

MOVING PEOPLE

➤ *Industry Advisory*

Door Safety Advisory



Bus and Coach Industry
Door Safety Advisory

BIC 
Bus Industry Confederation
moving people



MOVING PEOPLE

➤ *Industry Advisory*

Door Safety Advisory

Copyright 2012 Bus Industry Confederation

First Published October 2012

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without prior written permission from the Bus Industry Confederation. Requests and enquiries concerning reproduction and rights should be addressed to the BIC National Secretariat, PO Box 6171, KINGSTON ACT 2604. Telephone: +61 2 6247 5990. Fax: +61 2 6273 1035. Email: enquiries@bic.asn.au



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.

Contents

Preface	ii
---------------	----

Section 1: IMPORTANT READING

Executive Summary	1
Definitions	3
Background to Door Safety Systems	4
Performance of Door Safety systems	4

Section 2: Driver Vision

Improved Internal Driver Vision	9
Internal Mirrors	9
Internal Saloon Mirror	9
Internal Spotter Mirror	9
Handrails and Stanchions	9
Centre Door Mirror	9
No Standing Areas	10
Improved External Driver Vision	11
External Saloon Mirrors	11
Drivers Forward Vision	12

Section 3: Door Safety System Functions

Primary Door Safety System Functions	15
Legal Requirements for Door Safety Standards	15
Passenger Safety	15
Bus or Coach Rollaway Protection	16

Section 4: Types of Door Safety Systems and their typical applications

Functions and Components of Entrapment Systems	20
Bus Stop Brake	20
Accelerator Cut-out	20
Emergency Drive Away System	20
Door Position	20
Detection Systems	20
Drivers Door Switches	20
External Door Open Close Switches	20
External Dump Switches	20
Internal and External Emergency Exit Switches Function	20
Action to Release Bus Stop Brake Accelerator or Foot Brake	21
Bus Handbrake	21
Door Closing Force	21
Warning Lights and Alarm	21
Door Rubbers	21
Self Monitoring	21

Door Override or Maintenance Switch	21
Functions and Components for Non-Entrapment Systems	23
Bus Stop Brake	23
Accelerator Cut-out	23
Driver Emergency Drive Away System	23
Door Position	23
Detection Systems	23
Detection Systems on Opening	23
Drivers Door Switches	23
External Door Open Close Switches	23
External Dump Switches	23
Internal and External Emergency Exit Switches Function	24
Action to Release Bus Stop Brake Accelerator or Foot Brake	24
Bus Handbrake	24
Door Closing Force	24
Warning Lights and Alarm	24
Self Monitoring	24
Door Override or Maintenance Switch	24

Section 5: Ongoing Maintenance, Safety and Awareness

Potential of Slip, Trip and Crush Injury	28
Door System Maintenance	28
Maintenance Staff Training and Awareness	28
Driver Training and Awareness	28

Section 6: Appendixes

Appendix A	31
Appendix B	37
Appendix C	41
Bus Industry Confederation Members	43
National and State Bus and Coach Association Contact Details	45

If you think you know Scania, think again.

- World renowned driver comfort and safety
- National support network
- Parts and service management
- Service and maintenance programs
- Driver training
- Fleet management services
- Roadside assistance



Efficient · Clean · Safe · Reliable



➤ **Section I**

IMPORTANT READING



Executive Summary

Why has this Advisory been developed?	There is significant disparity between the original 1997 gazetted standard set by the New South Wales Road Transport Authority and what is currently the bus and coach industry standard for door safety systems. The industry has moved on to a more complete integrated system and hence government regulation does not reflect the current industry standards which has led to the establishment of this Advisory for door safety systems.
Who developed this Advisory?	In the development of this Advisory, the Bus Industry Confederation sought formal input from a wide range of both Government and Private Operators, State Based Industry Associations, Chassis and Bus Body Manufacturers and specialist bus door and door system control suppliers. Input and comment was also sought from appropriate government agencies.
What is the required outcome of this Advisory?	This Advisory presents successful door safety systems used by the bus and coach industry to ensure safe work practices by drivers and passenger safety.
What Standards does this Advisory apply to?	This Advisory is based on the adoption of the RTA technical standards RTA146 and RTA147 as a minimum and also outlines the common successful industry practices that provide a high level of safety for drivers and passengers.
Do I have to use the systems as prescribed in this Advisory?	<p>Although this Advisory is based on mainstream industry practices, alternative systems or alternative functionality of systems is not discouraged, as long as the basic safety outcomes are achieved and intended functionality is maintained.</p> <p>This Advisory is intended as a guide to be used in conjunction with any relevant regulations or standards. If there is a conflict then the relevant regulation or standard, including ADR's, should always take precedence.</p>
Can the door safety systems prescribed in this Advisory be installed on existing buses or coaches?	This Advisory or sections within, is intended to apply to newly designed and built buses. However should any operators intend to retrofit similar systems, the general safety functions and principals in this Advisory should be followed.
What should I do before I start looking at new door safety systems?	The fundamental aim of any door safety system is to improve passenger and driver safety. Bus and coach designers and operators should conduct their own risk assessments on any adopted system to help ensure that the correct safety outcomes are being achieved. The door safety systems outlined in this Advisory may provide a good platform for conducting a risk assessment on current safety systems deployed across your fleet.



<p>What if I wanted to retro fit the system to existing buses or coaches?</p>	<p>It is recommended that a risk assessment be conducted and the risk assessment should include a failure mode analysis of the final operating systems. This is to ensure that the system fails in a safe mode including the start-up and shut down sequences.</p>
<p>What are the main types of door safety systems?</p>	<p>There are two main types of door safety systems.</p> <p>Non-Entrapment which upon detecting an obstruction will reopen the doors and hold the vehicle stationary.</p> <p>Entrapment which upon detecting an obstruction the door can sense that it is not fully closed and will hold the vehicle stationary until the driver reacts or the passenger removes themselves from the door.</p>
<p>What are the recommended door safety systems for a route bus or a coach?</p>	<p>Entrapment systems are typically used for Coach type applications where high levels of door sealing are required and for route type buses Non-Entrapment systems are recommended.</p>
<p>Who currently uses door safety systems?</p>	<p>Door safety systems, in various forms, are required under all major bus supply specifications for both private and government bus operators.</p>
<p>Suggestions or comments?</p>	<p>Your suggestions or comments about this Advisory are welcome. Please contact the Bus Industry Confederation:</p> <p>Phone: +61 2 6247 5990</p> <p>Email: enquiries@bic.asn.au</p>

Definitions

The following terms have the following meanings:

Accelerator Cut-out – Where the chassis returns the throttle to the idle position.

Advisory – this Industry Advisory. The BIC makes no representation and provides no warranty that the information and recommendations contained in this 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.

BIC – The Bus Industry Confederation.

Bus Stop Brake – The system used by the chassis to stop and hold the bus or coach stationary.

Door Safety System – An integrated safety system that meets or exceeds the requirements of this Advisory for use on buses or coaches.

Detection Systems – the system used to detect that someone or something is trapped in the doors.

Emergency Drive Away System - Self-cancelling and speed limiting drive away panic or emergency button.

Entrapment Safety System – the system used to detect an obstruction in the door or can sense that it is not fully closed and will hold the bus or coach stationary until the driver reacts or the passenger removes themselves from the door.

External Door Open Close Switches – External Switches that open and close the doors under power.

External Dump Switches – An external switch that dumps air pressure from the door and allows the door to go limp.

Mirror - Flat – A Flat Mirror provides an image the same as the object.

Mirror - Convex – A Convex Mirror provides a wider field of view and the objects appear closer.

Industry – refers to the bus and coach industry of Australia.

Internal and External Emergency Exit Switches – Australian Design Rules (ADR) compliant switches that open the passenger doors in the case of an emergency.

Non-Entrapment – a system which upon detecting an obstruction will reopen the doors and hold the bus stationary.

RTA – New South Wales Road Transport Authority.

Background to Door Safety Systems

Since the 1990's various types of door safety systems have been in use in a range of fleets across Australia. The systems varied from relatively simple rear door brake interlocks, to systems that could detect if a passenger was caught in the door of a bus or coach.

In 1994 a young school girl was caught in the centre door of a government bus in New South Wales (NSW) and was dragged along the street. Tragically, she sustained fatal injuries from the incident.¹

As a result of this and other incidents, the local government bus operator and the then Department of Transport NSW undertook an inquiry (the Henderson Report) headed by the Bus and Coach Safety Standing Committee to investigate new types of safety systems.² The project team included both government and private sector industry staff and was used as a basis to develop criteria for the design of door safety systems and to undertake more trials of the door safety systems.

The investigation found that **driver vision** and **door safety** needed to be improved³ and as such, national input was sought from Interstate bus operators, chassis and body suppliers in relation to door safety and driver vision.

Based on the findings of these investigations the RTA was tasked with developing the standards for both door safety and driver vision. These standards became Technical Specifications **RTA 146 Bus door safety systems⁴** and **RTA147 Field of View of the Passenger Entrance Doors of a Bus⁵**. These original specifications are shown in Appendix A and Appendix B.

RTA146 and RTA147 were gazetted by the RTA in 1997.⁶

The implementation of RTA146 and RTA147 and ongoing operation of similar systems used by operators in other States, found that these door safety systems provided a high level of safety for passengers but also increased the potential for unsafe work practices by drivers. For example, drivers not applying the handbrake and then leaving the cabin unoccupied resulted in an industry termed incident called Bus Rollaway. Bus Rollaways often resulted in driver fatalities.⁷

Consequently, the bus and coach industry across Australia

developed a range of safety systems to address the Bus Rollaway issue with these systems being broadly adopted as the industry norm.

A number of specification upgrades to RTA146 were developed with the bus and coach industry to address the rollaway issue and make the doors safer for passengers however the subsequent versions of RTA146 were not gazetted. Although other State Road Authorities have recommended the fitment of door safety systems, no other official Standards have been issued for any type of door safety system.

Subsequently, this has left a gap between what is regulated and what the industry considers a safe vehicle. This gap is continuing to increase as door technology increases at a rapid rate and manufacturers and operators continue to refine the systems.

Performance of Door Safety systems

Since their introduction in the late 1990's, adoption of door safety systems has occurred in all States of Australia and are also required under all major bus supply specifications for both private and government bus operators.

The performance of the door safety systems in terms of passenger safety has proven to be exceptional. Door safety systems are widespread across bus and coach fleets in Australia. It is significant to note that there has not been any recorded passenger trap and drag incident resulting in serious injury or fatality, with vehicles fitted with a functioning door safety system.

Given the number of passengers that use buses this is a significant result. In Table 1 the annual number of bus passenger boarding's by Capital City from 2005 to 2008 is illustrated. The total number of passenger boarding's was 624 million for 2007-2008. Considering that the number of buses (private and government fleets in January 2009 was 9,515 and in Sydney was 3,465⁽²⁾) then an average city route bus could carry around 70,000 to 80,000 passengers per year.

With each passenger, or group of passengers, having to both enter and exit the bus, the number of times a city route bus' doors are opened and closed could average 100,000 times per year. Therefore, over the productive life of a bus, this could equate to the doors (and their door safety systems) being operated up to 2 million times.

Buses operating in heavy city conditions, a bus' doors could be opened and closed as much as 250,000 times per year.

1 Markson, S 2007, 'Kid's Can't Stand Anymore', *Daily Telegraph* 12 August
2 Henderson, M 1994, *Bus Door Safety Inquiry : Supplement to interim / report*, Department of Transport NSW
3 Note: The author of this Advisory was directly involved in this investigation conducted for the State Transit Authority (NSW) during 1994.
4 Roads and Traffic Authority of NSW, Technical Specification 146 Bus Door Safety (RTA TS146).
5 Roads and Traffic Authority of NSW, Technical Specification 147 Field of View of the Passenger Entrance Doors of a Bus (RTA TS147).
6 Ibid.,
7 Bytts, A 2010, 'Drivers 'strangled' in Door', *ntnews.com.au* 14 July
Aston, H 2012, 'Runaway bus leads for calls for handbrake safety checks', *Sun Herald* 29 April

**Table 1 Passenger boarding's across capital cities
2005–2006 to 2007–2008(1)**

	Total boarding's (million)		
	2005–06	2006–07	2007–08
	<i>Total reported boarding's</i>	<i>Total reported boarding's</i>	<i>Total reported boarding's</i>
Sydney	226.8	233.4	241.3
Melbourne	79.1	85.0	91.3
Brisbane	129.7	140.5	149.4
Adelaide	50.2	51.0	52.0
Perth	63.9	64.6	65.7
Hobart	7.6	7.7	7.4
Canberra	16.8	16.8	16.9
Total	574.1	599.0	624.1

(1) and (2) Urban public transport: Recent bus transport statistics
ISSN 1440-9593 December 2009/Infrastructure 08526.



Bus and Coach Solutions (BCS) provide transport engineering consultancy services specialising in supplying technical support to the Australian Bus and Coach Industry for both operators and suppliers.

Bus and Coach Solutions Managing Director, Luke Hardy, was appointed Technical Manager of the Bus Industry Confederation in September 2012. Luke was previously GM Engineering at Custom Coaches and Manager Engineering Policy and Standards at the NSW State Transit Authority.

Bus and Coach Solutions fee for service:

- Surveying of bus and coach fleets to review existing door system safety standards and identify potential areas for improvement.
- Develop fleet specific door safety inspection, maintenance and training programs.
- Assist manufacturers in the design and functionality development of door safety systems, including commissioning and certification of new door systems.
- Compliance services such as PBS Vehicle Certification, ADR Compliance, certification of CNG systems for vehicle registration and Workcover purposes.
- General engineering consultancy services related to tendering, contracting, bus design, manufacturing and in-service failure investigations and project management services.

Ph: **+61 2 9652 1218**

Mobile: **0400 144 111**

Email: **lukehardy55@gmail.com**





➤ **Section 2**

Driver Vision

Improved Internal Driver Vision

The key to passenger safety is the actions and professionalism of the driver. To allow the driver to achieve these requirements, the driver must have a clear and unobstructed view of the passenger door or doors.

This Advisory endorses the principals of **RTA147 Field of View the Passenger Entrance Doors of a Bus**, as issued 16th July 1997⁸. However, in a number of specific applications operators use modern Video Cameras and Screens to achieve RTA147. Any installed camera system needs to meet the RTA147 vision standards⁹.

Internal Mirrors

For a two door route bus, the internal mirror package should include an internal saloon mirror, an internal spotter mirror and a centre door mirror.

Internal Saloon Mirror

The internal saloon mirror should be as large as practicable to allow the driver to have a clear view of the interior of the bus without affecting the driver's forward vision.

Internal Spotter Mirror

For two door buses, the typical spotter mirror is a flat mirror that allows the driver to clearly see the reflection of the centre door mirror. The spotter mirror needs to be a *flat type* mirror in order to reflect the vision from the *convex type* centre mirror. If a curved spotter mirror was used, the image of the centre door would be distorted.



Handrails and Stanchions

Handrails and stanchions should also be positioned to allow a clear line of sight between the internal spotter mirror and the centre door mirror.

Handrails allow clear view of mirror



Centre Door Mirror

The centre door mirror should allow a clear view of both the interior and exterior areas around the centre door. The mirror is typically a convex type that is sufficiently curved to provide the view required, but not too curved as to distort the view for the driver. In special applications however, such as rear doors on articulated buses, the centre door mirror system is replaced with Video Cameras and Screens¹⁰.

⁸ Roads and Traffic Authority of NSW, Technical Specification 147 Field of View of the Passenger Entrance Doors of a Bus (RTA TS147).

⁹ RTA TS147 Clauses 4.1 to 4.8 inclusive.

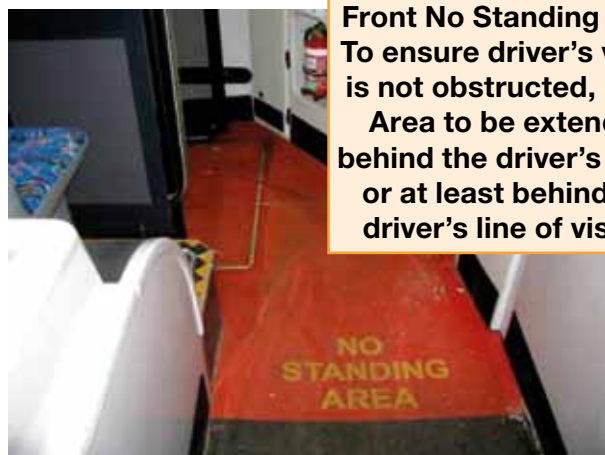
¹⁰ RTA TS147 Clauses 4.1 to 4.8 inclusive.

No Standing Areas

To help keep passengers clear of door areas and to aid in driver vision, on Low Floor route buses there should be clearly marked “No Standing” areas fitted to the front and where applicable centre doorways. These “No Standing” areas at the front door should extend to the area of the drivers cabin and for the centre door extend into the edge of the centre aisle.

Each “No Standing” floor area shall be either a contrasting colour, typically Red, and/or be suitably marked with appropriate signage.

Video cameras and screens may provide the driver with suitable vision without the need for the centre door “No Standing” areas, however thought should still be given to keeping passengers clear of the swept path of the inward opening doors.



Front No Standing Area.
To ensure driver's vision is not obstructed, Front Area to be extended behind the driver's cabin or at least behind the driver's line of vision.



Rear No Standing Area (showing signage inlaid), Red area extends towards the isle.



Improved External Driver Vision

External Saloon Mirrors¹¹

The near side external mirrors need to provide the driver with a clear view down the length of the side of the bus including a view of the near side rear wheels. To achieve this near side mirrors are typically either concave or split.

The near side mirror must be easily adjusted by the driver.

The positioning of the near side mirror can be either forward mounted or side mounted. The forward mounted mirrors are viewed through the front windscreen and within the swept path of the wipers. The side mounted mirrors are viewed through the front door glass and as required under RTA147², the door glass shall be suitably demisted.



Near Side Mirror Forward Mount viewed by the driver through the front windscreen and within the swept path of the windscreen wipers.



Nearside Mirror Forward Mount.



Nearside Mirror Side Mount viewed through the front door glass, (note glass to be demisted).

¹¹ RTA TS147 clauses 6.1 to 6.3.
¹² RTA TS147 Clauses 3.1 and 3.2.

The specific vision requirements for RTA 147¹³ are:

For the front door that a 300 mm diameter and 400 mm high cylinder located in the position shown in Figure 1 can be visible by the driver through either the mirror system or by looking through the front door glass. To allow visibility through the door, the door glazing should extend down as low as practicable.

For the rear door, that a 300 mm diameter and 400 mm high cylinder located in the position shown in Figure 1, needs to be visible by the driver through the mirror system and scaled as if the driver were looking at it 30 metres away. See figure 1 for details.

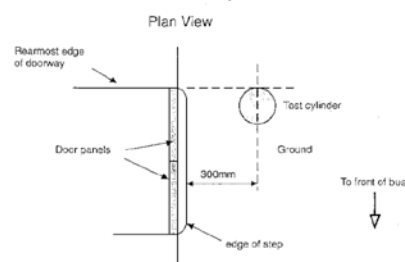
There are also requirements for external lighting which is activated by opening the doors to help ensure that the driver has suitable vision around the outside of the doors at night. The use of these lighting systems is encouraged¹⁴.

Drivers Forward Vision

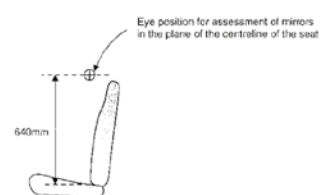
In addition to the above, the driver should also have a clear view of passengers standing around and beside the front area of the bus. As similarly specified in current Government Bus Procurement Specifications, the front of the vehicle should be designed so that a one metre high person standing immediately adjacent to the windscreen or the front side corners of the vehicle is clearly visible by the driver. This may be achieved through the use of a suitable mirror system.

Figure 1 RTA Vision Requirements¹⁵

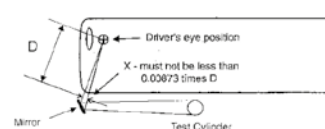
Appendix A Location of Test Cylinder for each Door



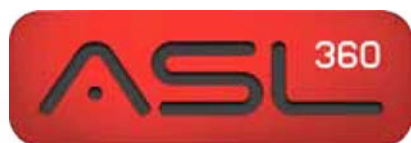
Appendix B Approximation for Driver's Eye Position



A method of testing the angular size of an image



Tech. Spec. 147



don't be blind to blind spots

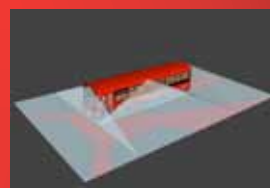
**TRUST THE SYSTEM
THAT IS USED IN OVER
1.5 MILLION CARS
WORLDWIDE.**



FULL 360° Surround View Intelligent Camera System

Finally a multi-camera system that improves driver visibility dramatically by providing a full 360 degree view around a vehicle

- **Up to 12 very wide angle cameras process images to produce a single birds eye view image around the vehicle or individual views from selected cameras.**
- **Dramatically reduces blind spot and visibility issues along with the hazards and risks of:**
 - Insurance claims
 - Driver downtime
 - Bus downtime
 - Compensation claims
- **Decrease**
 - Left turn accidents
 - Accidents whilst manoeuvring in tight spaces
 - Pedestrians collisions
 - Parking hazards
 - Passenger door entrapments



For your free demonstration please call (03) 9872 6673.



**FOR ALL YOUR
PARTS REQUIREMENTS**

**Factory 2/25 Redland Drive
Mitcham Vic 3132
Ph: 03 9872 6673
www.partssupply.com.au**

¹³ RTA TS147 Clauses 2.1 to 2.5.

¹⁴ RTA TS147 Clauses 5.1 to 5.5

¹⁵ Appendix A from Technical Specification RTA147 dated 17 July 1997



➤ **Section 3**

Door Safety System Functions

Primary Door Safety System Functions

The primary function of the door safety system is to stop passengers from being caught and possibly dragged in the door of the vehicle¹⁶. The basic functions of the system is to detect if anyone is caught in the door and if so either reopen the doors or hold the door stationary at low holding force to allow the person to remove themselves from the door. In either instance, the vehicle should be held stationary by the application of the Bus Stop Brake and by returning the throttle to idle.

The door safety system needs to reliably detect if someone or something is caught in the door as the door is closing and if detection occurs, the door safety system then holds the vehicle stopped, or stops the vehicle if it is moving and gives an alarm to the driver.

A Door Safety System must:

- > **Detect** if a person or object (such as a school bag) is caught in the door.
- > **Prevent** the vehicle from movement if a person or object is detected.
- > **NOT** apply a closing force greater than 150 Newtons

If the vehicle is held on the Bus Stop Brake whenever the doors are open, additional functions are needed to stop the vehicle from potentially running away without the driver being seated in the cabin. This can occur when drivers use the Bus Stop Brake to hold the vehicle instead of securing with the handbrake.

Legal Requirements for Door Safety Standards

All Route buses operated in New South Wales are required to meet **RTA 146**¹⁷. The gazetted version of **RTA 146** is the original version dated 16 July 1997. Although other States do not specify a particular door standard, generally door safety systems are encouraged. For example Public Transport Safety Victoria in their Bus Safety News Issue 14 November 09¹⁸, recommended passenger door safety systems that included rollaway protections.

Recommendations over and above RTA Standards

BIC recommend fitting **RTA146** compliant systems to all buses and coaches, and dependent on the designers and operators specific requirements, the following additional safety standards or alternatives to achieve similar outcomes are recommended. Refer to Section 4.

Passenger Safety

- > For route and school type buses, Non-Entrapment type door safety systems should be used; the doors automatically reopen upon detection of a person or object.
- > For Coach applications, due to the higher door sealing and security requirements, Entrapment type door safety systems could be used as a minimum.
- > To improve passenger safety, the Bus Stop Brake should be applied whenever the doors are opened by the driver. This applies for either the Entrapment or Non-Entrapment systems.
- > The Bus Stop Brake should also hold the vehicle stationary even on steep inclines.
- > To improve the chances of detecting a person or object, such as a person's item of clothing, the sensitive edges shall remain active to a set speed or for a period after the doors are shut. The use of other technologies such as light beams or acoustic systems could be utilized.
- > To limit door closing forces, but still enable the doors to be held closed at speed, the doors shall incorporate a high and low air pressure or electric drive type systems or other suitable technologies.
- > To stop accidental operation, the driver's door switches should be isolated at speed.
- > Door safety systems must detect down to a 20 mm rod¹⁹, which is intended to represent the size of a child's wrist.

¹⁶ Roads and Traffic Authority of NSW, Technical Specification 146 Bus door safety systems (RTA TS146).

¹⁷ Roads and Traffic Authority of NSW, Technical Specification 146 Bus door safety systems (RTA TS146).

¹⁸ http://www.transportsafety.vic.gov.au/_data/assets/pdf_file/0010/38863/BSN14-NOV09.pdf

¹⁹ RTA TS146 Clause 2.4.

Bus or Coach Rollaway Protection

- > To reduce the chances of vehicle rollaway, once activated the Bus Stop Brake shall only release after the activation of the throttle or foot brake. Alternatively the door close button shall not operate unless the handbrake is applied or the foot brake is depressed.
- > For doors that can be closed via an external power close button, then these external buttons shall only operate if the handbrake is applied.
- > For doors that have an external air dump button which allow the doors to go limp, the Bus Stop Brake shall not release unless the handbrake is applied even if the doors are manually pushed shut.
- > Vehicles should also be fitted with alarms that activate if the driver turns the vehicle off and does not apply the handbrake.
- > Some modern chassis will not allow the vehicle to be shut down unless the handbrake is applied. The use of these systems is encouraged.
- > Other warning systems such as alarms on the driver's cabin door or sensors that detect if the driver has left the cabin without applying the handbrake are also encouraged.
- > A handbrake warning system should still operate even if the driver activates any battery isolation switch accessible within the driver's cabin.

Due to the complexity of modern computer controlled chassis and body electrical systems, care should be taken to ensure that any alarm or safety system continues to function correctly during vehicle start up and shut down sequences.

Buses and coaches may also be fitted with a double-sided sticker at the driver's side window that states:

Parking Brake Must Be applied before leaving seat, and on the outer side Do not access bus through window.

Note: Double sided warning stickers are compulsory in New South Wales.²⁰



²⁰ Bus Door Safety Alert, Road Transport Authority, September 2009. Refer Appendix C.



➤ **Section 4**

Types of Door Safety
Systems and their
typical applications

Your partner in bus door safety and automation



Australian MADE, DESIGNED and MANUFACTURED

SMC bus door systems and electro-pneumatic equipment is used on government and private bus systems throughout Australia and South East Asia. SMC bus door equipment can be supplied as a basic mechanical door mechanism through to a complete package, including door mechanism, shelf-plates (assembled and pre-piped for rapid and accurate installation), pneumatic installation kit, driver & passenger panels, wiring looms and control system (pneumatic, electrical, PLC or multiplex).

Opening the door, first impressions of...

A SAFE, RELIABLE AND ECONOMICAL SERVICE



SYDNEY

MELBOURNE

ADELAIDE

PERTH

BRISBANE

Call 1800 763 862
E: enquiries@smcaus.com.au
www.smcbusdoors.com.au



There are two main types of door safety systems:

- > **Non-Entrapment** which upon detecting an obstruction will reopen the doors and hold the vehicle stationary.
- > **Entrapment** which upon detecting an obstruction the door can sense that it is not fully closed and will hold the vehicle stationary until the driver reacts or the passenger removes themselves from the door.

To avoid injury, the holding forces on both **Entrapment** and **Non-Entrapment** Doors are quite low (max 150 N)²¹. The most basic system is the **Entrapment** system as it does not include the reopening functionality of the **Non-Entrapment** system.

Functions and Components of Entrapment Systems

Bus Stop Brake

The Bus Stop Brake is used to keep the vehicle stopped or stop the vehicle from moving whenever the doors are opened by the driver. The Bus Stop Brake applies partial brake pressure to the service brakes and normally operates up to a speed of 5 to 10 km/h²². Chassis either come fitted with their own speed limited Bus Stop Brake or it is fitted by the body builder as part of the bus building process. The Bus Stop Brake should be configured so that it brings the vehicle to a stop within a reasonable distance without endangering standing passengers. Retardation rates of around 30% G are typical. It is important that when the door brake is activated, the vehicle's brake lights should also activate.

Accelerator Cut-out

When the door is opened the accelerator is cut-out so the vehicle cannot be driven away²³. If the door is forced open at speed, or a fault or loss of air pressure has allowed the doors to be blown open, to alert the driver that this has occurred, the throttle may be cut or the system should alarm or both.

Emergency Drive Away System

Some operators specify the use of a self-cancelling and speed limiting drive away panic or emergency button. In the event of a system failure, or passengers using the door system to purposely immobilise the vehicle, these buttons allow the driver to move the vehicle out of a dangerous situation, such as a railway crossing or road intersection. Systems should be designed so that the buttons will only be used in an emergency situation.

Door Position

To help ensure system reliability, whether the doors or individual leafs are opened or closed, needs to be accurately monitored by the door safety system.

Detection Systems

Whenever the door is open the Bus Stop Brake is applied and the throttle is returned to idle. The system must detect a 20 mm rod held loosely in the door²⁴. The most critical area of detection is at the base of the door, therefore the 20 mm rod needs to be detected down to the base of the door²⁵. As the base of the door is where passengers are most likely to trap their foot, the reliable performance of the detection system at the base of the door rubber is critical.

Drivers Door Switches

Drivers Door Switches are the open and close switches in the driver's side panel. To avoid accidental operation of the door at higher speeds, these switches should only allow the driver to reopen the doors when the vehicle is moving off from 0 km/hr up to speeds below 10 km/h. The Bus Stop Brake should only be used to stop a moving vehicle in an emergency or critical situation. To ensure that the Bus Stop Brake cannot be used to stop the vehicle from speed, the Drivers Door Switches should only re-activate when the vehicle is stationary.

External Door Open Close Switches

Some operators require that the door can be power opened or closed externally by the driver and therefore external open and close switches are fitted. To reduce the possibility of runaways, the external close switches should only operate if the handbrake is applied. With this option, the external open switch also operates as the external Emergency Exit Switch.

External Dump Switches

An external Dump Switch is an external switch that dumps air pressure from the door and allows the door to go limp. In this situation, to close the door the driver must dump the air and manually push the door closed. To stop bus rollaway, the Bus Stop Brake should remain active unless the handbrake is applied which avoids the situation where the external Dump Switch is pressed, the door goes limp and the driver manually closes the door without applying the handbrake.

The external Dump Switch is also used as the external Emergency Exit Switch.

Internal and External Emergency Exit Switches Function

The interior and exterior Emergency Exit Switches must at all times and irrespective of the operating state of the door control

21 RTA TS 146 Clause 2.9.

22 RTA TS 146 Clause 2.7.

23 RTA TS 146 Clause 2.6.

24 RTA TS146 Clauses 3.1 and 3.4.

25 RTA TS 146 Clause 3.9.

system, allow the doors to be opened or released, as required under Australian Design Rules²⁶.

The primary role of the internal exit switch is to allow passengers to easily and quickly exit the vehicle in an emergency. Therefore internal Emergency Exit Switches should be located at or above eye height and in a highly visible location adjacent to the door aperture.

Action to Release Bus Stop Brake Accelerator or Foot Brake

To help avoid bus rollaway, whenever the Bus Stop Brake has been activated, two actions are required to release the Bus Stop Brake:

The door being fully closed and then either:

- > The activation of the accelerator or
- > The application of the foot brake or
- > The application of the handbrake

This process is used to help ensure that the driver is in the driver's seat when the Bus Stop Brake is released. Some chassis are designed to only release the Bus Stop Brake after the accelerator has been activated. For other chassis the doors can only be closed when the foot brake is activated or the handbrake is applied.

Bus Handbrake

The door safety system needs to monitor whether the driver's handbrake is "off or on". If the vehicle is shut down without the handbrake being applied, the system should alarm to alert the driver. Importantly, the handbrake warning system should still operate even if the driver removes the ignition key and/or activates any Battery Isolation Switch accessible within the driver's cabin.

On some chassis, the vehicle can only be shut down when the handbrake is applied. Use of these systems is encouraged.

Door Closing Force

To avoid potential crush injuries, the closing force that the door(s) can exert on a passenger are critical. Conversely, the force holding the doors closed needs to be such that the doors will not blow open at speed and should be sufficient to stop the doors being forced open either intentionally or unintentionally by a passenger. The limits used by the industry are 150 N closing force with an at speed 300 N holding force.

RTA146 sets maximum forces for the doors when closing at 150 N (15 Kg)²⁷. The EU Regulation No.107⁽⁴⁾, specifies an upper door holding force of 300 N (30 Kg)²⁸.

Door control panels achieve these limits by having maximum air pressure settings for the door cylinder(s). Typically to meet the closing and hold forces, the door control panels operate on high and low air pressure settings which the panels also monitor.

Warning Lights and Alarm

The indicator lights and alarms required are:

Lights

- > Door open light
- > Bus Stop Brake "on" light
- > Door safety system operating OK light
- > Door fault light which can also be the door alarm light.

Audible Alarm

- > An audible alarm is required to operate if the system detects someone or something in the door or a fault occurs.

Door Rubbers

Door rubbers on entrapment systems tend to be harder which then allows the system to detect the 20 mm rod on closing.

Self Monitoring

The Door Safety system should be designed so that it continually monitors its own state of operation and if a fault does occur, the system should also fail to a Safe Mode and the driver should be notified via a suitable alarm or warning.

Door Override or Maintenance Switch


The door safety system is to include an override switch that isolates the system if a malfunction occurs and to allow for maintenance. The system should make it very clear to the driver that the system is overridden. These override systems vary in complexity from buttons that allow the driver to move a defective vehicle from harms way, through to complex type overrides that allow vehicles with defective systems to continue in operation albeit with reduced functionality but increased warnings.

²⁶ RTA TS 146 Clause 2.12.

²⁷ RTA TS146 Clause 2.9.

²⁸ E/ECE/324 Rev.2/Add. 106/Rev.2 16 October 1995

Responsibility demands commitment.



Mercedes-Benz understands the huge responsibility involved in delivering your drivers and passengers every day. It takes a commitment to safety, excellence, consistency and reliability. This commitment is one we've shared with Australian bus companies for more than 90 years. It's a commitment Mercedes-Benz will continue to share in years to come, partnering with industry to deliver continued innovation and a commitment to superior service.

www.mercedes-benz.com.au/bus



Mercedes-Benz

Functions and Components for Non-Entrapment Systems

Bus Stop Brake

The Bus Stop Brake is used to keep the vehicle stopped or stop the vehicle from moving whenever the doors are opened by the driver or by the door safety system itself. The Bus Stop Brake applies partial brake pressure to the service brakes and normally operates up to a speed of 5 to 10 km/h²⁹. Most chassis come with their own speed limited Bus Stop Brake. Chassis either come fitted with their own speed limited Bus Stop Brake or it is fitted by the body builder as part of the bus building process. The Bus Stop Brake should be configured so that it brings the vehicle to a stop within a reasonable distance without endangering standing passengers. Retardation rates of around 30 % G are typical. When the door brake is activated, the vehicles brake lights should also activate.

Accelerator Cut-out

When the doors are opened the accelerator is cut-out so the vehicle cannot be driven away³⁰. If the doors are forced open at speed or a fault or loss of air pressure has allowed the doors to be blown open, to alert the driver that this has occurred the throttle must be cut and the system should alarm.

Driver Emergency Drive Away System

Some operators specify the use of a self-cancelling and speed limiting drive away panic or emergency button. In the event of a system failure, or passengers using the door system to purposely immobilise the vehicle, these buttons allow the driver to move the vehicle out of a dangerous situation, such as a railway crossing or road intersection. These systems should be designed so that the buttons will only be used in an emergency situation.

Door Position

To help ensure system reliability, whether the doors or individual leafs are opened or closed needs to be accurately monitored by the door safety system.

Detection Systems

The primary function of the detection system is to detect if someone or something is caught in the door. Once the system detects any kind of obstruction, the door(s) should reopen and the system should alarm³¹.

Typical systems used to achieve this are sensitive door edges and backpressure systems or alternative technologies such as light beams or acoustic systems.

These detection systems when activated should reopen the doors and be sensitive enough to detect a 20 mm diameter rod loosely held in the door rubber as the door closes³². The most critical area of detection is at the base of the door as this is where passengers are most likely to trap their foot. The 20 mm rod needs to be detected down to the base of the door.³³ The reliable performance of the detection system at the base of the door rubber is critical.

To stop unwanted door openings, detection systems are only activated when the doors have been opened and/or below a set road speed (typically 5 to 10 km/h).

Detection Systems on Opening

Some operators also require the inclusion of detection systems during door opening; this is to stop passengers from being caught between the inward opening door and a fixed part of the vehicle interior. These systems are typically only used on centre or rear doors.

Drivers Door Switches

The Drivers Door Switches are the open and close switches in the driver's side panel. To avoid accidental operation of the door at higher speeds, these switches should only allow the driver to reopen the doors when the vehicle is moving off from 0 km/h up to speeds below 10 km/h. The Bus Stop Brake should only be used to stop a moving vehicle in an emergency or critical situation. To ensure that the Bus Stop Brake cannot be used to stop the vehicle from speed, the Drivers Door Switches should only re-activate when the vehicle is again stationary.

External Door Open Close Switches

Some operators require that the door can be power opened or closed externally by the driver and hence external open and close switches are fitted. To reduce the possibility of bus rollaway, the external close switches should only operate if the handbrake is applied. With this option, the external open switch also operates as the external Emergency Exit Switch.

External Dump Switches

The External Dump Switch is an external switch that dumps air pressure from the door and allows the doors to go limp. In this situation, to close the doors the driver will dump the air and manually push the doors closed. To stop bus rollaway, the Bus Stop Brake should remain active unless the handbrake is applied which avoids the situation where the external Dump Switch is pressed, the doors go limp and the driver manually closes the door without applying the handbrake.

The external Dump Switch is also used as the external Emergency Exit switch.

29 RTA TS146 Clause 2.7.

30 RTA TS146 Clause 2.6.

31 RTA TS146 Clause 2.6.

32 RTA TS146 Clause 3.1 and 3.4.

33 RTA TS146 Clause 3.9.

Internal and External Emergency Exit Switches Function

The interior and exterior Emergency Exit Switches must at all times and irrespective of the operating state of the door control system allow the doors to be opened or released, as required under Australian Design Rules³⁴.

It should be remembered that the primary role of the internal Emergency Exit Switch is to allow passengers to easily and quickly exit the vehicle in an emergency, therefore these switches should be located at or above eye height and in a highly visible location adjacent to the door aperture.

To inhibit passengers from using the internal Emergency Exit Switch to maliciously stop the vehicle, some systems isolate these switch from a speed of 10 km/h.

Action to Release Bus Stop Brake Accelerator or Foot Brake

To help avoid bus rollaway whenever the Bus Stop Brake has been activated, two actions are required to release the Bus Stop Brake:

The door being fully closed and then either:

- > The activation of the accelerator or
- > The application of the foot brake or,
- > The application of the handbrake.

This process is used to help ensure that the driver is in the driver's seat when the Bus Stop Brake is released. Some chassis will only release the Bus Stop Brake after the accelerator has been activated. For other chassis the doors can only be closed when the foot brake is activated or the handbrake is applied.

Bus Handbrake

The door safety system needs to monitor whether the driver's handbrake is "off or on". If the vehicle is shut down without the handbrake being applied, the system should alarm to alert the driver. Importantly, the handbrake warning system should still operate even if the driver removes the ignition key and/or activates any Battery Isolation Switch accessible within the driver's cabin.

On some chassis, the vehicle can only be shut down when the handbrake is applied. Use of these systems is encouraged.

Door Closing Force

To avoid potential crush injuries, the closing force that the door(s) can exert on a passenger is critical. Conversely, the force holding the doors closed needs to be such that the doors will not blow open at speed and should be sufficient to stop the doors being forced open either intentionally or unintentionally

by a passenger. The limits used by the industry are 150 N closing force with an at speed 300 N holding force.

RTA146 sets maximum forces for the doors when closing at 150 N (15 Kg)³⁵. The EU Regulation No.107⁽⁴⁾, specifies an upper door holding force of 300 N (30 Kg)³⁶.

Door control panels achieve these limits by having maximum air pressure settings for the door cylinder(s). Typically to meet the closing and hold forces, the door control panels operate on high and low air pressure settings which the panels also monitor.

Warning Lights and Alarm

The indicator lights and alarms required are:

Lights

- > Door open light
- > Bus Stop Brake "on" light
- > door safety system operating OK light
- > Door fault light and this can also be the door alarm light.

Audible Alarm

- > An audible alarm is required to operate if the system detects someone or something in the door or a fault occurs.

Self Monitoring

The door safety system should be designed so that it continually monitors its own state of operation and if a fault does occur the system should also fail to a Safe Mode and the driver should be notified via a suitable alarm or warning.

Door Override or Maintenance Switch

The door safety system is to include an override switch that isolates the system if a malfunction occurs and to allow for maintenance. The system should make it very clear to the driver that the system is overridden. These override systems vary in complexity from buttons that allow the driver to move a defective vehicle from harms way, through to complex type overrides that allow vehicles with defective systems to continue in operation albeit with reduced functionality but increased warnings.

³⁴ RTA TS146 Clause 2.12.

³⁵ RTA TS146 Clause 3.10.

³⁶ E/ECE/324 Rev.2/Add. 106/Rev.2 16 October 1995



➤ **Section 5**

Ongoing Maintenance,
Safety and Awareness



DRIVING THE SAFETY MESSAGE

**" SAFETY IS AND MUST ALWAYS BE, THE BASIC PRINCIPLE FOR
ALL ENGINEERING DESIGN "**

The basic principle set by Volvo's founders Assar Gabrielsson and Gustaf Larsson is still our guiding star.

SAFETY BASED ON EXPERIENCE. Volvo has worked with safety since the company was founded in 1927. The knowledge we have acquired over the years is an invaluable asset in our continuous development of vehicles that are superior in safety. Not only do we maintain a high level of safety in our products to benefit you, but we also try and improve safety for other road-users that will help make safer roads, safer drivers and safer bus stops.

Find out more about our safety philosophy at
www.volvobuses.com



VOLVO BUSES. DRIVING QUALITY OF LIFE

www.volvobuses.com



Potential of Slip, Trip and Crush Injury

Passengers doors are frequently opened and closed and passengers are continually entering and exiting the buses. Care must be taken to ensure that the moving parts of the door systems are so designed to ensure that passengers cannot get parts of their bodies, including hands and feet or clothing caught, trapped or crushed by either an opening or closing door.

Moving parts of the door mechanisms should not be able to be used as unintended handholds or grab handles by passengers.

Door System Maintenance

The door safety systems outlined in this Advisory have proven to offer a high degree of passenger safety, but also require a high level of maintenance. As such regular testing of the systems is critical as is ensuring that all routine maintenance tasks are completed on the door hardware and all associated systems.

While the actions and professionalism of the driver and the behaviour of the passengers are both critical to vehicle safety, safety systems fitted to buses and coaches should always function as intended. Door safety systems that self monitor system performance and notify the driver if a fault within the system occurs are the preferred types of systems.

All suppliers of door safety systems should provide operators with both detailed maintenance manuals plus functionality check sheets. These check sheets are then to be used during vehicle maintenance to ensure that all safety systems are functioning correctly.

Operators should ensure that they have suitable maintenance programs that involve the following:

- > Regular safety inspections of the door safety system(s) which check that all the functions are operating correctly.
- > Routine maintenance programs for the door mechanisms and hardware as determined by the door supplier such as door gap adjustment, lubrication of moving parts, checking tightness of components and mechanical connections.
- > Given the high frequency of use for any door system and the need for system reliability, planned preventative maintenance programs are recommended. Preventative maintenance programs should involve the planned replacement of key components such as door rubbers, bushing and potentially resetting or certifying of the complete system.

Maintenance Staff Training and Awareness

Training of maintenance staff is seen as critical in the successful operation of the door safety system(s).

It is recommended that maintenance staff be sufficiently trained to allow them to:

- > Undertake the maintenance and servicing functions.
- > Understand how the door system should function.
- > Know what causes the system to alarm.
- > Understand how to reset the system and how to retrieve a vehicle that has encountered a failure in the door system.

Driver Training and Awareness

The door safety system is intended to assist the bus or coach driver in achieving a safe environment for both themselves and the passengers. It should not be overlooked that the safe operation of the vehicle is still reliant on the actions and professionalism of the driver.

Driver training and general awareness of the door safety system functions will help ensure the successful and safe operation of vehicles. It is essential that drivers be appropriately trained in both the use and operation of the door safety system(s).

It is recommended that drivers are sufficiently trained to allow them to understand:

- > How to operate the door system correctly.
- > What the safety features of the system are and how they operate.
- > How the door safety system should function and what causes the system to alarm.
- > What to do when the system alarms.
- > What to do if they encounter a failure in the door system.



➤ **Section 6**

Appendixes



Roads and Traffic Authority of New South Wales

TECHNICAL SPECIFICATION 146

Bus Door Safety Systems

1 Scope

- 1.1 This Specification sets the criteria for the design of a bus door safety system which is intended to prevent passengers from being trapped by a door system in a moving bus.
- 1.2 A door safety system meeting the criteria in this Specification will prevent the bus from moving or stop it, if already moving, which in turn will minimise any chance of injury to a passenger. The door safety system will also limit the door closing force in some positions of the door.
- 1.3 This Specification applies only to buses fitted with a driver controlled door.

2 General Requirements

- 2.1 Each passenger access door shall be fitted with a door safety system as described in this Specification.
- 2.2 The door safety system shall operate:
 - (i) without any driver intervention,
 - (ii) whenever the engine ignition key is in the “on” position,
 - (iii) in the case of a stored energy system, whenever there is sufficient energy to operate the door (see Clause 2.8).
- 2.3 The door system may or may not automatically reopen when the door safety system is activated.
- 2.4 The door safety system shall be capable of detecting a 20 mm diameter rod. Note: the rod is intended to simulate the thickness of the wrist of a child.
- 2.5 The door safety system shall detect the rod at all vertical positions of the rod when placed on the door step up to 1500 mm from the door step.

ISSUED: 16 July 1997

- 2.6 When the rod is detected, the door safety system shall prevent movement of the bus or stop it, if already moving, by:
- (i) mechanically or electronically securing the engine in idle mode and,
 - (ii) applying the brakes on at least one axle or by locking the driveline.
- 2.7 The control of the braking or driveline system shall be designed so that it will not cause the brakes or driveline mechanism to apply while the bus is in motion if there is no controlled operation of the door system. Note: This can be achieved by disarming the brake or driveline control once a preset speed (nominally 10 km/h) has been reached.
- 2.8 The operation of the door safety system shall not affect the compliance of the bus with any Australian Design Rule in particular, any braking rule. If the braking system uses stored energy, the brake system shall be preferentially supplied.
- 2.9 When the door is being closed, the steady force applied to an object which is located at any position up to 1500 mm above the door step shall not exceed 150N when measured from 20 mm to 300 mm from the fully closed position (see Appendix A).
- 2.10 An audible warning and/or visual warning shall be given to alert the driver that the door safety system has activated. If a visual warning device only is installed, it shall be located in the area of the driver's normal driving controls and be marked with or display the word "DOOR FAULT". An audible warning device which reproduces a recorded message shall say in English "DOOR FAULT".
- 2.11 When activated, the door safety system shall only be capable of being deactivated by a reapplication of the door control.
- 2.12 Any emergency door release control or other device fitted to a door system shall not be rendered ineffective by the installation of a door safety system.
- 2.13 The correct operation of the door safety system shall be capable of being readily checked without the use of special tools or dismantling any component. In the case of components which have "normally open" circuits, there shall be a method of automatically checking the integrity of the circuit.
- 2.14 The door safety system shall be capable of operating reliably under the full range of environments likely to be encountered during bus operation. This includes extremes of temperature and cleaning with pressurised water. Note: rubber or plastic components might perform differently over a range of temperatures such as, the flexibility of a door seal.
- 2.15 All components shall be located or designed to minimise the risk of passengers tampering with their operation.

3 Checking the door safety system performance.

- 3.1 Place a 20 mm diameter rod between adjacent door panels in a two piece door system or, in the case of a door closing to one side, between the edge of a door panel and the door frame.
- 3.2 The rod shall be perpendicular to the vertical edge of the door and the end of the rod shall protrude no more than 30 mm beyond the inside surface of the door (see Appendix B).
- 3.3 Close the door using the normal door closing control.
- 3.4 Hold the rod loosely so that when the door makes contact the rod will self-align with the door closing geometry.
- 3.5 Once the rod is detected:
 - (i) the door may or may not automatically reopen,
 - (ii) the engine shall remain at or go to idle speed and be incapable of increasing engine revolutions,
 - (iii) the vehicle shall be immobilised by locking the brakes on at least one axle or by locking the driveline,
 - (iv) an audible and/or visual warning shall be given to alert the driver that the interlock function has operated.
- 3.6 Open the door using the normal door control or in the case of an automatic opening door safety system, operate the door control to release the brakes or driveline lock and throttle control.
- 3.7 Operate the engine throttle and attempt to move the bus to ensure the brakes or driveline lock and throttle control have released.
- 3.8 Close and open the door again to ensure normal vehicle operation.
- 3.9 Check the rod sensing operation at all vertical positions from the rod sitting on the door step up to 1500 mm from the door step.
- 3.10 Using a suitable gauge, check the door closing force between 20 mm and 300 mm to ensure that it does not exceed 150 N at all vertical positions up to 1500 mm from the door step.

Note: In order to assess the correct performance of the door safety system it might be necessary to disarm or override some of the automatic functions.

4 Certification

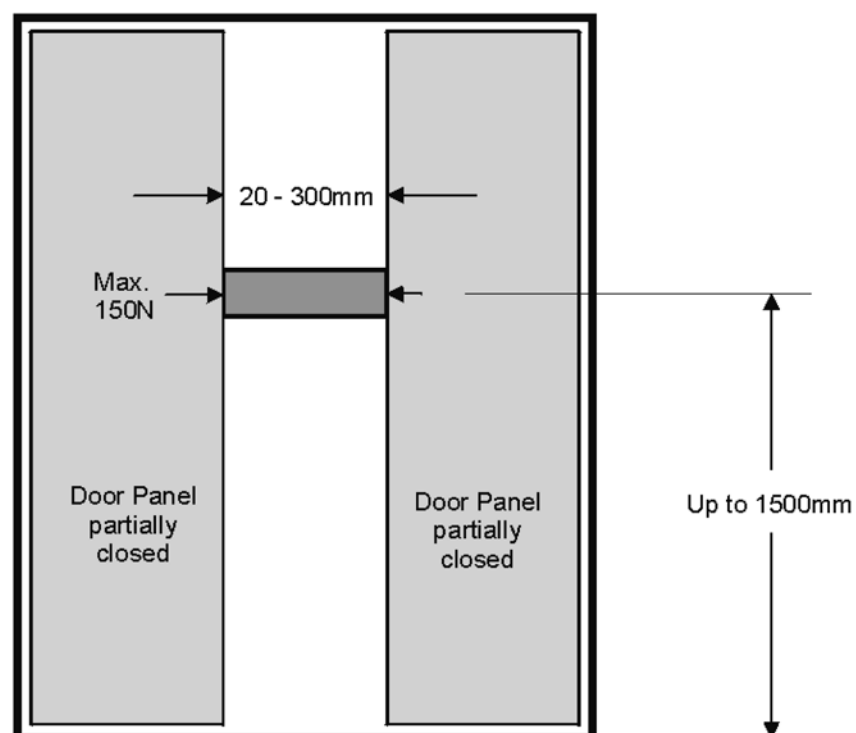
- 4.1 A plate or label made of durable material shall be fitted adjacent to the vehicle manufacturer's Compliance Plate. The plate or label shall display the following information:

The name of the door safety system manufacturer; the person who installed the door safety system and the statement,

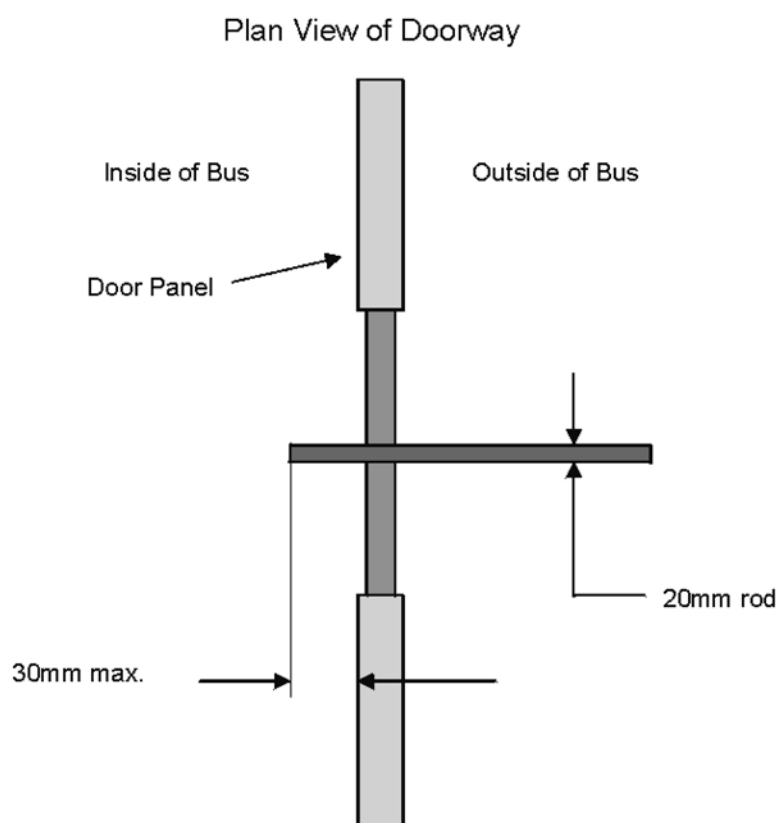
The door safety system fitted to this bus has been manufactured and installed to comply with RTA Technical Specification No. 146 "Bus Door Safety Systems"

- 4.2 Where the door safety system uses the braking system to immobilise the bus, a certification is required by an RTA approved recognised engineering signatory (see Vehicle Standards Information sheet 15, "Recognised Engineering Signatories").

Appendix A Closing force test



Appendix B Detection test



The Australian Public Transport Industrial Association (APTIA) is the industrial arm of the Bus Industry Confederation (BIC). APTIA provides IR advice, express IR News and representation at Fair Work Australia (FWA).

If you are a member of an approved State Association or a direct member of APTIA, you can receive **free** advice at your fingertips, **free** monthly IR Bulletins and **free** express IR News delivered to your in-box, **free** access to the APTIA resource centre and IR manuals exclusive to the APTIA members only area of our website.

For a minor fee, APTIA can also help you with:

- Unfair Dismissal claims and General Protection applications
- Notices of Dispute
- Enterprise Agreement making and lodgement with FWA
- Representation at FWA conciliation involving respondents reply
- Representation at an arbitration in FWA including affidavits and submissions
- Representation at stakeholder meetings



Why Choose APTIA?

- Minimise cost by not having to engage an expensive lawyer without expert industry knowledge
- Business risk is reduced by using specialised industry knowledge of the relevant legislation
- APTIA gives advice that is in line with your company policy and practice
- APTIA can be your Partner in developing company policy and practices so that your company remains up to date with current legislation

Ph: **Ian MacDonald: +61 2 6247 5990** Email: **imacdonald@aptia.com.au** Web: **www.aptia.com.au**

Contact your State Association who can help with referring you to APTIA



Roads and Traffic Authority of New South Wales

TECHNICAL SPECIFICATION 147

Field of View of the Passenger Entrance Doors of a Bus

1. Scope

- 1.1 This Specification addresses the issue of the field of view of all external passenger doors visible to a driver of a bus when seated in the normal driving position.
- 1.2 It is intended to assist the driver from accidentally closing the doors on the passengers when they are entering or leaving the bus.
- 1.3 If there is no direct line of sight to the outside of a door, it is required that one or more mirrors or a video camera system will be used to satisfy the requirements of this Specification.

2. Field of view to the rear

- 2.1 The field of view from the driver's seat shall be evaluated using a set of test cylinders located on the ground near each doorway. Each test cylinder shall be 300 mm in diameter and 400 mm in height.
- 2.2 For each doorway, one cylinder shall be placed in accordance with Appendix A. The cylinder shall be located on the ground outside the bus with the axis of the cylinder 300 mm from the edge of the door step and with its rearmost edge in line with the rearmost edge of the door.
- 2.3 The centre point of an eye location relative to a 25th percentile adult female seated in the driver's seat shall be located as detailed in Appendix B. From this point, the whole of the top surface of every test cylinder for each door shall be visible either directly, via a mirror or a video monitor. This requirement shall be met with all doors closed and with all doors open.
- 2.4 If the driver's seat is adjustable, the requirements described in Clause 2.3 shall be satisfied in all driving positions of the seat (raised & lowered, fore & aft, side to side, where applicable).
- 2.5 The angular size of the longest dimension of the image of the cylinder's disk shall be not less than 30 minutes of arc. Note: (i) This is equivalent to directly viewing a cylinder which is approximately 30 metres away. (ii) See Appendix C for a method of measuring angular size using a template.

ISSUED: 16 July 1997

Note: This Section assumes a single mirror is used or a single video camera is used in place of a single mirror. If two or more mirrors or cameras are used the requirements may be adjusted accordingly provided an equivalent or better field of view is attained.

3. Additional requirements for Mirror Systems

- 3.1 A demister shall be provided for any window, door pane or partition which is viewed through to see the image in the mirror system.
- 3.2 No line of sight from the driver's eye location (see Clause 2.3) shall be more than 30 degrees rearward of a transverse plane through the eye location. Note: This is to ensure that the driver is not required to turn excessively to the rear in order to view the image of any doorway.

4. Additional Requirements for Video Systems

- 4.1 A video camera shall be capable of operating under all lighting conditions, from direct sunlight to night and shall automatically adjust to the prevailing light conditions including short term high and low transients eg. the headlight beam of a passing car.
- 4.2 Black and white monitor images are acceptable.
- 4.3 The image shown shall be in real time and not a stored image.
- 4.4 The video camera shall have a minimum resolution of 380 TVL* horizontal by 420 TVL* vertical.
(* TeleVision Lines)
- 4.5 The monitor shall be mounted so that it is readily visible to the driver. It shall not interfere or obstruct any other driver control or the driver's control of the bus.
- 4.6 If more than one video camera is used in the system and they display on the same monitor, there shall be an interlock system so that a door can only be closed by the driver if the monitor is first displaying the image from the video camera associated with that door when the driver operates the switch to close the door. The monitor shall clearly display on its screen which is the relevant door.
- 4.7 If a more than one video camera is used each with its own monitor, each monitor shall be clearly marked to indicate which door image is displayed.
- 4.8 All components shall be capable of operating reliably under the full range of environments likely to be encountered during bus operation. This includes extremes of temperature and the cleaning of external components with pressurised water. Surface temperatures of 80 degrees Celsius are typically encountered.

5. External lighting

- 5.1 The driver shall have the same quality of image at night in the mirror or video monitor.
- 5.2 Where a mirror system is used, an external light source shall be provided over or around each door.
- 5.3 If the colour of any light is in the visible light spectrum it shall be white.
- 5.4 Any white light shall be positioned or shrouded so that its beam does not affect other road users.
- 5.5 Any white light shall extinguish 15 seconds after the vehicle sets in motion.

6. Location of system components

- 6.1 Where any component used to satisfy the requirements of this Specification is mounted on the exterior of a bus it will be treated as being the same as a standard external rear vision mirror and will not be included when determining the maximum width of a bus for regulation purposes, provided clause 6.2 is met.
- 6.2 The maximum protrusion of any rear view component from the side of the bus shall not be greater than 150 mm unless the components are designed to fold back towards the vehicle body upon any impact. Note: In order to reduce any hazard to a person standing on a footpath consideration should be given to designing the system so that no component is lower than 2000 mm from the ground.
- 6.3 The lines of sight of the mirror or video system shall be such that they are not obstructed by any object, pillar, rail, partition, internal or external fitting, luggage or passenger, other than passengers who are getting on or off the bus.

7. Certification

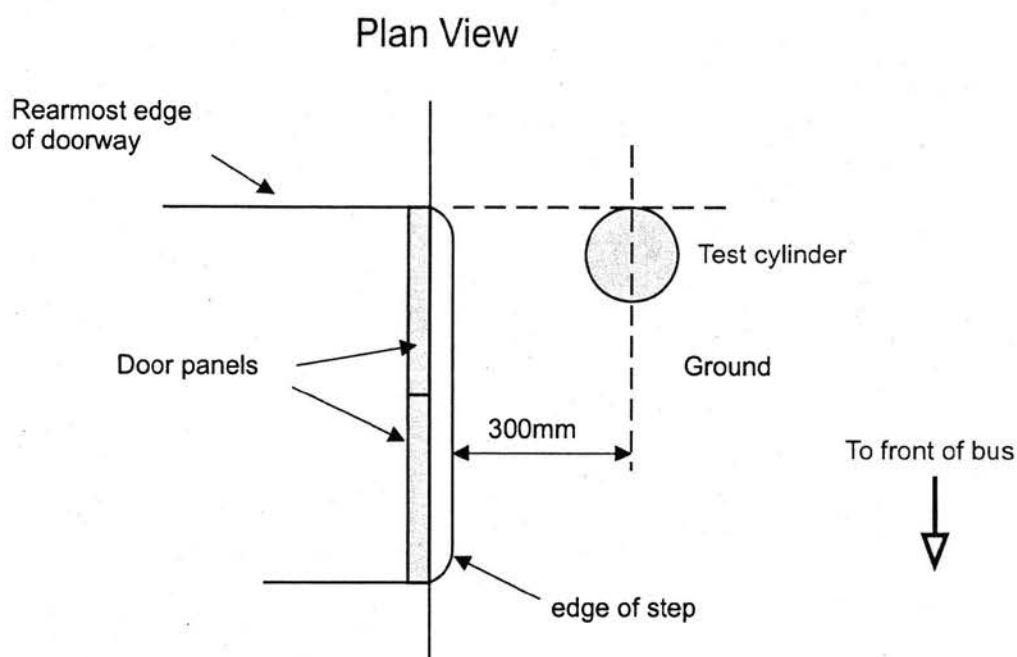
A plate or label made of durable material shall be fitted adjacent to the vehicle manufacturer's Compliance Plate. The plate or label shall display the following information:

The name of the field of view system component manufacturer; the person who installed the field of view system and the statement,

The doorway field of view system fitted to this bus has been manufactured and installed to comply with RTA Technical Specification No. 147 "Field Of View Of The Passenger Entrance Doors Of A Bus"

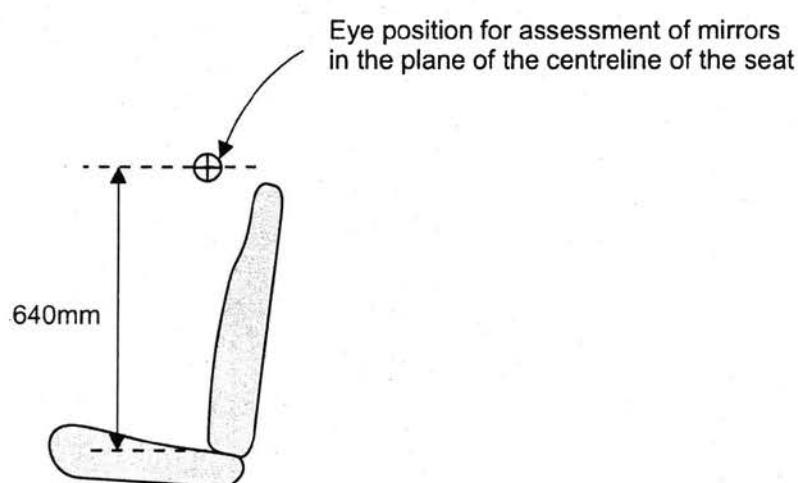
Appendix A

Location of Test Cylinder for each Door



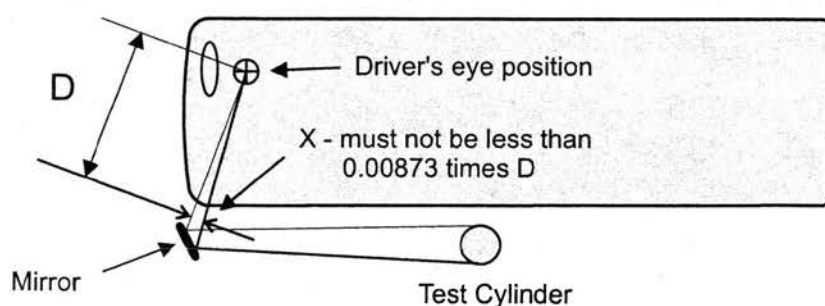
Appendix B

Approximation for Driver's Eye Position



Appendix C

A method of testing the angular size of an image



Runaway Buses Information Procedure

NSW Transport and Infrastructure (NSWTI) is concerned at the number of incidents involving runaway buses, whereby bus drivers have incorrectly relied on the front door brake interlock system to act as a bus Parking Brake to secure a bus. This practice has the potential to cause serious or fatal injury and should be discontinued immediately.

The attached Bus Safety Alert outlines the correct procedure for securing a bus and should be issued by bus operators to all drivers as a reminder that they should not under any circumstances:

- (i) leave the bus without correctly securing the bus via the bus Parking Brake; and
- (ii) access the bus control mechanism/s via the driver's window.

NSWTI, in consultation with the NSW Bus and Coach Association, unions, the Roads and Traffic Authority and WorkCover, has developed a safety message in the form of an adhesive double-sided sticker to be affixed in a visible position. The requirement to affix the safety stickers to all buses and to distribute the Bus Safety Alert to all drivers forms part of the bus operator accreditation and audit program.

The sticker must be affixed on the lower half of the driver's side window on all buses. The safety message on the inside of the bus will be:

"Parking brake must be applied before leaving seat"

The safety message on the outside of the bus will be:

"Do not access bus through window"

Note: This instruction applies to all operators and all drivers. No exemptions are available or will be granted.

Operators can purchase the safety stickers from the NSW Bus and Coach Association.

 **8839 9500**

 Locked Bag 13, NORTH PARRAMATTA NSW 1750

Note: *Stickers are available to both members and non-members of the BCA.*

BUS SAFETY ALERT

ISSUE: **Runaway Buses**

SA 01/01 **July 2001 – reprinted 2004, revised September, 2009**

A runaway bus, whether in the bus depot or on a public road, has the potential to cause serious or fatal injury, and significant damage to property and assets.

To prevent these serious incidents from occurring, it is essential that bus drivers correctly secure their bus by applying the **Park Brake** before leaving the driver's seat.

Note:

It is not acceptable to rely upon an open front, centre and or rear door (therefore utilising a door brake interlock system) or the bus stop brake to secure the bus.

There are engineering systems in place, which are designed to prevent incidents of runaway buses. These are, however, not substitutes for drivers' vigilance in ensuring that the Park Brake is always applied before leaving the drivers seat.

Bus drivers, as professional drivers, are responsible for their own and others' safety arising out of their work. Correctly securing your bus before exiting is part of this responsibility.

All runaway bus incidents must be reported immediately to management who must notify NSW Transport and Infrastructure via the Bus Incident Management Database (and OTSI and the Police, when required).

INSTRUCTION

- Before leaving the driver's seat, you must apply the park brake and check that it is correctly engaged.
- Where a bus is fitted with an external door close control, you must use this to close the bus.
- You must not close the bus doors by reaching switches from outside the bus through the driver's side window.
- Under no circumstances should you access the bus controls via the driver's window.



Bus Industry Confederation Members

ASSOCIATIONS

Bus & Coach Association (SA)
 Bus & Coach Association of NZ
 BusVic
 BusNSW
 BusWA
 Queensland Bus Industry Council
 SA Bus Association
 TasBus
 UITP (International Association of Public Transport)

URBAN BUS GROUP

Australian Transit Enterprises
 Brisbane Transport
 Buslink Australia
 ComfortDelGro Cabcharge
 Greyhound Australia
 Transit Australia Group
 Transit Systems Australia
 TransLink
 Veolia Transdev Australasia

BODY MANUFACTURERS

Bus & Coach International
 Bustech
 Chiron Commercial Vehicles
 Custom Coaches
 Express Coach Builders
 Heavy Vehicles Australia
 Higer Bus & Coach
 IRIZAR Oceania
 Peninsula Yutong Buses
 Scania Australia
 Volgren Australia Corporation

CHASSIS MANUFACTURERS

Alexander Dennis
 Asia Motors Australia
 Bus & Coach International
 Bustech
 Denning Manufacturing
 Heavy Vehicles Australia
 Higer Bus & Coach
 Hino Bus
 IVECO
 MAN Automotive
 Mercedes-Benz Australia Pacific
 Peninsula Yutong Buses
 Scania Australia
 Volvo Australia

AIR CONDITIONING MANUFACTURERS

Air-Pac (AUST)
 Coachair Australia
 Cooltek Asia Pacific
 Denso Automotive Systems Australia
 QTK Group
 Transit Refrigeration & Air Conditioning

SEAT MANUFACTURERS

McConnell Seats
 StyleRide Seating Systems

ASSOCIATED SERVICE PROVIDERS

ABC Underwriting
 Airbags Australia
 Aldridge Electrical Industries
 ALIB Businsure
 APN Outdoor
 Armbro Insurance Brokers
 Bandag/Bridgestone
 Bus Advertising
 Bus Cover
 Bus Finance Australia
 Coachworks
 Continental Tyres
 Cooper Grace Ward Lawyers
 Cummins Engine Company
 Davidson Trahaire Corpsych



Festo
Firestorm Fire Protection
Fleet Pro Bus and Coach Repairs
Fry's Spares
Gunnebo Australia
Heritage Finance
Hobson Engineering
Holdsworth Australasia
Hopwood Integrated Training
INIT
International Cleaning Services
Into Training Australia
IVU Traffic Technologies AG
John Gilbert Australasia
Kevrek
Mobitec Australia
Money Resources Group
Multispares
National Australia Bank
National Biodiesel
Newcastle Commercial Vehicles
OAMPS Insurance Brokers
O'Brien Glass Industries

Parts Supply Solutions/Hanover
Displays
Pitcher Partners Advisors
Powerdown Australia
Reatex Marketing (Aust)
Sika Australia
SMC Pneumatics Australia
Special Transport Solutions
Thoreb Australia
Transfab
Transit Training Solutions
Transport Training ACT
Trapeze Group
Vehicle Inspection Systems
Wabtec Australia
Westpac
Whitehorse Truck and Bus
Yara Australia
ZF Services Australia

ATPIA MEMBERS

Australian Transit Enterprises
Australian Transit Group
BusVic
BusNSW
BusWA
Forest Coach Lines
Greyhound Australia
Murray's Australia
Queensland Bus Industry Council
SA Bus Association
TasBus
Transit Australia Group
Transit Systems Australia
Ventura Bus Lines
Veolia Transdev Australasia
WA Road Transport Association

To become a Member of BIC, call us on 02 6247 5990 or go to our website and download the membership kit at **www.ozebus.com.au**

National and State Bus and Coach Association Contact Details

Bus Industry Confederation

PO Box 6171
KINGSTON ACT 2604

Contact: Michael Apps
Tel: (02) 6247 5990
Fax: (02) 6273 1035
Email: enquiries@bic.asn.au



BusNSW

Locked Bag 13
NORTH PARRAMATTA NSW 1750

Contact: Darryl Mellish
Tel: (02) 8839 9500
Fax: (02) 9683 1465
Email: dmellish@busnsw.com.au



SA Bus Association

PO Box 139
ALDGATE SA 5154

Contact: Lauran Huefner
Tel: 0410 422 040
Email: lheufner@sabus.asn.au



UITP

PO Box 258
Brunswick VIC 3056

Contact: Rob Pearce
Tel: (03) 9077 4046
Email: rob.pearce@uitp.org



Bus WA

239 Star Street
WELSHPOOL WA 6106

Contact: Wally Gargano
Tel: (08) 9355 3022
Fax: (08) 9355 3122
Email: wally@warta.com.au



Bus and Coach Association

PO Box 1126
PROSPECT EAST SA 5082

Contact: Agnes Wong
Tel: (08) 8269 1077
Fax: (08) 8269 1087
Email: bcasa@bcasa.asn.au



BusVic

PO Box 125
PORT MELBOURNE VIC 3207

Contact: Chris Lowe
Tel: (03) 9645 3300
Fax: (03) 9645 4455
Email: clowe@busvic.asn.au



QLD Bus Industry Council

PO Box 324
STONES CORNER QLD 4120

Contact: David Tape
Tel: (07) 3397 1700
Fax: (07) 3397 1766
Email: Manager@qbic.com.au



TasBus

33 Forbes Street
DEVENPORT TAS 7310

Contact: Geoff Lewis
Tel: (03) 6423 2611
Fax: (03) 6423 2614
Email: glewis@tasbus.com.au



Bus & Coach Association of New Zealand

PO Box 9336
WELLINGTON NZ

Contact: Philip Manning
Tel: +64 4 499 7334
Fax: +64 4 499 7353
Email: info@busandcoach.co.nz







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

