a safe distance from the fire**. You should also be able to assess the fire and the type of fire extinguisher to make sure the fire extinguisher will provide the reduction needed. Using this understanding of how to use a fire extinguisher, you can now be in a much better position to fight fires in case of an emergency.

NOTE: Give the fire extinguisher a quick test squirt before using on the fire to ensure it is working.

Appendix 8 – Fire Extinguisher Standards and Approved Examples[51]

The Size and Type of Fire Portable Fire Extinguisher Required for Buses

The minimum size, type and mounting location for the Portable Fire Extinguisher(s) to be used on buses is determined by Australian Design Rule 58/00 – Requirements for Omnibuses Designed for Hire and Reward 2006. ADR 58/00 which states the following in regard to Portable Fire Extinguishers on buses:

> *"58.2.4 FIRE EXTINGUISHER*
>
> *There shall be provided on every omnibus in such a position as to be readily available for use a fire extinguisher which is selected and located in accordance with AS 2444-2001 "Portable Fire Extinguishers — Selection and Location".*[52]

The ADR refers to the Australian Standard AS 2444-2001 Portable Fire Extinguishers and Fire Blankets — Selection and Location and this standard requires that passenger carrying vehicles or buses in urban areas carry one appropriately sized fire extinguisher and for outside urban areas or for buses fitted with integral luggage compartments, then two appropriately sized fire extinguishers are required. This is detailed in the following extract from AS 2444-2001.

51 Bus Industry Confederation, 2014, *Fire Mitigation Advisory*
52 Vehicle Standard Australian Design Rule 58/00, Requirements for Omnibuses Designed for Hire and Reward 2006

Appendix 8 – Fire Extinguisher Standards and Approved Examples

Table 7 Minimum Rating, Classification and Number of Extinguishers for Vehicles

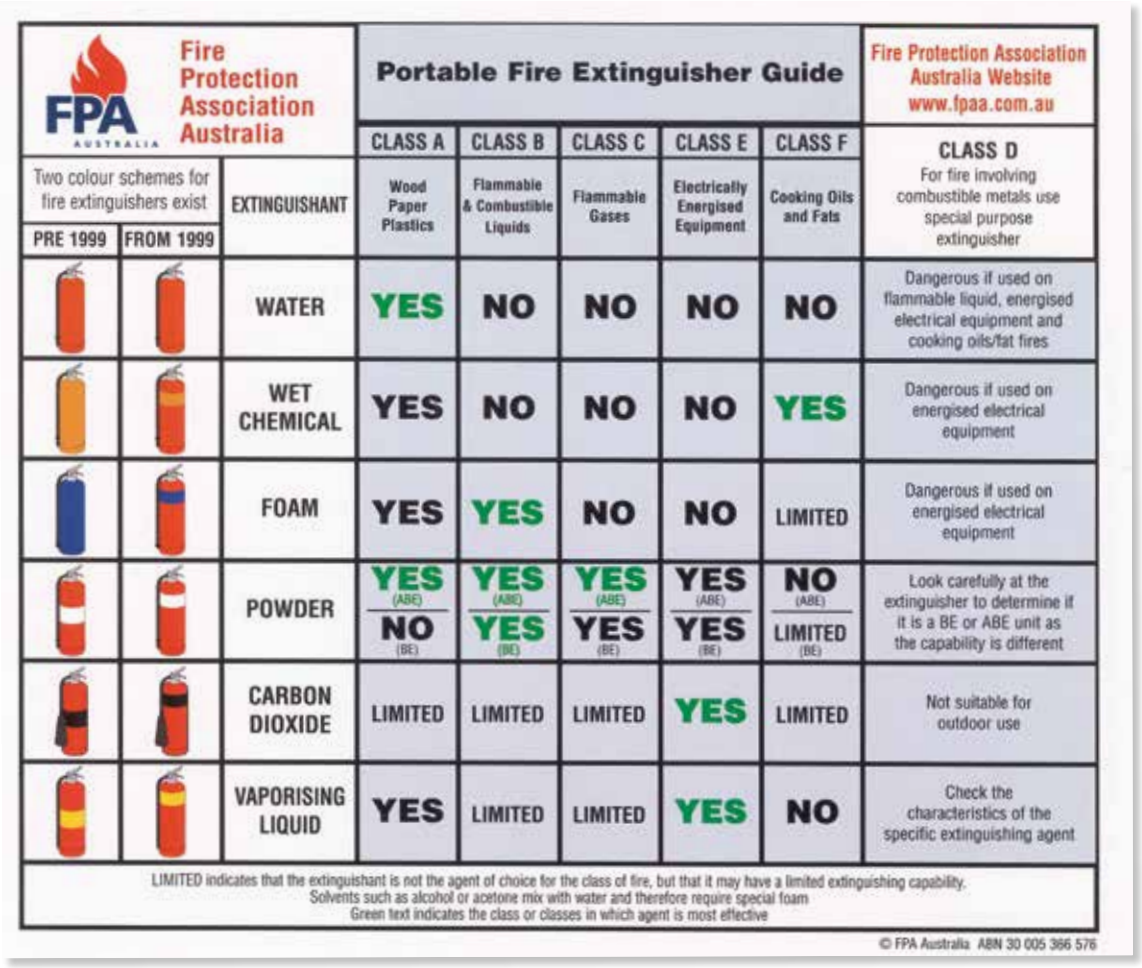
Type of vehicle	Minimum rating and classification of extinguishers	Minimum number of extinguishers
Passenger-carrying vehicle In urban areas or on short trips outside urban areas	2A:20B (fitted with hose)	1
Outside urban areas or when fitted with integral luggage compartment	2A:20B (fitted with hose)	2 (one to be mounted near the under-floor area or engine)

Source: Australian Standard AS 2444-2001 Portable Fire Extinguishers and Fire Blankets[53]

Table 8 Example of how to read a Fire Extinguisher Rating (2A:40B[E])

2	A	40	B	(E)
Rating relative to a specific size of carbonaceous fire	Fire involving carbonaceous materials E.g. wood, paper, timber etc.	Rating relative to a specific size of flammable liquid fire	Fire involving flammable liquid E.g. petrol, oil, turps etc.	Fire involving energised electrical equipment E.g. switchboards, photocopiers, computers etc.

Table 9 Identifying the Correct Extinguisher to use on Different Types of Fire



FPA AUSTRALIA — Fire Protection Association Australia

Portable Fire Extinguisher Guide

Fire Protection Association Australia Website www.fpaa.com.au

Two colour schemes for fire extinguishers exist: PRE 1999	FROM 1999	EXTINGUISHANT	CLASS A Wood Paper Plastics	CLASS B Flammable & Combustible Liquids	CLASS C Flammable Gases	CLASS E Electrically Energised Equipment	CLASS F Cooking Oils and Fats	CLASS D For fire involving combustible metals use special purpose extinguisher
		WATER	YES	NO	NO	NO	NO	Dangerous if used on flammable liquid, energised electrical equipment and cooking oils/fat fires
		WET CHEMICAL	YES	NO	NO	NO	YES	Dangerous if used on energised electrical equipment
		FOAM	YES	YES	NO	NO	LIMITED	Dangerous if used on energised electrical equipment
		POWDER	YES (ABE) / NO (BE)	YES (ABE) / YES (BE)	YES (ABE) / YES (BE)	YES (ABE) / YES (BE)	NO (ABE) / LIMITED (BE)	Look carefully at the extinguisher to determine if it is a BE or ABE unit as the capability is different
		CARBON DIOXIDE	LIMITED	LIMITED	LIMITED	YES	LIMITED	Not suitable for outdoor use
		VAPORISING LIQUID	YES	LIMITED	LIMITED	YES	NO	Check the characteristics of the specific extinguishing agent

LIMITED indicates that the extinguishant is not the agent of choice for the class of fire, but that it may have a limited extinguishing capability.
Solvents such as alcohol or acetone mix with water and therefore require special foam
Green text indicates the class or classes in which agent is most effective

© FPA Australia ABN 30 005 366 576

Source: FPA Portable Fire Extinguisher Guide[54]

53 AS 2444, 2001, Portable fire extinguishers and fire blankets — Selection and location. pp.19
54 FPA Portable Fire Extinguisher Guide www.fpa.com.au

The required minimum size is a 2A:20B Type Portable Fire Extinguisher, fitted with hose. This rating and size requirement is explained in the following sections.

Portable Fire Extinguisher Rating and Classification Standards

Fire extinguishers complying with Australian Standards are marked with a classification and rating, determined in accordance with AS/NZS 1850:2009 Portable fire extinguishers — Classification, Rating and Performance Testing. Extinguishers are rated by their performance and suitability for a particular class of fire, i.e. a water extinguisher will be marked 2A and a dry chemical extinguisher will be marked 2A:40B:E.[55]

The classes of fire are:[56]

Class A: Fires in ordinary combustible materials, such as wood, cloth, paper, rubber and many plastics.

Class B: Fires in flammable and combustible liquids, greases, and oils.

Class C: Fires in combustible gases.

Class D: Fires in combustible metals.

Class E: Fires which involve energised electrical equipment.

Class F: Fires for cooking oils and fats.

The number before the letter is a measure of the relative performance within that class range, namely:[57]

- between 0 and 10 for **Class A**
- 2 and 80 for **Class B**
- 1 and 4 for **Class F**

When a fire extinguisher is rated for more than one class of fire, it is expressed in alphabetical order, eg. 2A:40B(E)[58] as shown in Table 8.

Types of Portable Fire Extinguisher

The above standards then determine the type of fire extinguisher that can be used on the different types of fires, as shown in Table 9.

As is seen in Table 9, there are two options of portable fire extinguishers that can meet the 2A:20B type requirement and that is either foam or a dry powder (ABE) type of extinguisher. Table 10 provides an example of each type of extinguisher for reference purposes only.

Options for Larger Fire Extinguishers

As stated, the minimum standard of Fire Extinguisher for buses is 2A:20B, which is either a 9L foam or 1.5 kg dry chemical extinguisher. If a larger extinguisher is to be used, it still needs to be the Class A and B type extinguisher, but the rating numbers increase due to the large size and hence performance.

Table 11 shows the typical commercially available details of larger dry chemical extinguishers:[59]

55 Metropolitan Fire & Emergency Services Board Community Safety Directorate, 2009, Guideline No: GL-16
56 AS 2444, 2001, Portable fire extinguishers and fire blankets — Selection and location. pp.19
57 Metropolitan Fire & Emergency Services Board Community Safety Directorate, 2009, Guideline No: GL-16
58 Fire Protection Association of Australia Tasmanian Branch, 2007, Guide to the Selection and Location of Portable Fire Extinguishers and Fire Blankets
59 Wormald Portable Fire Equipment Solutions www.wormald.com.au

Appendix 8 – Fire Extinguisher Standards and Approved Examples

Table 10 Examples of Different Types of Fire Extinguishers

	1.5 Kg Dry Chemical Extinguishers	9 L Stored Pressure Foam
Agent Capacity	1.5 kg	9.1 litres
Agent Type		AFFF Foam
Weight Full (approx)	3.2 kg	11.9 kg
Fire Rating	2A:20B	2A:20B
Approvals	AS/NZS 1841.4	AS/NZS 1841.4
Discharge Time	12 sec	48 sec
Effective Range	5 m	4.5 m
Dimensions — Height — Width — Depth	375 mm 100 mm 100 mm	683 mm 180 mm 180 mm
Cylinder Pressure Test	5 Yearly	5 Yearly
Periodic Test Pressure	2.5 Mpa	2 Mpa

Table 11 Examples of Large Dry Chemical Extinguishers

	1.1 kg ABE	2.3 kg ABE	4.5 kg ABE	9.0 kg ABE
Agent Capacity	1.1 kg	3.5 kg	4.5 kg	9.0 kg
Agent Type	Foray®Powder	Foray®Powder	Foray®Powder	Foray®Powder
Weight Full (approx)	2.4 kg	4.2 kg	7.9 kg	14.6 kg
Fire Rating	1A: 10B:E	3A:30B:E	4A:80B:E	6A:80B:E
Approvals	AS/NZS 1841.5	AS/NZS 1841.5	AS/NZS 1841.5	AS/NZS 1841.5
Discharge Time	10 secs	13 secs	22 secs	24 secs
Effective Range	4.6 m	5.2 m	5.8 m	6.7 m
Dimensions — Height — Width — Depth	362 mm 140 mm 88 mm	432 mm 216 mm 113 mm	470 mm 216 mm 148 mm	573 mm 241 mm 183 mm
Cylinder Pressure Test	5 Yearly	5 Yearly	5 Yearly	5 Yearly
Periodic Test Pressure	4.14 MPa	4.14 MPa	4.14 MPa	4.14 MPa

Source: Wormald Portable Fire Equipment Solutions

The 2.3 kg (3A:80B:E), 4.5 kg (4A:80:E) or even the 9.0 kg (6A:80B:E) units have higher performance ratings than the minimum 1.5 kg (2A:20B) units. The E coding means that these units are also rated for Electrically Energised Equipment.[60]

Maintenance of Portable Fire Extinguisher

Portable Fire Extinguishers used in buses are required to be maintained in accordance with AS/NZS 2444 which stipulates AS/NZS 1851.1 in reference to the maintenance requirements.

AS/NZS 1851.1 includes a number of procedures that must be followed including;

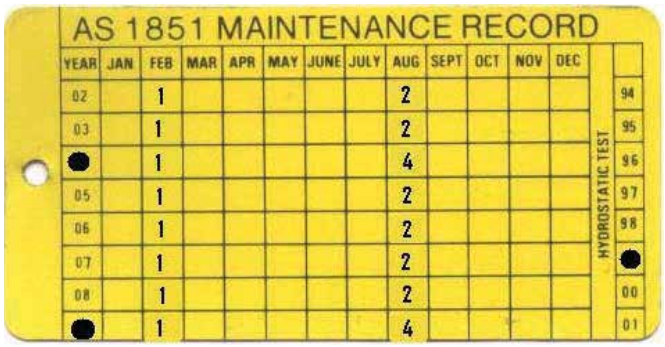
- Recording of maintenance performed
- Reporting any discrepancies found during servicing
- Use of suitably trained staff to carry out the servicing procedures.

For maintenance record tag purposes, maintenance work involving inspection and servicing is classified according to inspection and service intervals as follows:[61]

- '1' denotes six monthly intervals
- '2' denotes yearly intervals
- '3' denotes three yearly intervals
- '4' denotes six yearly intervals
- '5' denotes 'after use' procedures.

The maintenance intervals of different fire extinguishers are set out in maintenance schedules that stipulate various functions of maintenance that must be carried out and the level of inspection (e.g. 1, 2, 3, 4 or 5) intervals. Recharging of fire extinguishers 'after use' must be carried out in accordance with procedures specified in schedules contained in an AS 3676 Portable fire extinguishers — guide to servicing.

Irrespective of what type of fire extinguisher is utilised, a 6 monthly check is required on a number of components and functions of the fire extinguisher. Consequently, when checking the maintenance record tag of a fire extinguisher located in a bus, the tag should indicate a number (1, 2, 3, 4 or 5) stamped in to indicate that some degree of maintenance has been carried out every 6 months.[62]



Example of a Portable Fire Extinguisher Maintenance Tag with eight years of service levels.

The following lists the Australian Standards for smoke detectors and or alarms and it should be noted that any alarm used should comply with the relevant standards. Australian Standards and Draft Standards are available from Standards Australia retail, SAI Global, www.saiglobal.com.

1. **AS 12239-2004** Fire detection and fire alarm systems – Smoke alarms.
2. **AS 1603.2-1997** Automatic fire detection and alarm systems – point type smoke detectors.
3. Amendment-1998 to AS 1603.2-1997.
4. **AS 1603.7-1996** Automatic fire detection and alarm systems – optical beam smoke detectors.
5. Amendment-2001 to AS 1603.7-1996.
6. **AS 1603.8-1996** Automatic fire detection and alarm systems – multi point aspirated smoke detectors
7. **AS 1670.1-2004** Fire detection, warning, control and intercom systems – system design, installation and commissioning – Fire.
8. Amendment 1-2005 to AS 1670.1-2004.
9. **AS 1670.4-2004** Fire detection, warning, control and intercom systems – sound systems and intercom systems for emergency purposes.
10. **AS 3786-1993** Smoke alarms:
    i. Amendment 1-1995 to AS 3786-1993
    ii. Amendment 2-1995 to AS 3786-1993
    iii. Amendment 3-2001 to AS 3786-1993
    iv. Amendment 4-2004 to AS 3786-1993
11. **AS 7240.7-2004** Fire detection and alarm systems – point type smoke detectors using scattered light, transmitted light or ionisation.
12. **AS 7240.12-2007** Fire detection and alarm systems – line type smoke detectors using a transmitted optical beam.

60 FPA Portable Fire Extinguisher Guide www.fpa.com.au
61 Vehicle Standards Instruction, 2003, Fire Extinguishers in Buses, Public Passenger Vehicles Inspection Number P 5.0.
62 Ibid.,^

Appendix 9 – Bus Inspection Sheet

This list would vary dependent on the bus or buses being inspected, but the items listed are the basic items that can contribute to the fire risk.

Table 13 System and Inspection Checklist to Reduce the Risk of Fire

Item or System to be Checked or Inspected to Reduce the Risk of Fire	Requires rectification		Rectified
	Yes	No	
Administration			
Ensure that all driver defect reports are rectified and repairs documented.			
Interior Body Checks			
Check Engine cover & Floor hatches for sealing and security.			
Check Emergency Lights & Decals			
Check Emergency Hammers & Function			
Check Fire Extinguisher Charge and Condition and that is in Date			
Passenger Door Emergency Exit Function			
Exterior Body Checks			
Check Engine bay insulation material for contamination			
Check Fuel tank(s) & lines for leaks & security			
Battery Compartment			
Check Battery Fluid Levels			
Check Battery terminals & cables for condition & security.			
Check Battery carrier & hold down straps for condition & security			
Engine Bay			
Check Alternator Mounting			
Check Electrical Connections & Cables to Alternator			
Check Electrical Connection & Cables to Stater Motor			
Check that all belts and pulleys are secure and free of wear and play.			
Check A/C Compressor for Leaks			
Check A/C Boost Pump Connections & Hoses			
Check Coolant / Intercooler Hoses; Pipes & Air Flow			
Check Tension on Power Steering Oil Lines & Steering Gear			
Check for Exhaust Leakage			
Check Turbo Connections			
Check Fuel system for leaks & lines for condition & security			
Check Engine for excessive oil leaks			
Ensure that any fire and smoke detection systems fitted in the vehicle are correctly connected and working.			

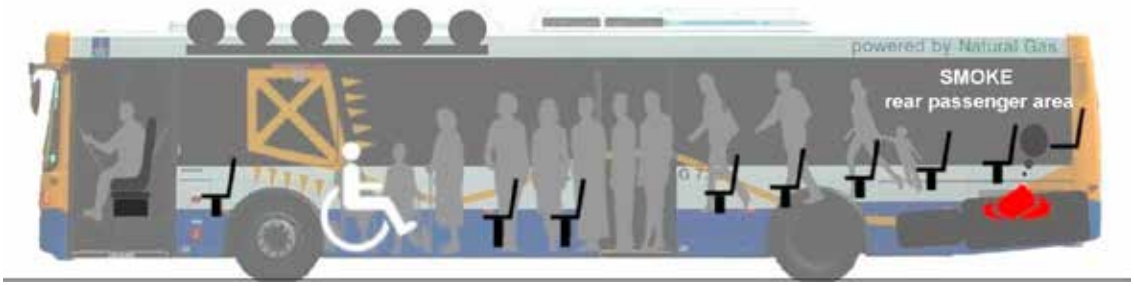
Item or System to be Checked or Inspected to Reduce the Risk of Fire	Requires rectification		Rectified
	Yes	No	
Underbody			
Check that all exposed cables are secure and not chafing and that there is no loose wiring.			
Check that all clamps and cable ties are connected correctly and are secure.			
Check all fuel and hydraulic lines are secure and leak free.			
Front Axle & Suspension			
Check front Axle Vent			
Check Hubs have sufficient grease and or oils.			
Rear Axle & Suspension			
Check Rear Axle Vent			
Check Hubs have sufficient grease and or oils.			
Brakes& Disc Pads			
Check Air Lines & Hoses are Free of Leaks & Secured			
Check For Leakage from Hubs onto Linings			
Check Brake Cylinders Levers & Forks			
Check Brake Lever Travel			
Check Electronic Cables to Wear & ABS Sensors			
Tyres and Wheels			
Check Recaps for tread separation			
Check Set pressures to manufacturers specs & test valves for leaks			
Check Tyre wall condition with particular attention to bead area			
Cleaning			
Wash Engine bay area & Batteries			
Clean all fluid or grease deposits or rubbish from the engine, transmission and surroundings.			
Check that the radiator, intercooler and oil cooler are free of debris.			
Clean the battery surfaces and terminals			
Pressure Tests			
Check for Coolant Leaks and Conduct regular Cooling System Pressure Tests			
Before Road Test			
Check Engine Oil Pressure Gauge Reading			
Check Warning light for ABS is Activated			

Appendix 10 – Bus Engine Bay Fire Suppression Equipment[63]

Overview

- Understand the fire suppression system
- Know how to manually activate the fire suppression system
- Know evacuation procedures

Rear Engine 10m from the driver or more



How the system Works
The System only protects the Engine Bay

Linear (green) Heat Detection cables Detect Fire

Powder Delivery. Tank, Pipes and Nozzles spray the engine bay with 15 Kg of ABC Powder

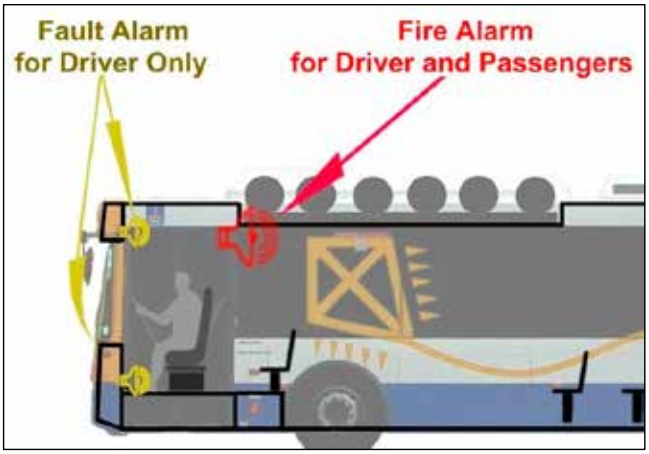
63 Provided by Brisbane City Council

Normal day to day operation and how to deal with a FAULT

When the ignition is turned on…

When the bus is shut down…

There are two Audio Warnings



Appendix 10 – Bus Engine Bay Fire Suppression Equipment

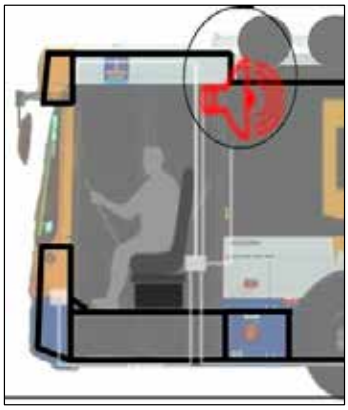
Normal day to day operation and how to deal with a FAULT

If the system has a fault…

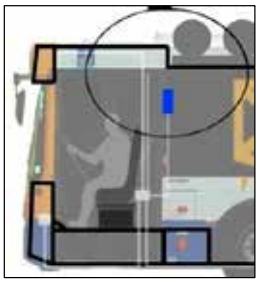
The Manual Release Point is covered by a sticker and no lamps are on…

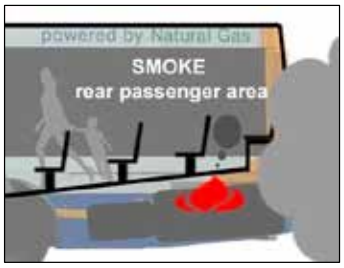
The Fire Alarm has two modes…

- Beeping tone.
- Steady tone.



This sign is a visual alert displayed to passengers.





Detect and control a fire quickly…

You can also activate manually but you will only need to do so in extraordinary circumstances.

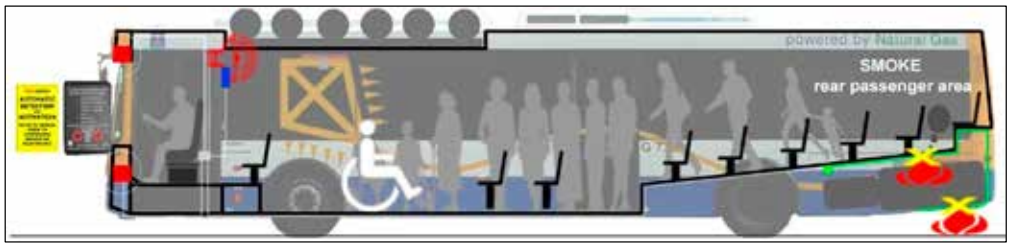
Fire Triangle

Removing at least one element will extinguish the fire.

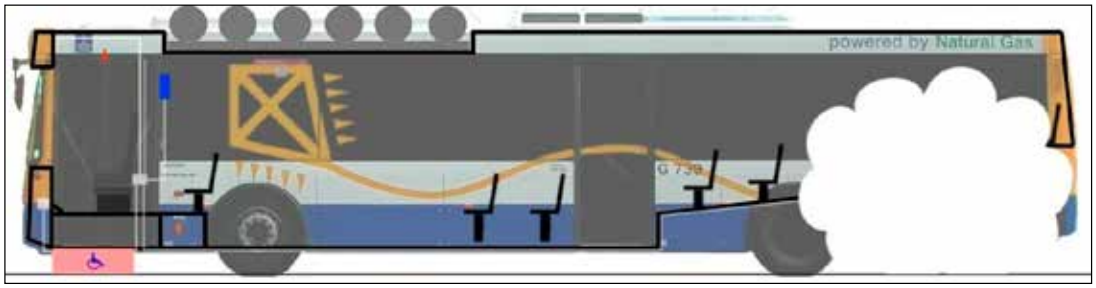
Appendix 10 – Bus Engine Bay Fire Suppression Equipment

Commence the evacuation procedures immediately

Stop
Alert
Finalise
Exit



Stay Away



Conclusion

Summary of important points

- On any alarm, stop and check monitoring unit.
- Amber light on unit and steady alarm indicate a fault only and not a fire.
- Flashing red light/s and beeping alarm indicate a fire.
- If any red lights are visible on monitoring unit, evacuate.
- Bring the bus to a stop as quickly as possible.
- Avoid tunnels, interchanges, bus stations and congested areas if possible.

Safe

- **Stop** the motor but leave the ignition on.
- **Alert** your passengers and advise NCC of your situation.
- **Finalise**, isolate the gas supply and turn off ignition.
- **Exit** the bus and stay clear.

Appendix 11 – Training Needs Analysis Sheet

TRAINING NEEDS ANALYSIS		
Department/Unit		
Period		
Depot		
Training Co-Ordinator		

EMERGENCY RESPONSE AND RELATED TRAINING								
Name	Position	Emergency Evacuation Protocols Bus Type	Emergency Evacuation Protocols School Children	Emergency Evacuation Protocols Special Needs	Driver Bus Familiarisation Course	Use of Fire Extinguishers	Radio Communications	Pre-Departure Checks
Location of Training Records	Personnel Files							

COLOUR CODING	
	Compulsory training, not yet completed
	Recommended training
	Completed training
	Not usually required of this type of worker
	Not required

Appendix 12 - Verbal Assessment

Unit: Bus Operator Refresher

Lesson: Bus Fire and Evacuation procedure and First Response & General Evacuation training

Name:_____Signature: _____ Date: _____

Trainer: _____

Instructions to the Participant

During the activity, you are to listen to the trainer, consider your answer and be prepared to answer any questions asked.

During the session, the trainer/presenter will ask these questions of the class. Whether or not you are the person who answers the question, write the answer on the space next to the question. This is part of your record of learning.

If you do not understand an answer, please ask for further clarification so that you do understand and are comfortable with the answer before moving on to the next question.

Please use the page titled “Participant’s Notes” for your additional notes. There is also a section at the end of the assessment for you or your trainer to make notes about points to remember or specific concerns on which to work.

If you do not agree with the feedback or the outcome you may discuss your concerns with the course senior trainer.

Trainer Signature: _____

Result: _____ / 15

Verbal Assessment

Unit: Bus Operator Refresher

Lesson: Bus Fire and Evacuation Procedure

Criteria ref.	Questions to be answered by the participant	Answers	Participate in Group discussion (Yes / No)
1.2, 1.4	Q1. Would the system put out a dashboard fire?		
1.2, 2.2, 3.1,3.5	Q2. What would be the first thing you would do if you had a fire on board?		
2.2, 3.1, 3.5	Q3. Where would you stop your bus if it is on fire?		
1.1, 1.3, 1.4, 1.5, 1.6, 2.2, 2.3, 2.4, 3.5	Q4. How would you assess the risk to yourself and others?		
1.4, 1.5, 1.6, 2.1, 2.2, 3.1, 3.3, 3.4, 3.5	Q5. What is your responsibility as the bus driver?		
2.2, 3.1, 3.5	Q6. Who would you inform if your bus was on fire?		
2.2, 3.3, 3.4, 3.5	Q7. How would you evacuate your bus?		
2.2, 3.1, 3.2, 3.5	Q8. When would you turn off the ignition?		
3.1, 3.3, 3.4, 3.5	Q9. Would you stay and fight the fire with the extinguisher?		
3.1, 3.2, 3.4, 3.5	Q10. After leaving the bus with all your passengers would you return?		

Criteria ref.	Questions to be answered by the participant	Answers	Participate in Group discussion (Yes / No)
4.1, 4.4	Q11. Who is responsible during a fire or emergency in a depot?		
4.2, 4.4, 4.5	Q12. What is the difference between a ‘Beep, Beep’ and ‘Whoop, Whoop’ alert tone?		
4.3, 4.4, 4.5	Q13. How is a Manual Call Point activated and who does it alert?		
4.1, 4.2, 4.3, 4.4, 4.5	Q14. How can you raise the alarm in an emergency?		
4.5	Q15. Where can you find information on emergency assembly areas, exit points, fire extinguishers and MCPs?		

Participant’s Notes

Appendix 13 - Driver Bus Familiarisation for a Specific Bus Type[64]

DRIVER BUS FAMILIARISATION FOR A SPECIFIC BUS TYPE

Section from Sample Driver Training Document Dash, Emergency Communications, Warning Systems and Emergency Exit Locations Courtesy of State Transit

Mercedes-Benz OC 500 LE 1825h CNG City Bus - Custom Coaches CB60 Body

64 Provided by State Transit Authority NSW

1.1 Emergency Alarm Radio Buttons

Figure 2-1 Emergency alarm under flip-up foot rest

There are three emergency radio buttons. One is located under the footrest to the left of the steering column. To access the foot switch, lift the metal plate with the toe of your shoe then press the switch with your foot for three seconds

Figure 2-2 Emergency alarm on left hand side of driver

The second switch is located to the left of the driver's seat on the panel behind the driver's cabin door.

Figure 2-3 emergency alarm of right-hand side of driver

The third button is located to the right of the driver's seat

Hold any button down for three seconds to activate the system.

DO NOT ACTIVATE THESE ALARMS UNLESS IN AN EMERGENCY

Appendix 13 - Driver Bus Familiarisation for a Specific Bus Type

1.2 Location of Emergency Door Open Switches

Figure 2-4 Emergency door open button front door - internal

Emergency door open switches are located inside the bus and outside the bus to allow passengers and rescuers to open the doors in an emergency where the driver is unable to operate the doors.

Inside the bus, these buttons are located in the panel above the door lintel as shown and are activated by lifting the flap and pressing the red button.

Figure 2-5 Emergency door open button rear door - internal

Outside the bus, the emergency open buttons are located at the base of the rearmost pillar of each doorway.

Figure 2-7 Emergency door open button front door - external

Figure 2-6 Emergency door open button rear door - external

With the flap lifted, the red button opens the door and the green button closes the door.

1.3 Location of Fire Extinguisher

The fire extinguisher is a 4.5kg dry chemical extinguisher suitable for all fire types. It is located outside of the driver's cabin just forward of the driver's door.

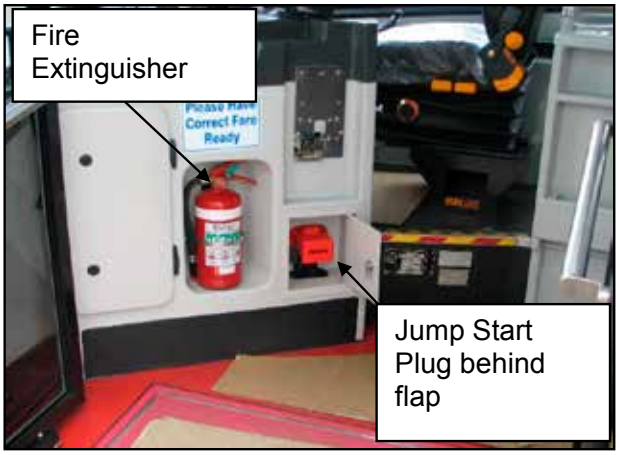


Figure 2-8 Location of fire extinguisher and jump start plug

1.4 Location of Emergency Exits

1.4.1 Emergency Exits – Side Windows

In case of an emergency where the front door and centre door may be blocked or restricted, there are two window emergency exits in the vicinity of the wheelchair spaces; one on the left hand side, one on the right hand side. Emergency break glass hammers are used to smash the safety glass and are located near the windows on the interior cant panel above the window. If the hammer is removed from its holder, an alarm sounds and a warning light illuminates in the driver's cab.

Figure 2-10 Emergency exit window is smashed to allow escape/entry

2-9 Hammer to Break Window emergency Exit

Appendix 13 - Driver Bus Familiarisation for a Specific Bus Type

1.4.2Emergency Exits – Roof Hatches

There are also two exits through the roof hatches but these are used mainly for the situation where the bus may be lying on its side or if the bus is sandwiched by obstructions on either side. Familiarise yourself with the operation of the roof hatch.

Figure 2-11 Roof Hatch Emergency Exit

1.5 Location of Emergency Stop / Master Isolation Switch

The emergency stop switch is located on the console to the right hand side as shown in the figure below. This switch will turn the engine off and cut off the electrical power supply to the body. This is also to be activated when securing the bus. NEVER ACTIVATE THIS SWITCH WHILE THE BUS IS IN MOTIION.

Figure 2-12 Location of Emergency Stop / Isolation Switch

2 Instruments and Warning Lights

2.1 Indication Display Unit

2.1.1 Layout

The indication display unit is shown in figure below:

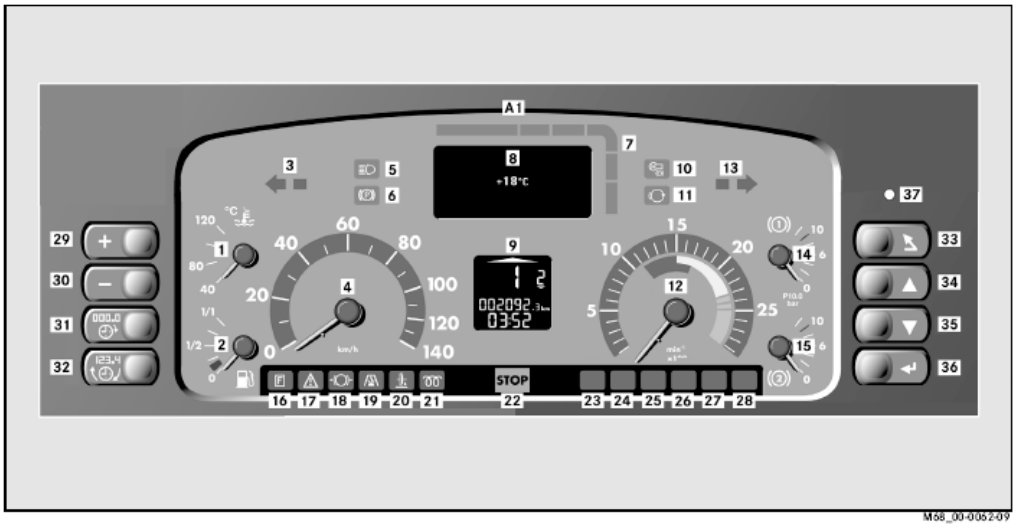


Figure 2-1 Indication Display Unit

1	Coolant Temperature	20	Not used
2	Not used	21	Not used
3	Turn indicator left /hazard warning	22	STOP Red warning lamp
4	Road speed display	23	Not used
5	High beam indicator light	24	Not used
6	Parking brake indicator	25	Not used
7	Red/Yellow fault lamp	26	Not used
8	Driver information (FIS) display	27	Not used
9	Multi function display (MFD)	28	Not used
10	Door/brake interlock indicator lamp	29	Adjust clock/ increase instrument lighting brightness
11	Not used	30	Adjust clock/ decrease instrument lighting brightness
12	Engine speed display (Tachometer.)	31	Reset trip meter to “0” /Adjust clock/Store
13	Turn indicator right /hazard warning	32	Show trip meter or clock
14	Reservoir pressure brake circuit 1 display(Front)	33	Menu / Exit
15	Reservoir pressure brake circuit 2 display(Rear)	34	Move up menu
16	Not Used	35	Move down menu
17	Not Used	36	Enter/Select
18	Not used	37	Not Used
19	Not used	38	

Appendix 13 - Driver Bus Familiarisation for a Specific Bus Type

2.1.2Features

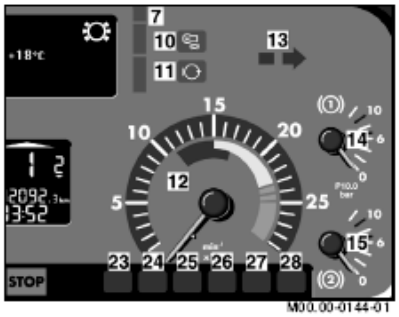
2.1.2.1 Lamp test on start-up

After the engine is switched on the instrument panel tests all assigned indicator lamps by illuminating for approximately ten seconds.

2.1.2.2 Parking brake indicator lamp

The parking brake indicator lamp(6) lights up when the parking brake is applied

2.1.2.3 Door interlock indicator lamp



The door interlock indicator lamp(10) lights up when the a door is opened.

2.1.2.4 STOP red warning lamp

The Stop red warning lamp (22) lights up when a serious fault is detected on the bus and the operational reliability and or roadworthiness of the bus is endangered. This may be due to:

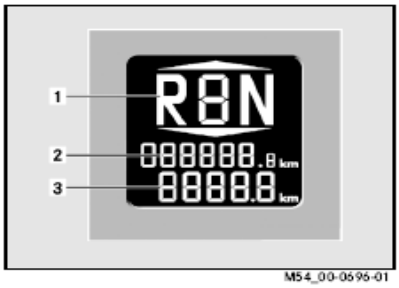
1. Engine oil pressure too low
2. Air system pressure too low.

If the STOP red warning light is illuminated, stop the bus immediately depending on traffic conditions and switch off the engine.

2.1.3 Adjust Instrument Lighting

The brightness of the instrument lighting can be infinitely adjusted. With the ignition on, press and hold button [**+**] , (1) to increase brightness, or button [**-**] , (2) to decrease brightness.

2.1.4 Multifunction display



The information below is displayed to the driver:

- Gear display(1)
- Total distance travelled (2)
- Trip or time meter (3)

2.1.4.1 Displaying the trip meter or time

Press button (4). The display changes from time to trip meter..The time will always be displayed after the ignition is switched on.

2.1.4.2 Setting the trip meter to zero

Press button (3) with trip meter displayed in MFD

2.1.4.3 Setting the time

Press button (3), and the hours currently set flash. To adjust the hours, press button (1) or (2). Press button (3) again. The minutes currently set flash. To adjust the minutes press buttons (1) or (2).

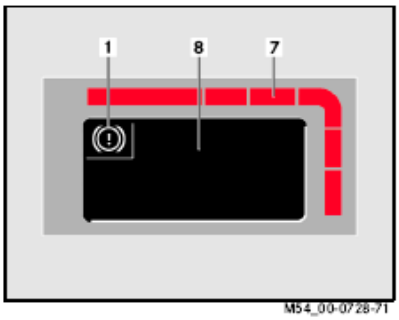
Appendix 13 - Driver Bus Familiarisation for a Specific Bus Type

2.1.5 Driver information system (FIS) display

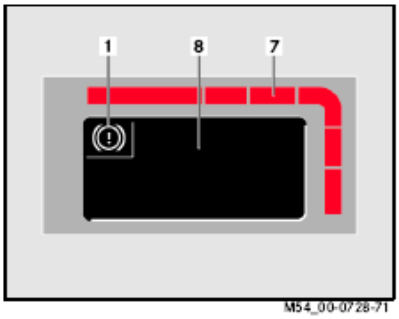
Operating information and warnings are automatically displayed to the driver in the FIS display (8) and the status indicator (7). Symbols are used to show the vehicle's operating state on the FIS display. Several items of information can be shown simultaneously

2.1.5.1 Status indicator Warnings

When the status indicator (7) lights up yellow it is permissible to continue to drive the bus with care, but the cause of the warning must be rectified as soon as it is possible. NOTE: IF THE FAULT IS A BRAKING SYSTEM FAULT, DESIGNATED BY "BS" IN THE TOP LEFT-HAND SQUARE AT (1), THE BUS DRIVING AND BRAKING BEHAVIOUR MAY CHANGE AND THE DOOR/BRAKE INTERLOCK FUNCTION MAY NOT OPERATE.

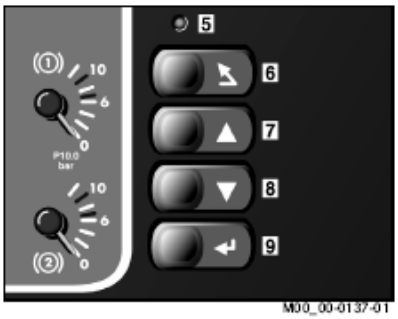


When the status indicator (7) lights up red the bus must be stopped immediately if traffic conditions allow and maintenance staff notified.
A warning buzzer in the instrument panel alerts the driver to the red indicator status.
NOTE: IF THE FAULT IS A BRAKING SYSTEM FAULT, DESIGNATED BY "BS" IN THE TOP LEFT-HAND SQUARE AT (1), THE BUS BRAKING BEHAVIOUR CHANGES AND BRAKE PEDAL TRAVEL/FEEL CAN CHANGE.



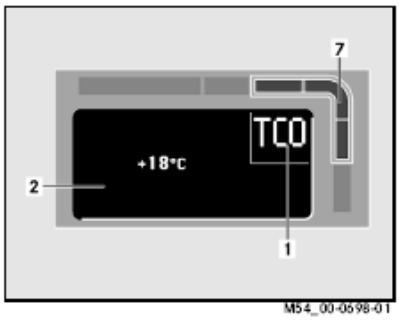
All current warnings and operating information are shown in succession in the FIS display. The display changes every five seconds. The size of the status indicator also changes in response to the malfunction severity noted above.

2.1.5.2 FIS display memory field



NEVER OPERATE THIS PANEL WHILE THE BUS IS IN MOTION. THE PARK BRAKE MUST BE APPLIED AND THE IGNITION ON

When a warning is displayed the warning can be transferred into the memory field by pressing button (6). If several warnings are pending they are displayed in succession when button (6) is pressed. After all warnings have been displayed they are moved into the memory field.



The warning displays transfer to the memory field (1). The status indicator corresponding to the memory field lights up in yellow or red depending on the severity of the malfunction. In the memory field all pending warning displays are shown in succession.

THERE ARE A NUMBER OF OTHER DIAGNOSTIC FUNCTIONS IN THIS SYSTEM WHICH ARE USED BY MAINTENANCE TECHNICIANS TO REPAIR THE BUS – THE DETAILED USE OF THESE MENUS ARE NOT DISCUSSED HERE.

Appendix 13 - Driver Bus Familiarisation for a Specific Bus Type

2.1.6 Symbols shown on FIS Display

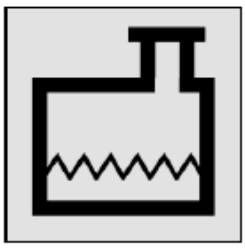
The following symbols can be shown on the FIS display:

2.1.6.1 External Temperature

The external temperature is automatically displayed after the functional check is complete.

2.1.6.2 Coolant Level

Is displayed when the coolant level in the cooling system expansion tank has dropped below the minimum capacity.



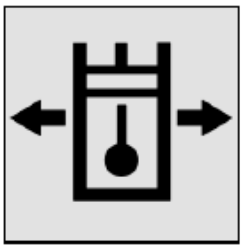
At the next stop pull over and seek advice. Considerable damage to the engine can occur when the coolant level is too low.

If the status indicator immediately lights up red, stop the bus immediately, traffic permitting.

2.1.6.3 Oil Pressure

The engine oil pressure warning display is shown in the FIS when the oil pressure is too low in the engine. Danger – stop the bus immediately, traffic permitting, switch the engine off and seek advice. Significant engine damage can occur if the oil pressure is too low.

2.1.6.4 Power Steering oil Level



Is displayed when the oil level in the power steering pump has dropped below the minimum capacity. Danger – stop the bus immediately, traffic permitting, switch off the engine and seek advice. There is a risk of accident if there is oil loss and the steering becomes heavy.

2.1.6.5 Engine protection function information

The engine protection operating information is displayed when the coolant temperature reaches 105 degrees Celcius while the bus is being driven. This may be caused by a number of causes. The engine power will be reduced significantly to protect the engine.

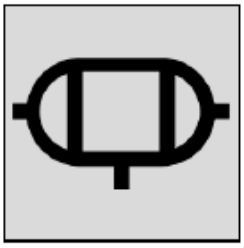
2.1.6.6 Display failure

Is displayed when important operating information warnings or events can no longer be shown on the FIS display. Danger – risk of accident – the bus driving and braking characteristics may change. Stop the bus, traffic permitting and switch off the engine and seek advice.

2.1.6.7 Brake Circuits 1-2 reservoir pressure

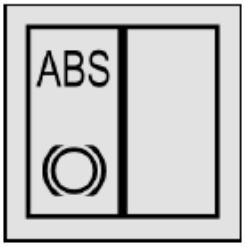
The reservoir pressure in brake circuits 1 or 2 are is under 6.8 bar, which is too low. Danger – stop the bus immediately, traffic permitting and seek advice.

2.1.6.8 Reservoir pressure auxiliary consumers



Is displayed when the reservoir pressure in the auxiliary consumer circuit drops to under 5.5 bar. This may be caused by an air leak or excessive constant raising and lowering of the suspension and opening and closing doors. Danger – this indicates malfunctions in the pneumatic suspension system , door system. Stop the bus seek advice and only drive if the air system recharges so the display goes out.

2.1.6.9 Anti Lock Braking System Information



If the display does not go out, or lights up as the bus is being driven, the ABS and the ASR are fully or partially inoperative. Danger – drive the bus carefully and report the fault.

Appendix 13 - Driver Bus Familiarisation for a Specific Bus Type

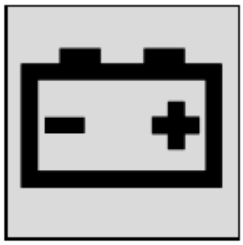
2.1.6.10 Brake Pad Wear

Is displayed when the brake pad wear is too high on one or more axles. Danger – the bus driving and braking characteristics may alter. Drive with care and report the fault.

2.1.6.11 Retarder Temperature

This is displayed when the retarder temperature integrated in the automatic gearbox is too high. Danger – when the retarder temperature is too high the effectiveness of the retarder drops.

2.1.6.12 Alternator 1 not charging properly



Is displayed when the charging voltage from the alternator is incorrect. Danger the driving characteristics may change, Stop the bus, traffic permitting, and switch off the engine. Seek advice.

2.1.6.13 Battery Overcharge

The overcharge warning display is shown if the alternator is overcharging the batteries. Danger – the driving and braking characteristics may change – stop the bus, traffic permitting and seek advice.

2.1.6.14 Battery Undervoltage

The under voltage display is shown when the voltage drops below 22 volts. Danger the bus drivig and braking characteristics may alter – Stop the bus, traffic permitting and switch off the engine

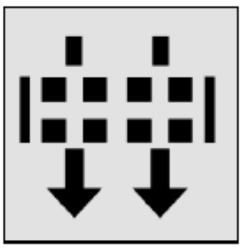
2.1.6.15 Bus suspension levels

Suspension is at normal level

Suspension is either raised or lowered. Danger drive carefully when the bus is raised or lowered – be careful of overhead clearances and ground clearances.

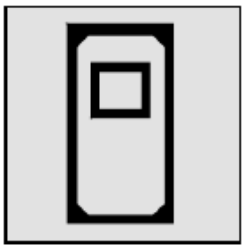
Suspension is in kneeling position. Danger – risk of entrapment of pedestrians – make sure persons outside bus do not come between the underside of the bus and the kerb surface. Only use when bus is stationary.

2.1.6.16 Air Filter Clogged



Is displayed when the air filter is clogged.

2.1.6.17 Door Open



Is displayed if one or more doors are open. Danger – ensure doors are closed.

2.1.6.18 Stop Request

Is displayed if passenger presses stop button – note there is also a large dashboard light to the right hand side of the steering wheel to warn a passenger has made a stop request.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BUS INDUSTRY CONFEDERATION
PO Box 6171, KINGSTON ACT 2604

Tel: +61 2 6247 5990
Fax: +61 2 6273 1035

Email: enquiries@bic.asn.au
Web: www.ozebus.com.au

Bus Australia Network