National Heavy Vehicle Regulator

National Roadworthiness Baseline Survey 2017 – A Health Check of Australia's Heavy Vehicle Condition

Prepared for

National Heavy Vehicle Regulator
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Glossary

Acronyms	
ABS	Australian Bureau of Statistics
CAPI	Computer Assisted Individual Interview
HV	Heavy Vehicle
HVNL	Heavy Vehicle National Law
NRBS	National Roadworthiness Baseline Survey
NHVAS	National Heavy Vehicle Accreditation Scheme
NHVIM	National Heavy Vehicle Inspection Manual
NHVR	National Heavy Vehicle Regulator

Technical Glossary	
Axle	One or more shafts positioned in a line across a vehicle, on which one or more wheels intended to support the vehicle turn.
Axle group	A single axle group, tandem axle group, twinsteer axle group, tri-axle group or quad-axle group.
B-double	A combination consisting of a prime mover towing two semitrailers, with the first semitrailer being attached directly to the prime mover by a fifth wheel coupling and the second semitrailer being mounted on the rear of the first semitrailer by a fifth wheel coupling on the first semitrailer.
Combination	A group of vehicles consisting of a motor vehicle such as a prime mover or rigid truck towing one or more other vehicle units such as a semi-trailer or trailer.
Consultation	Communicate or engage with persons through appropriate methods (face-to-face, email, meetings etc.).
Coupling	A device used to couple a vehicle in a combination to the vehicle in front of it.
Dog trailer	A trailer (including a trailer consisting of a semitrailer and converter dolly) that has: • one axle group or a single axle at the front that is being steered by connection to a towing vehicle by a drawbar; and • one axle group or a single axle at the rear.
Hauling Unit	A motor vehicle that forms part of a combination, but does not include a trailer.
Heavy Vehicles	Vehicles that have a gross vehicle mass (GVM) or aggregate trailer mass (ATM) greater than 4.5 tonnes.
Inspection	An Inspection is an assessment of a vehicle against a set of standards to determine compliance to the standards. Its components and subsystems are examined to determine if their jurisdiction complies with the applicable design and operating standards.
Inspection Form	The data collection survey form aligned to the NHVIM which is designed to record the outcome of an Inspection for the purpose of the National Roadworthiness Baseline Survey
Inspection Operation	Inspections for the purpose of the National Roadworthiness Baseline Survey
Inspection Service Provider (ISP)	Organisation undertaking safety Inspections of Heavy Vehicles, usually a jurisdiction
Inspection Type	Inspections categorised by specific tasks and processes
Inspector	A skilled person engaged by an ISP to examine Heavy Vehicles to identify non-conformities which would render the vehicle unsafe
Investigate	Conduct a detailed examination or enquiry, especially officially, in order to find out about something or somebody
Jurisdictions	Australian State and Territory Road Authorities

National Heavy Vehicle Accreditation Scheme (NHVAS)	NHVAS is voluntary and open to operators who can demonstrate a record of compliance with heavy vehicle regulation and standards. Operators can apply for accreditation under several NHVAS modules.
Non-conformity	Systems and components on a Heavy Vehicle that contravenes the Heavy Vehicle Safety Standards, or part that does not perform its intended function, or has deteriorated to such an extent that it cannot be reasonably relied upon to perform its intended function
Defect notice	Issued to the operator of a Heavy Vehicle by an Inspector who after conducting an Inspection, reasonably believes that the vehicle is a non-conforming Heavy Vehicle and the use of the vehicle on a road poses a safety risk
Registration Authorities	The Australian state or territory government agencies that currently undertakes registration related business
Road train	A B-triple; or A combination, other than a B-double, consisting of a motor vehicle towing at least two trailers, excluding any converter dolly supporting a semitrailer.
Semitrailer	A trailer that has: • one axle group or a single axle towards the rear; and • a means of attachment to a prime mover that results in some of the mass of the trailer's load being imposed on the prime mover.
Special purpose vehicle (SPV)	A motor vehicle or trailer, other than an agricultural vehicle or a tow truck, built for a purpose other than carrying goods; or A concrete pump or fire-engine.
Survey Partner	The contracted party engaged to assist the NHVR and the Jurisdictions deliver the National Roadworthiness Baseline Survey
Trailer	A vehicle that is built to be towed, or is towed, by a motor vehicle, but does not include a motor vehicle being towed.
Truck	A rigid motor vehicle built mainly as a load carrying vehicle.

Survey Glossary	
Computer assisted personal interviewing (CAPI)	Where the survey data is entered using a computer. Inspectors entered the survey into a tablet during the inspection.
Quota	The required number of sample items (i.e., vehicles), for the overall survey and for specific sub-groups.
Random sampling	Selection of units where each unit has equal probability of being selected.
Standard deviation	A measure of variation in the distribution of results, as a distance from the mean; it is determined by taking the square root of the average of the squared deviations of a distribution of scores or results.
Statistical significance	A pre-determined probability level. A significance level of .01 or less has been applied generally—meaning that there is a 99% probability that the differences are real.
Statistical test	To assess the probability, or likelihood, that differences in results for sub-groups are great enough that it is unlikely to be due to chance.
Unweighted data	Results from the survey without any manipulation, or weighting, of the representation of the vehicle units.
Weighting	Applying a multiplier to individual sub-groups in the survey so that the resulting distribution matches that of the target population.
Weighted data	Results from the survey after weighting has been applied, to represent the target population.

1. Introduction

1.1 Background

The National Heavy Vehicle Regulator (NHVR) administers a set of laws for heavy vehicles (over 4.5 tonnes gross vehicle mass) under the Heavy Vehicle National Law (HVNL).

The NHVR was directed by state and territory ministers to undertake and accelerate the Roadworthiness Program which is a series of projects aimed at supporting reduction in the impacts of unroadworthy heavy vehicles on safety, the economy and the environment.

The National Heavy Vehicle Roadworthiness Program is being undertaken to implement a risk-based approach for assurance about adherence to vehicle standards by inspecting heavy vehicles on a common basis.

Data on the results of inspections is collected by jurisdictions in varying degrees; however there is no national dataset that can be used to determine the current mechanical condition of the heavy vehicle fleet or be used to understand its effect on adverse road safety outcomes.

The objective of the National Roadworthiness Baseline Survey (NRBS) was to gather sufficient information about the Australian heavy vehicle fleet to judge the mechanical condition and to guide the identification of causal factors that may result in adverse outcomes. The project was undertaken to provide a national baseline for the condition of the heavy vehicle fleet against which future reform initiatives will be measured and it is a first step towards a nationally consistent inspection approach. The foundation for this consistent approach is the use of the National Heavy Vehicle Inspection Manual (NHVIM) to describe the non-conformity identified. It is the first time that a survey of this type has been undertaken across the nation.

The NRBS is the broadest, most well-resourced and comprehensive assessment of the condition of the Australian heavy vehicle fleet ever undertaken.

It was designed to identify the condition of a range of vehicle components and subsystems that may contribute to an increased risk of an incident and could potentially result in congestion, environmental damage, serious injury or death. The data will also inform the development of a targeted, risk-based heavy vehicle inspection regime and identify high risk category components, subsystems, vehicles or operators (e.g. vehicle age, load type or industry sector).

Western Australia (WA) and Northern Territory (NT) do not operate under the HVNL. While both states agreed to participate in the Roadworthiness Program, including the NRBS, resourcing constraints in Western Australia resulted in their inability to participate.

1.2 Survey overview

The NRBS included inspections of 7,130 vehicles across all states and territories, other than WA. The survey provides substantial information about the state of the heavy vehicle fleet. While WA was not included, there is sufficient consistency in the results, and in particular the three states with the largest vehicle populations — Victoria (VIC), New South Wales (NSW), and Queensland (QLD)—to consider that the overall results of the survey would be consistent with the inclusion of WA.

1.3 Survey objectives

As a baseline survey the NRBS establishes a point-in-time snapshot which will support future surveys, providing a suitable basis to build on. The NRBS also provides an avenue for improvement in the roadworthiness of the Australian heavy vehicle fleet, including providing industry with information about opportunities for improvement.

The NHVR set a number of specific objectives for the project:

- assess the roadworthiness of the Australian heavy vehicle fleet through planning, coordinating and managing the conduct of a program of inspections on a recommended statistical basis;
- plan, coordinate and manage the conduct of sufficient inspections to establish the extent to which the heavy vehicle fleet meets Heavy Vehicle Standards;
- collect, analyse and report on the findings, results and outcomes of the data collected;
- work with inspection service providers to ensure sufficient inspections are conducted and performed to assess vehicle safety in a manner that allows comparison between vehicle types and location;
- ensure data is recorded and analysed during the survey in the agreed timeframe to monitor quality;
- work with inspection service providers to conduct a program of inspections of randomly selected vehicles using a standardised process, completing an approved inspection form, and reporting the findings from the data collected, as well as on the process itself;
- apply management process to the selection of vehicles and conduct of inspections to ensure the validity and reliability of the survey results for analysis and reporting on an Australia-wide comparison.

1.4 Terminology

A glossary is presented at the front of this document to define technical language and common terms used throughout the report.

In order to achieve a consistent basis for analysis the severity of a non-conformity was classified in line with the HVNL. A non-conformity describes an item that does not meet the heavy vehicle safety standards. The classifications, in order of increasing severity, are described below:

- A **formal written warning** is where the vehicle standard non-conformity does not pose a safety risk, but should be rectified.
- A **minor** non-conformity creates a concern over the safety of a vehicle, and subject to conditions, does not prevent the vehicle from being used on the road.
- A **major** non-conformity creates a significant concern over the safety of a vehicle, and subject to conditions and restrictions of use, does not prevent the vehicle from being used on the road.
- A **major (grounded)** non-conformity creates critical concern over the safety of a vehicle and the vehicle must not be used on a road while the non-conformity exists.

The use of this classification was not to align with the categorisation of a Defect Notice; it was to rank the non-conformity in line with a recognised definition. As the NRBS was a research activity designed to take a snapshot of the mechanical condition of Australia's Heavy Vehicle fleet, the categorisation identified on a corresponding Defect Notice may not reflect the data captured for the purpose of the survey. Each non-conformity was classified in isolation, rather than being classified as the safety risk of the aggregate impact of all non-conformities identified on the vehicle combination.

The report analyses three vehicle categories:

- **Hauling unit**: the motorised unit of the vehicle combination (which may or may not be towing a trailer), including:
  - Rigid truck with no trailer (also includes a prime mover running bob-tail)
  - Prime mover
  - Bus/Coach
  - Plant/SPV.
- **Trailer**: the non-motorised unit attached to the hauling unit.
- **Vehicle combination**: where the hauling unit is towing a trailer, including:
  - Rigid truck and trailer
  - Semi-trailer: prime mover with one trailer
  - B-double: prime mover with two trailers
  - Road train: rigid truck with three or more trailers and prime mover with two or more trailers.

Vehicle categories were further divided into:

- **Freight**:
  - Rigid truck
  - Semi-trailer
  - B-double
  - Road train.
- **Non-freight**: the other vehicle categories
  - Bus/Coach
  - Plant/SPV.
- **Articulated:** semi-trailer, B-double or road train.

1.5 Survey process

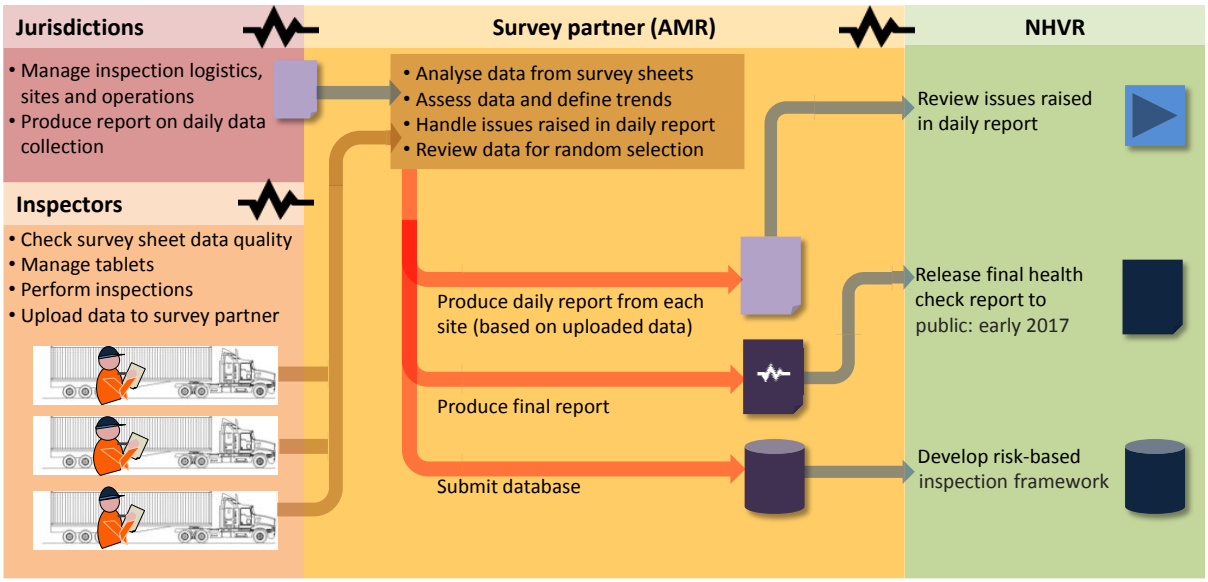
1.5.1 Consultation and management

The NHVR consulted extensively with jurisdictions nationally and with industry to explain the rationale and objectives of the survey, along with details of implementation, to demonstrate the value of the survey and address any concerns about the impact of its implementation.

The overall management approach involved three key stakeholders (Figure 1):

- **Jurisdictions**: to manage the inspection logistics, perform inspections and record the survey data.
- **AMR**: as the survey partner, to set up the survey method, consult with the jurisdictions on scheduling, address issues with data collection through the survey period, provide daily reports on progress, and analyse and report on the results.
- **NHVR**: to coordinate the survey implementation and liaise with the jurisdictions to address any logistical issues.

Figure 1-1.
Summary of survey management process



1.5.2 Inspection modes

Three main modes of selection of vehicles for inspection were implemented in the survey:

- **roadside intercept,** principally for rigid trucks, truck and trailer combinations and articulated vehicle combinations, as well as plant vehicles, where relevant;
- **present-for inspection (PFI) – by invitation**, principally for buses, coaches and plant vehicles, including visiting the operator depot or having the vehicle come to an inspection station; and
- **present-for inspection (PFI) – by periodic inspection**, for all types of vehicles, but again particularly for buses, coaches and plant vehicles.

1.5.3 Final survey numbers and shifts

The final number of vehicles inspected was 7,130, which was 415 over the original total quota of 6,715 (Table 5). Some of the over-sampling, however, was for freight vehicles from the present-for inspection mode, which was required to represent no more than 7% of freight vehicles inspected. A more detailed breakdown of the quotas and sample achieved after final cleaning of the data is shown in Appendix C.

Table 1-1.
Overall survey numbers vs. overall quotas by state of inspection

State of Inspection	Quota	Surveyed	Difference	Comment
NSW	1635	1761	+126	
VIC	1730	1917	+187	
QLD	1585	1696	+111	
SA	1050	983	-67	(under-sampling of plant/SPV)
TAS	290	316	+26	
NT	255	241	-14	(under-sampling of plant/SPV)
ACT	170	216	+46	(over-sampling of PFI)
TOTAL	**6715**	**7130**	**+415**	

The final numbers of inspections for vehicle categories inspected in each state are shown in Table 1-2. Results for sub-groups with sample sizes of less than 30 have been highlighted. Results for these sub-groups have not been reported separately in the detailed results in the tables and charts.

Table 1-2.
Sample sizes for vehicle categories by state of inspection

VEHICLE TYPE	STATE OF INSPECTION NSW	VIC	QLD	SA	TAS	NT	ACT
	n	n	n	n	n	n	n
Vehicle units							
Rigid truck	854	792	756	419	175	110	121
No trailer	*772*	*706*	*655*	*380*	*158*	*104*	*110*
Truck & trailer	*82*	*86*	*101*	*39*	*17*	*6*	*11*
Semi-trailer	286	362	279	178	65	30	21
B-double	159	284	195	122	29	4	9
Road train	60	8	59	51	0	43	0
Articulated	*505*	*654*	*533*	*351*	*94*	*77*	*30*
Bus/Coach	247	242	265	136	34	51	40
Plant/SPV	155	229	142	77	13	3	25
Total vehicle units	**1761**	**1917**	**1696**	**983**	**316**	**241**	**216**
Trailers	**876**	**1043**	**972**	**622**	**140**	**233**	**50**
TOTAL UNITS	*2637*	*2960*	*2668*	*1605*	*456*	*474*	*266*

As more than one team could be working at a single site, the final number of shifts was estimated by counting the number of days that each tablet, for recording the survey data electronically, was used. This led potentially to underestimating shifts in NSW where some sites involved 24-hour operation. The estimated total was 1,049 shifts.

1.5.4 Vehicle systems

Non-conformities have been reported for the vehicle systems covered in the NHVIM to provide a consistent way of reporting (Table 1-3). For this purpose, components under *Section 14: Trailers* were aligned with the substantive systems (*Section 2: Brakes*, etc.).

Table 1-3.
Categories of non-conformities in the NHVIM

Categories of non-conformities	
Section 2	Brakes
Section 3	Couplings
Section 4	Steering and Suspension
Section 5	Wheels, Tyres and Hubs
Section 6	Structure and Body
Section 7	Seats and Seatbelts
Section 8	Lights and Reflectors
Section 9	Mirrors
Section 10	Windscreens and Windows
Section 11	Engine, Driveline and Exhaust
Section 12	LPG and NG Vehicles
Section 13	Buses
Section 14	Trailers

1.5.5 Survey method and presentation of results

A detailed description of the survey method is presented in Appendix B, including the steps taken to *weight* the survey data to represent the heavy vehicle population.

The NHVR engaged a statistical consultant, Data Analysis Australia (DAA), to recommend a sample size and sampling method to ensure the data collected was valid and reliable. This approach included over-sampling states and vehicle groups with a smaller share of the vehicle fleet. Weighting involved applying a multiplier to individual sub-groups in the survey so that the resulting distribution matched that of the target heavy vehicle population. In general, the weighted results are presented in this report.

1.5.6 Tests of statistical significance

Test of statistical significance were conducted to assess whether differences in the incidences of non-conformity between groups of vehicles in the survey (e.g., comparing results for different states, or comparing results for different vehicle categories) should be considered as real differences or just occurring by chance. Three main types of tests were used:

- simple chi-square tests of differences between groups on non-conformities;
- Analysis of Variance (ANOVA), to measure differences in results reported as averages; and
- General Linear Modelling (GLM), to take into account the influence of more than one factor on non-conformity (e.g., vehicle category and age of vehicle).

Where a difference is confirmed, it is described as *statistically significant*. More detail about the statistical analysis is presented in Appendix B.

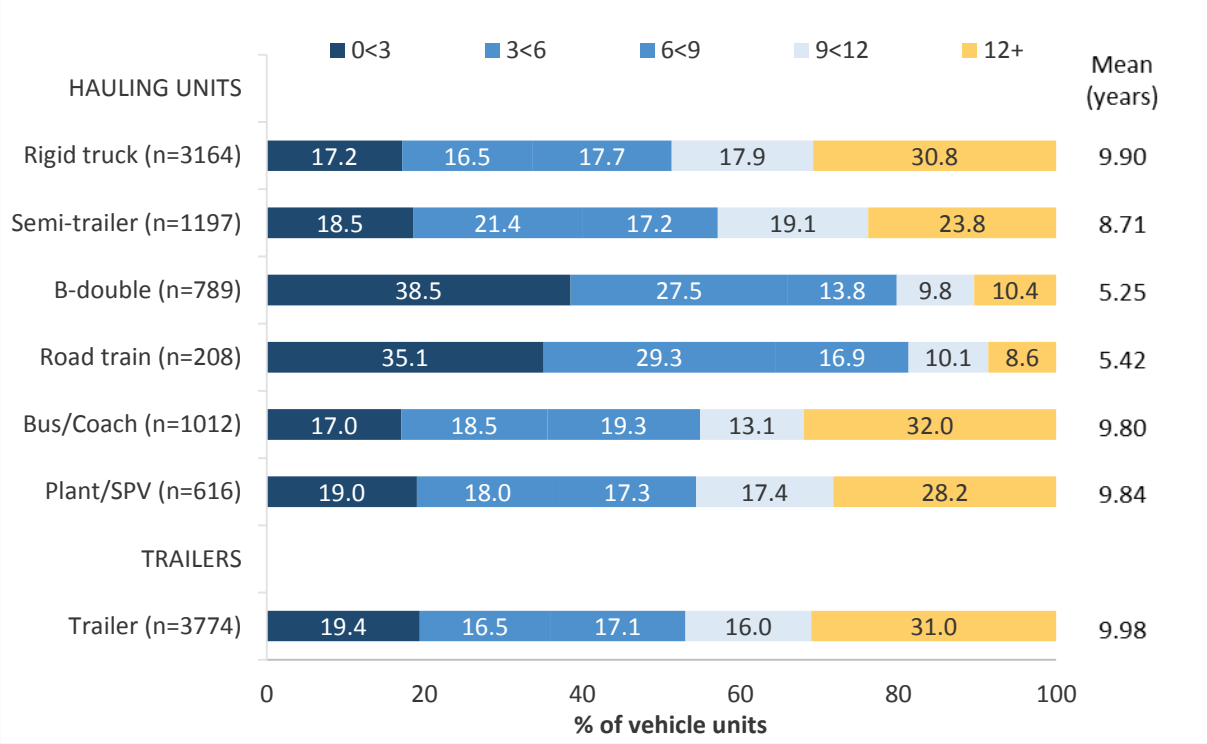
2. Key findings

2.1 Age of vehicle

2.1.1 Age profile of fleet identified

Vehicle age had been found in earlier compliance surveys conducted in NSW to be strongly associated with the incidence of non-conformities. A profile of age of vehicle units in the NRBS was assessed to provide context to the roadworthiness results. Age was also considered when assessing relationships between other factors and non-conformity (Figure 2-1).

Figure 2-1
Age profile of hauling units and trailers (year groups)



Note: Adding percentage results may give a rounding error of ±0.1% on the total

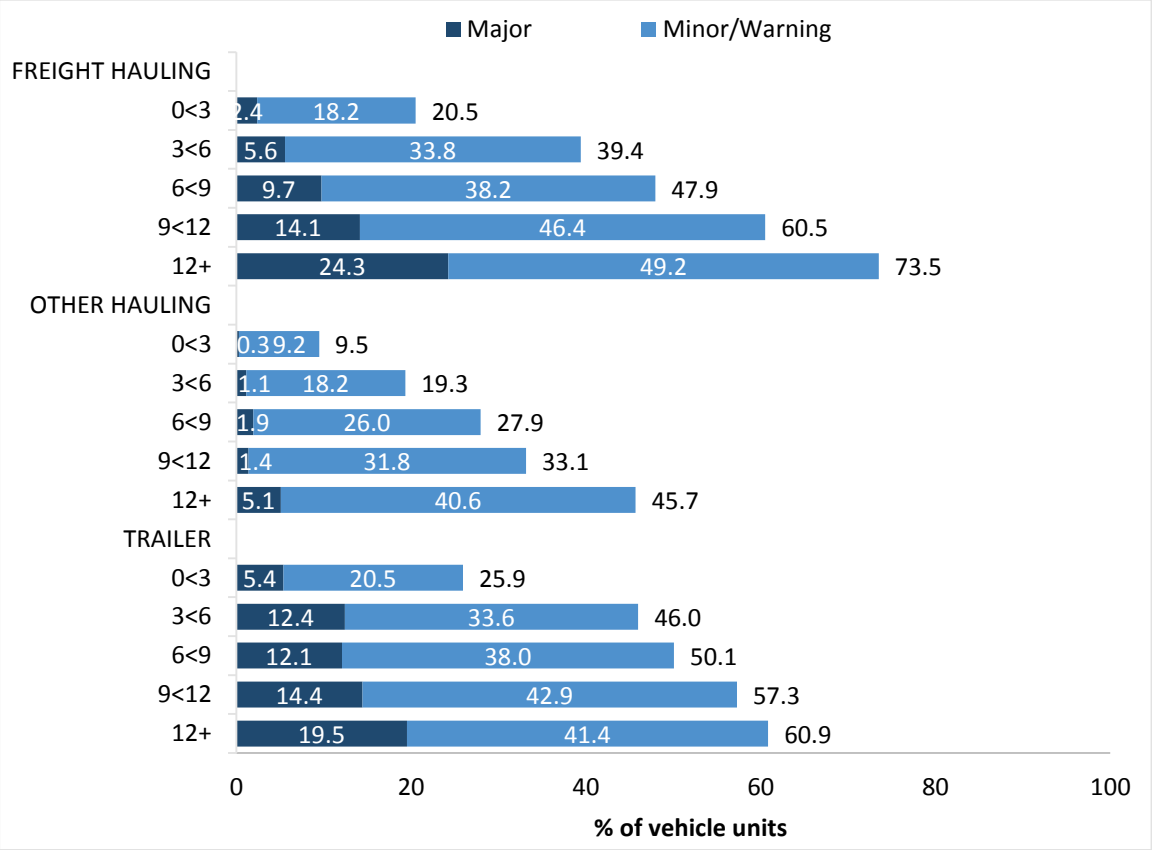
The age of each unit was calculated based on the date of manufacture, referenced to the survey day for the unit. Over a quarter (29.2%) of total units were assessed to be 12 years and older, and close to half (46.0%) of total units were assessed to be 9 years and older.

B-double and road train hauling units were the newest, with the average age below 5.5 years. Rigid trucks, buses/coaches, plant/SPV and trailers were the oldest, with an average exceeding 9.0 years. Over a quarter of each of these latter units were 12 years and older.

2.1.2 Relationships between age and non-conformity identified

The relationship between age and non-conformity was assessed for freight hauling units, other hauling units and trailers for five age groupings (Figure 2-2).

Figure 2-2
Incidence of highest categorised non-conformities among vehicle units by age (year groups)

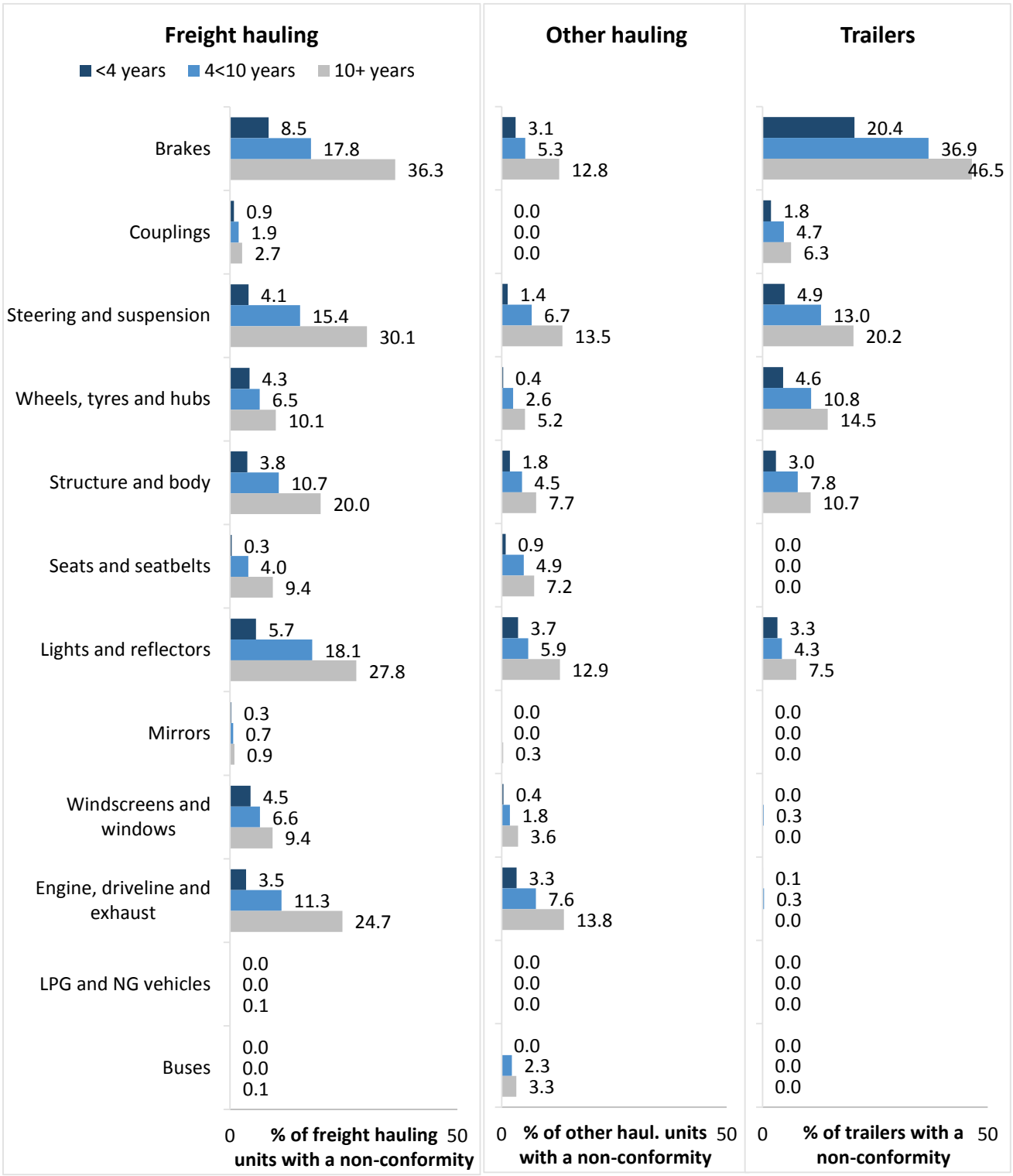


Note: Adding percentage results may give a rounding error of ±0.1% on the total

A strong positive relationship was found between the age of a unit and the incidence of non-conformities. The findings demonstrated that the incidence of non-conformities increased with age. Trailers had a higher non-conformity rate for the newest group (25.9% in the 0<3 years grouping), while freight hauling units showed the greatest increase with age (from 20.5% for 0<3 years up to 73.5% for 12+ years age). This outcome was similar for increases in major non-conformities.

Non-conformities were assessed for 12 main vehicle systems covered in the NHVIM, to have a consistent way of reporting the non-conformities identified. The figure below shows that the increase in the incidence of any classification of non-conformity (i.e. formal warning, minor or major) occurred consistently with age for the 12 systems, including brakes, and steering and suspension (Figure 2-3).

Figure 2-3.
Incidence of any system non-conformity in freight hauling units, non-freight hauling units and trailers, by age



Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

The incidence was greatest for brake non-conformities for trailers aged 10 years and over (46.5%). The four systems with the highest incidences for units aged 10 years and over were:

- brakes: trailers (46.5%) and freight hauling units (36.3%);
- steering and suspension: freight hauling units (30.1%);
- lights and reflectors: freight hauling units (27.8%); and
- engine, driveline and exhaust: freight hauling units (24.7%).

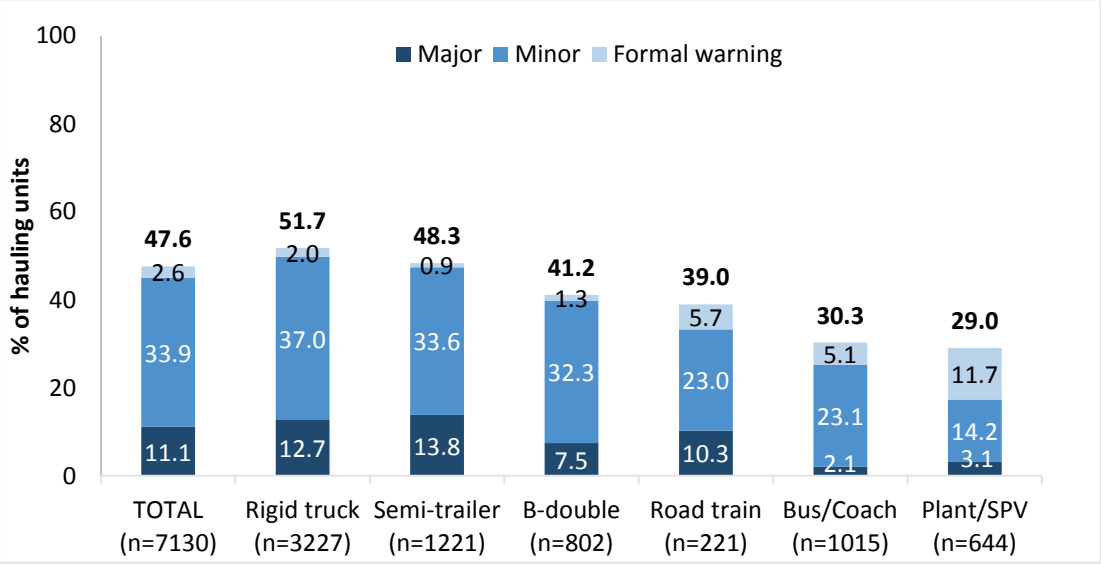
2.2 Vehicle types

The highest non-conformity in each vehicle type was analysed. The most frequent highest classified non-conformity was found to be minor; that is, where the non-conformity creates a concern over the safety of a vehicle and, subject to conditions, does not prevent the vehicle from being used on the road.

2.2.1 Hauling unit non-conformities identified

The figure below identifies the percentage of hauling unit vehicle types with non-conformities where the highest non-conformity classification on the hauling unit is presented (Figure 2-4).

Figure 2-4.
Incidence of highest level of non-conformity for hauling units by classification



Note: Adding percentage results may give a rounding error of ±0.1% on the total

Overall, close to half of hauling units (47.6%) were found to have a non-conformity, with over three-quarters of non-conforming units having a minor non-conformity as the highest classification.

The incidence of one or more non-conformities was highest for rigid truck hauling units (51.7%) and the prime mover in a semi-trailer combination (48.3%). The incidence of non-conformities was lower for the hauling unit in B-double (41.2%) and road train (39.0%) combinations, and lowest for bus/coach (30.3%) and plant vehicles (29.0%).

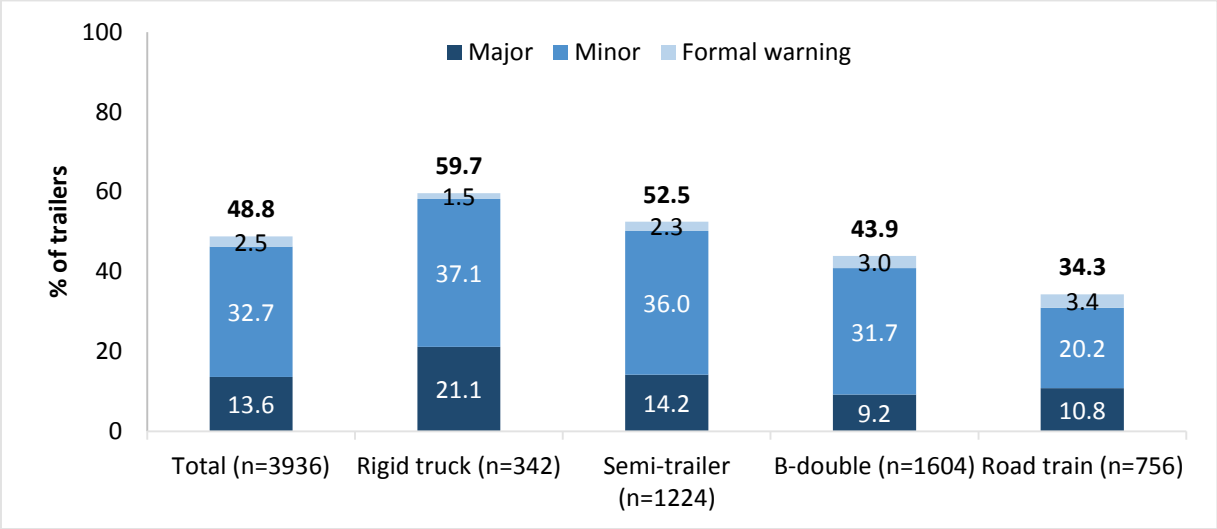
Among the freight hauling units, the decreasing non-conformity rate with increasing size of vehicle combination was consistent with decreasing average age.

About one in nine hauling units (11.1%) had a major non-conformity. In contrast, a formal warning made up the greatest percentage of the highest level of non-conformity for plant hauling units, representing over a third of non-conforming units (11.7% out of 29.0%).

2.2.2 Trailer non-conformities identified

The figure below identifies the percentage of trailers with non-conformities where the highest non-conformity classification on the trailer is presented (Figure 2-5).

Figure 2-5.
Incidence of highest level of non-conformity for trailers, by classification*



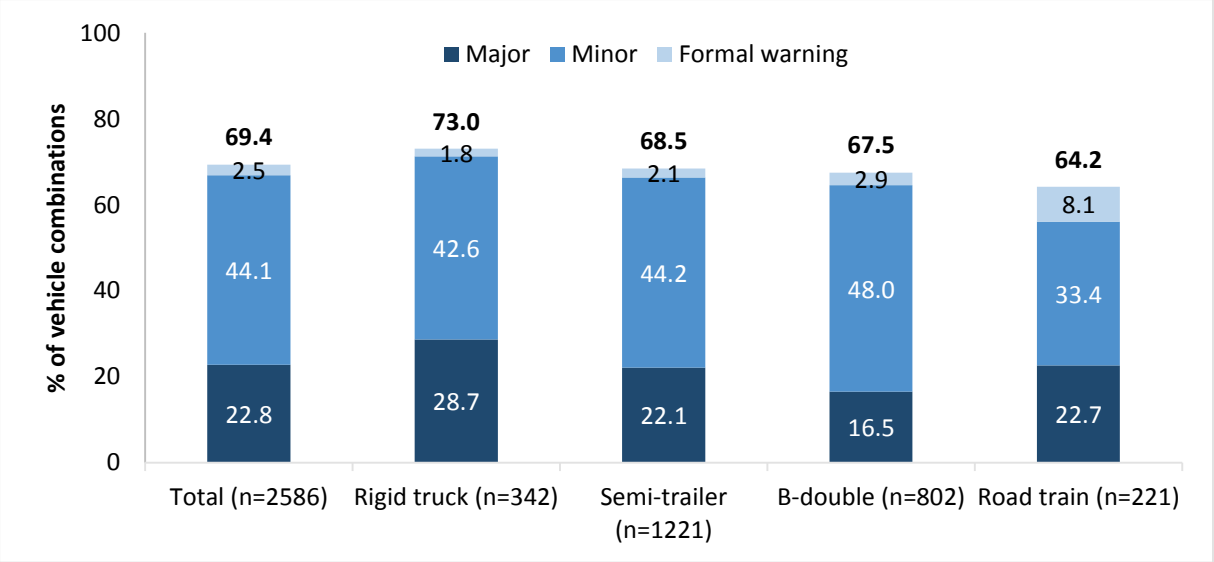
**10 trailers with bus/coach or plant vehicles are included in the total*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Overall, about half (48.8%) of trailers were found to have a non-conformity. The incidence of non-conformity decreased for trailers with the size of freight combinations. This outcome was similar to that identified for freight hauling units. The highest incidence of non-conformities was among trailers in rigid truck and trailer combinations (59.7%), and the lowest among trailers in road train combinations (34.3%). About one in seven trailers (13.6%) had a major non-conformity, representing about a quarter of units with a non-conformity.

2.2.3 Vehicle combination non-conformities identified

The figure below identifies the percentage of freight vehicle combinations with non-conformities where the highest non-conformity classification on the vehicle combination is presented (Figure 2-6).

Figure 2-6.
Incidence of highest level of non-conformity for vehicle combinations by category



Note: Adding percentage results may give a rounding error of ±0.1% on the total

The highest incidence of overall non-conformity was in the rigid truck and trailer vehicle combinations, at close to three-quarters (73.0%), including over a quarter with a major non-conformity.

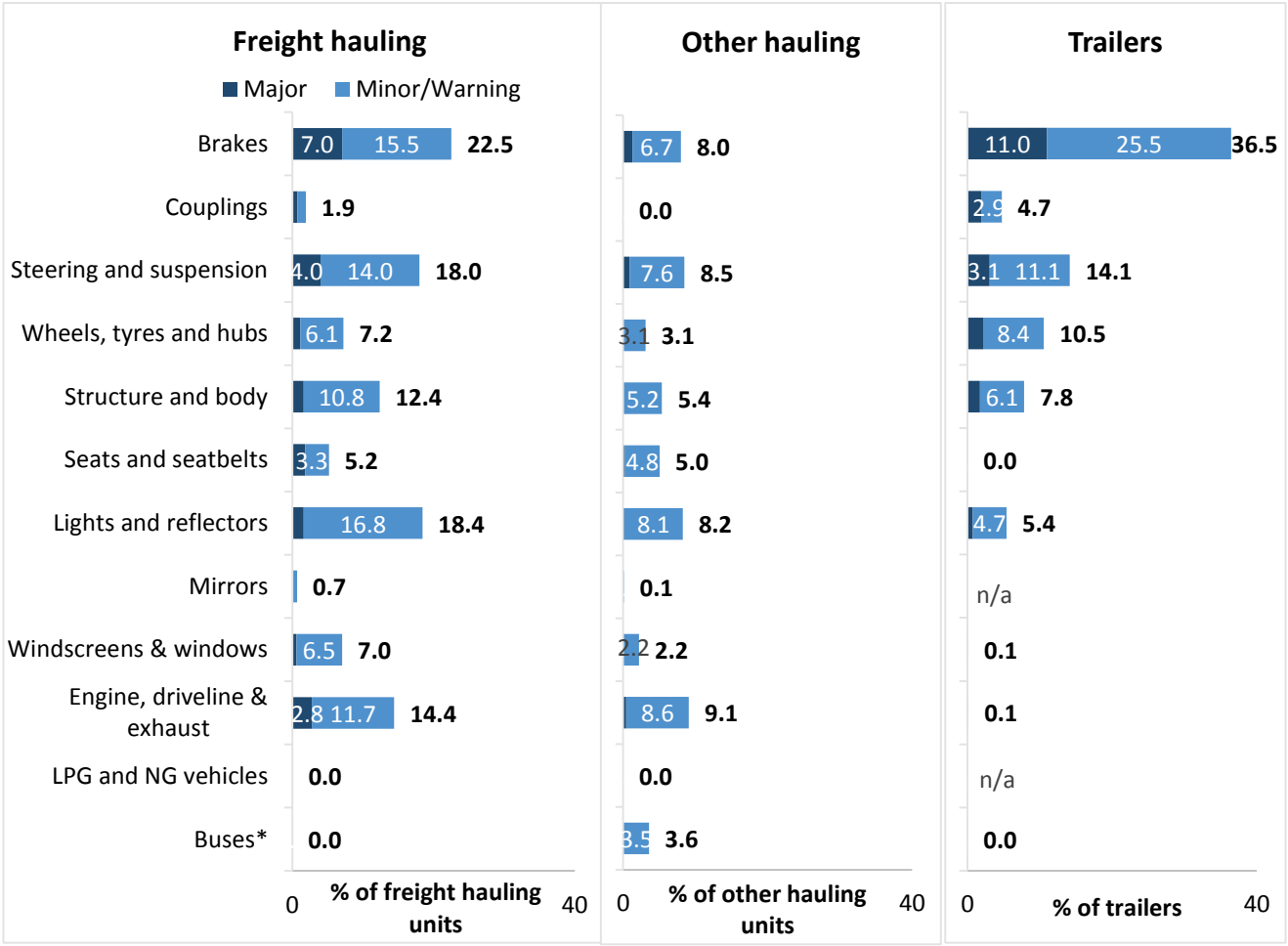
The incidence of any non-conformity increased substantially for articulated combinations compared with the hauling unit alone, as a result of also including non-conformities in the additional trailers in the combination. The rate was higher for semi-trailers (68.5%, up from 48.3%) and B-doubles (67.5%, up from 41.2% for the hauling unit), and marginally lower for road trains (64.2%, up from 39.0%). About a fifth of these three types of vehicle combinations had a major non-conformity (ranging from 16.5% to 22.7%).

The level of non-conformity for truck and trailer combinations tended to be high compared with the larger combinations, considering the combination included only one trailer. B-doubles and road trains in vehicle combinations have more units, and it would be expected that the incidence of non-conformity of the combination would be higher. A trend was found for the non-conformity rate per unit to be lower for three-unit and four-unit combinations compared with two-unit combinations.

2.3 Vehicle systems

Non-conformities were assessed for 12 main vehicle systems covered in the NHVIM, to have a consistent way of reporting the non-conformities identified. The figure below shows the incidences of non-conformity for the different systems, for groupings of freight hauling units, other hauling units and trailers (Figure 2-7).

Figure 2-7.
Incidence of highest level of non-conformity for vehicle systems, by broad category of unit



Note: Major and minor/warning incidences <2% are not labelled
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit
Note: Adding percentage results may give a rounding error of ±0.1% on the total

A brake non-conformity was the most common type for non-conforming vehicle systems among freight hauling units and trailers, including for over one-third (36.5%) of trailers and about a quarter (22.5%) of freight hauling units.

The four systems with the highest incidence of non-conformities for freight hauling units were:

- brakes (22.5%, including 7.0% major);
- lights and reflectors (18.4%, including 1.6% major);
- steering and suspension (18.0%, including 4.0% major); and
- engine, driveline and exhaust (14.4%, including 2.8% major).

Brakes were also the most common system non-conformity for trailers. The four systems with the highest incidences were:

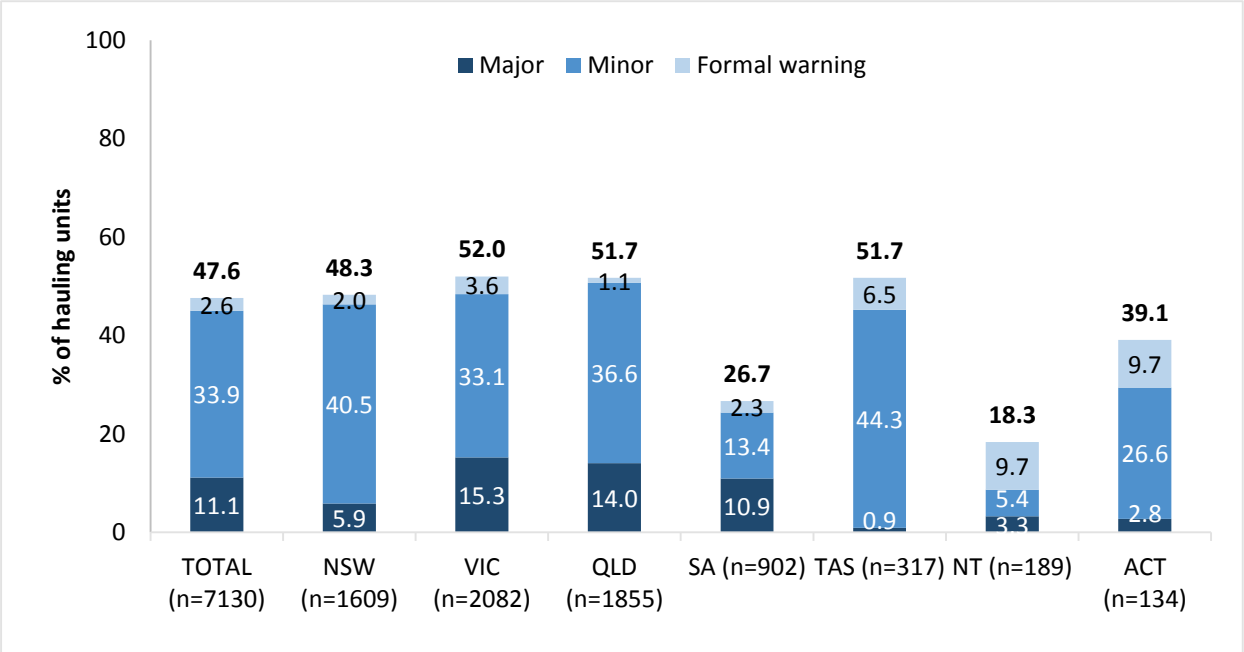
- brakes (36.5%, including 11.0% major);
- steering and suspension (14.1%, including 3.1% major);
- wheels, tyres and hubs (10.5%, including 2.1% major); and
- structure and body (7.8%, including 1.7% major).

2.4 Non-conformity category and state of registration

2.4.1 Hauling unit non-conformity category by state of registration

The figure below shows the incidence of the highest level of non-conformity for hauling unit categories by state of registration of the unit (Figure 2-8).

Figure 2-8.
Incidence of highest level of non-conformity for hauling units by state of registration*



**42 hauling units registered in WA are included in the total*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

The large majority of hauling units were inspected in their state of registration. About half of hauling units were non-conforming for NSW, VIC, QLD and TAS (ranging from 48.3% to 52.0%). The incidences were lower in particular for SA (26.7%) and NT (18.3%) units, and below average for the ACT (39.1%).

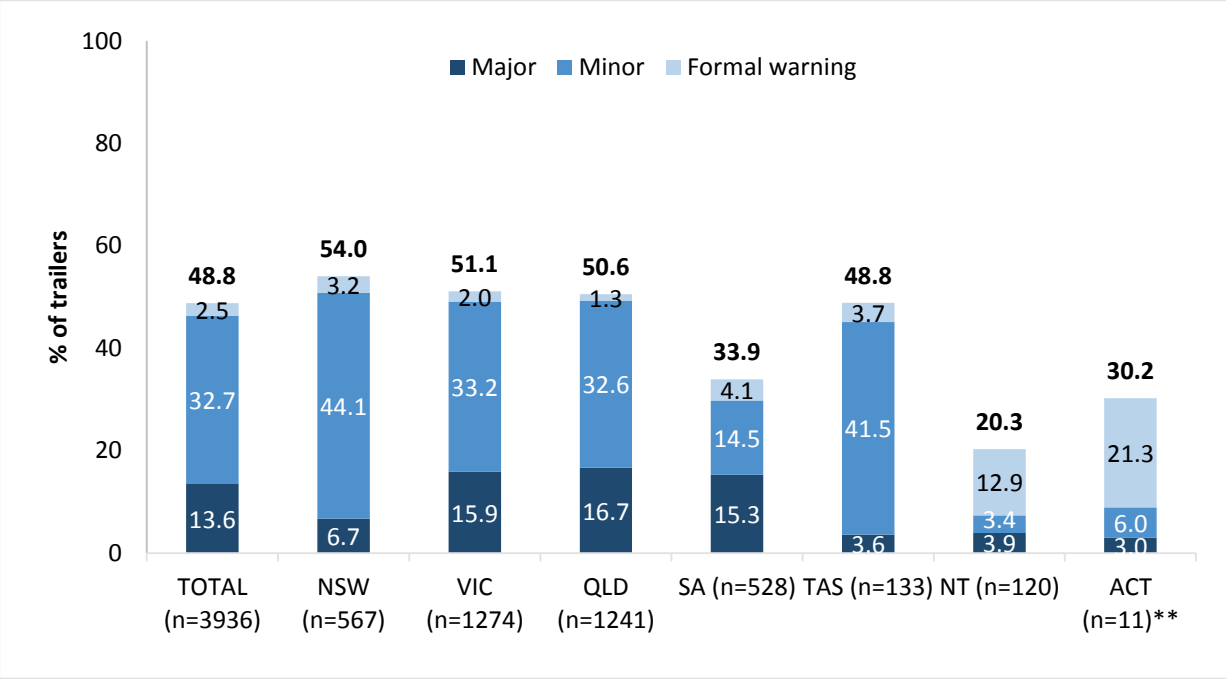
The larger states had comparable result when identifying overall non-conformities (regardless of classification), and as such it is suggested that the difference in the results is more likely to be associated with varying inspection practices and therefore variation in classification or identification of non-conformities. Further analysis of the incidences of non-conformities in vehicles registered in SA (which had a suitable number of inspections for analysis) and inspected in SA compared with those inspected outside SA indicated that the overall incidence in SA was relatively low. The lower incidence was primarily among minor non-conformities.

A formal warning was more prominent among hauling unit non-conformities particularly in NT but also in the ACT. The proportion of non-conforming units where the highest level of non-conformity was major was relatively high for SA (40% of non-conforming units).

2.4.2 Trailer non-conformity category by state of registration

The figure below shows the incidence of the highest level of non-conformity for trailers by state of registration of the unit.

Figure 2-9.
Incidence of highest level of non-conformity for trailers by state of registration*



**62 trailers registered in WA are included in the total*
***Small sample size*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

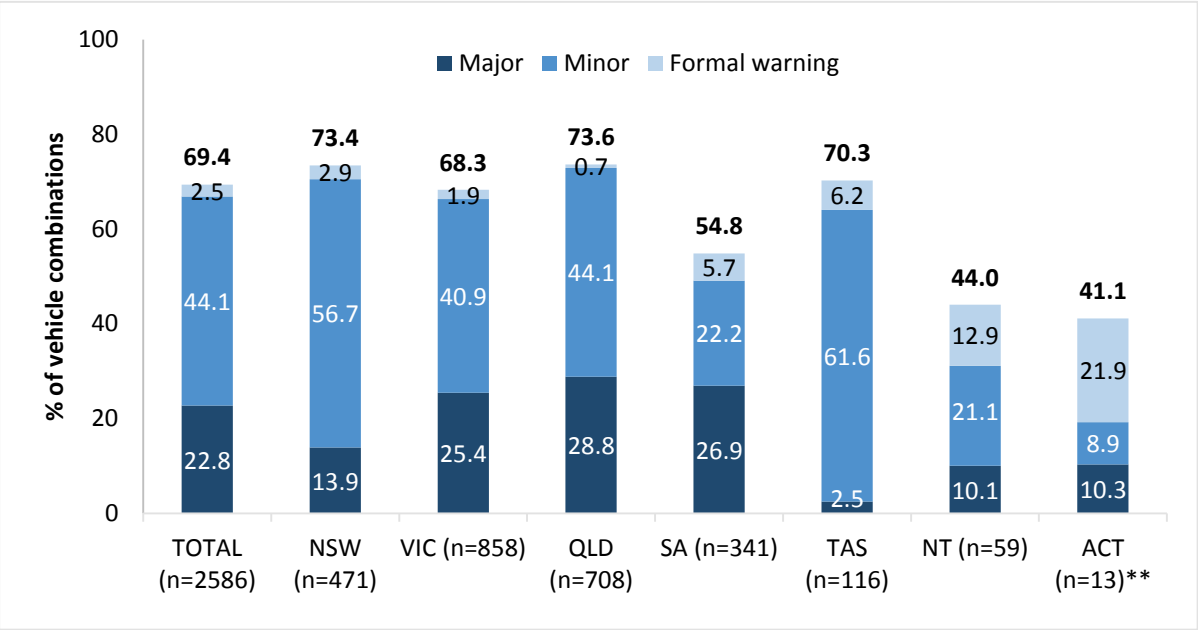
The outcome for non-conforming trailers, as for hauling units, showed broadly higher incidences in NSW, VIC, QLD, and TAS, with about half the trailers being non-conforming. There was an additional trend in SA for the rate to be higher than for hauling units for SA vehicles (33.9% vs 26.7%). A formal warning was more prominent among trailer non-conformities in NT (and also in the ACT, although this was based on a very small sample size). The proportion of non-conforming trailers where the highest level was major was again relatively high for SA (45% of non-conforming trailers).

The incidence of overall non-conformity for TAS and NSW was generally consistent with the overall national incidence. A larger proportion of these non-conforming units, however, were made up of minor non-conformities, compared with other states with a similar overall rate of non-conformity (i.e., VIC and QLD).

2.4.3 Vehicle combination non-conformity category by state of registration

The figure below shows the incidence of the highest level of non-conformity for freight vehicle combinations by state of registration of the hauling unit (Figure 2-10).

Figure 2-10.
Incidence of highest level of non-conformity for combinations by state of registration of hauling unit*



**20 combinations where the hauling unit was registered in WA are included in the total*
***Small sample size*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

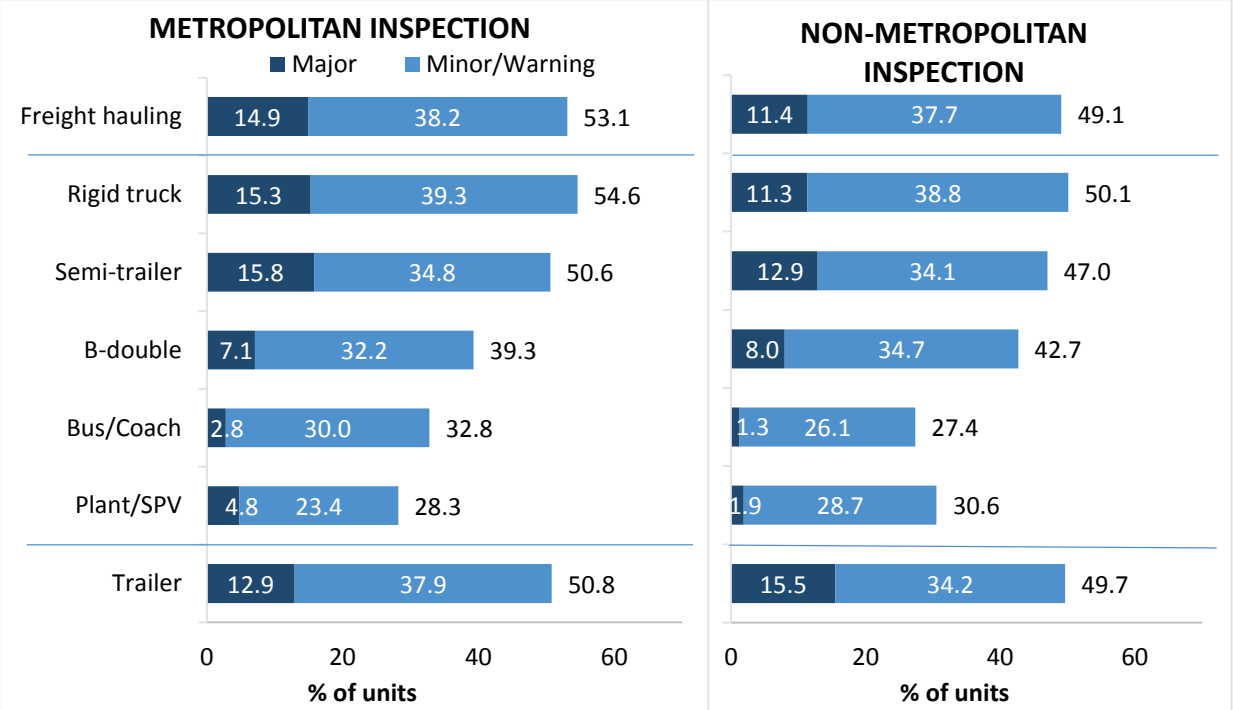
The outcome of non-conformities for vehicle combinations by state of registration was also similar to the one for non-conforming hauling units.

The outcome for vehicle combinations showed increases in incidences in non-conformity over the hauling unit alone. (The exception was in the ACT, although this was based on a very small sample size for combinations). The proportion of non-conforming combinations where the highest level of non-conformity was major was again very high for SA (49%).

2.5 Metropolitan and non-metropolitan

The figure below shows the incidence of non-conformities in hauling units and trailers by metropolitan and non-metropolitan inspection locations.

Figure 2-11.
Incidence of highest level of non-conformity in hauling units and trailers by region (NSW, VIC, QLD and SA)



Note: Adding percentage results may give a rounding error of ±0.1% on the total

Overall, freight hauling units were marginally more likely to have a non-conformity in metropolitan areas (14.9% vs. 11.4% for a major non-conformity, and 53.1% vs. 49.1% for any classification of non-conformity). This margin of difference was consistent for rigid trucks and semi-trailers in particular. At this overall level, B-doubles did not follow the same trend, having a marginally lower overall incidence in metropolitan areas (39.3% vs. 42.7%).

2.6 Participation in compliance schemes

2.6.1 Participation

Participation of drivers or vehicles was assessed for three specific schemes: the National Heavy Vehicle Accreditation Scheme (NHVAS)–maintenance module, TruckSafe–maintenance and CraneSafe.

Table 2-1.
Participation of hauling units in alternative compliance schemes (weighted %s)

SCHEME	Freight	Articulated	Rigid truck	Semi-trailer	B-double	Road train	Bus/ Coach	Plant/ SPV	Trailers
	%	%	%	%	%	%	%	%	
NHVAS – Maintenance	12.5	37.7	5.9	26.6	53.7	61.2	0.0	2.0	34.1
TruckSafe – Maintenance	0.3	0.5	0.2	0.5	0.7	0.0	0.0	0.0	0.4
CraneSafe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.7	0.0
Total (nett) participation	***12.6***	***37.9***	***5.9***	***26.8***	***54.1***	***61.2***	***0.0***	***25.7***	***34.4***

Note: There can be participation in more than one scheme
Note: Adding percentage results may give a rounding error of ±0.1% on the total

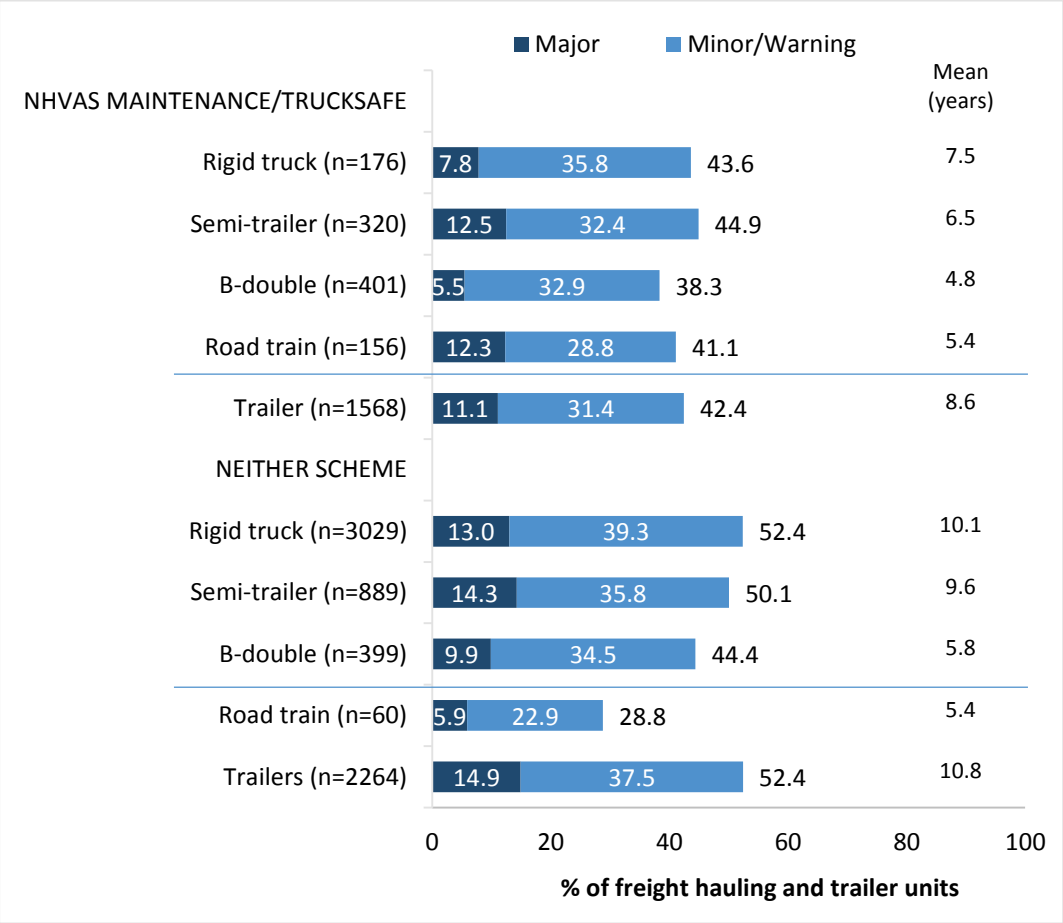
About one in eight (12.6%) freight hauling units, were participating in the NHVAS maintenance scheme or the TruckSafe scheme, with the large majority in the former. Participation was greatest for road trains (61.2%), decreasing for B-doubles (54.1%), semi-trailers (26.8%), and rigid trucks (5.9%). Over a third (34.4%) of trailers were participating.

Participation in CraneSafe represented about a quarter (23.7%) of plant/SPV drivers or vehicles, and was close to half (46%) of cranes in the survey.

2.6.2 Non-conformity category comparison between key freight hauling units by scheme participation

The figure below shows the incidence of non-conformities for freight hauling vehicle categories by participation in the NHVAS maintenance scheme or TruckSafe.

Figure 2-12.
Incidence of highest level of non-conformities by participation in schemes for freight hauling units



Note: Adding percentage results may give a rounding error of ±0.1% on the total

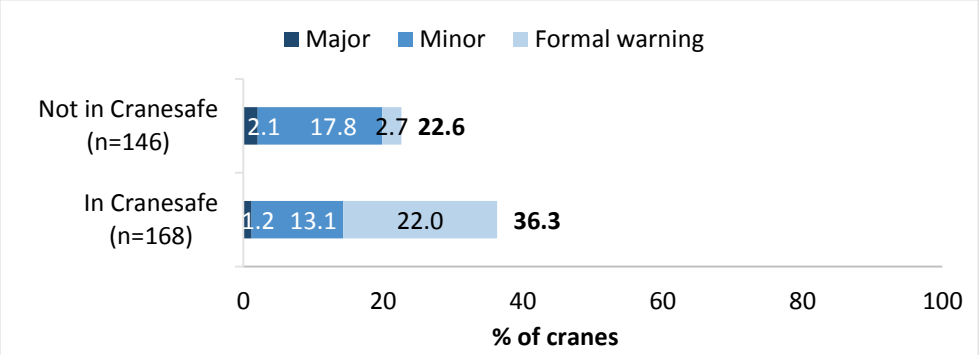
The overall incidence of non-conformity was lower for rigid truck, semi-trailer and B-double hauling units, as well as trailers, participating in either of the NHVAS or TruckSafe schemes compared with non-participation, although relatively low for the small group of non-participating road train hauling units.

It was, however, found that the units in these schemes, other than road train hauling units, were on average newer, which suggested that the lower non-conformity identified could be associated with age. An overall lower rate was not confirmed when taking into account additional variables, including age. A higher incidence for road trains participating in a scheme, however, was maintained.

2.6.3 Non-conformity category comparison by participation in CraneSafe

The figure below shows the incidence of non-conformities for cranes by participation in CraneSafe.

Figure 2-13.
Incidence of highest level of non-conformity by participation in CraneSafe (unweighted)



Note: Adding percentage results may give a rounding error of ±0.1% on the total

The incidence of the highest level of non-conformity being minor or major was marginally lower for participation (14.3%) than non-participation (19.9%). The incidence of any classification of non-conformity, however, was found to be higher among participating cranes (36.3% vs. 22.6%). The difference was related primarily to the number of formal warnings issued to vehicles in CraneSafe particularly in VIC, but also in QLD and the ACT.

2.7 Brake test results

The NHVR requirement is for brake efficiency for a vehicle unit to reach a minimum of 4.5 kiloNewtons per tonne (kN/t). There is a strong relationship between brake performance as measured in roller brake tests and braking performance of a vehicle on the road. Below that level, there is a risk of insufficient braking performance.

The distribution of brake efficiency is shown in the figures below for rigid trucks (Figure 2-14), articulated hauling units (Figure 2-15), trailers (Figure 2-16) and bus/coaches (Figure 2-17).

Figure 2-14.
Brake efficiency measured as total kN/tonne for the vehicle: rigid trucks

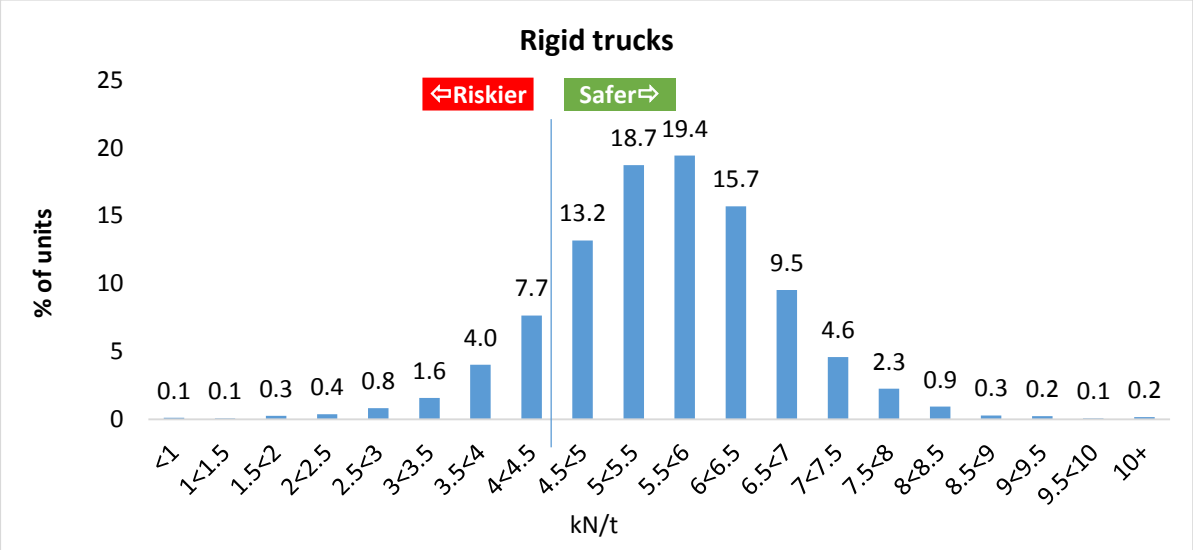


Figure 2-15.
Brake efficiency measured as total kN/tonne for the vehicle: articulated hauling units

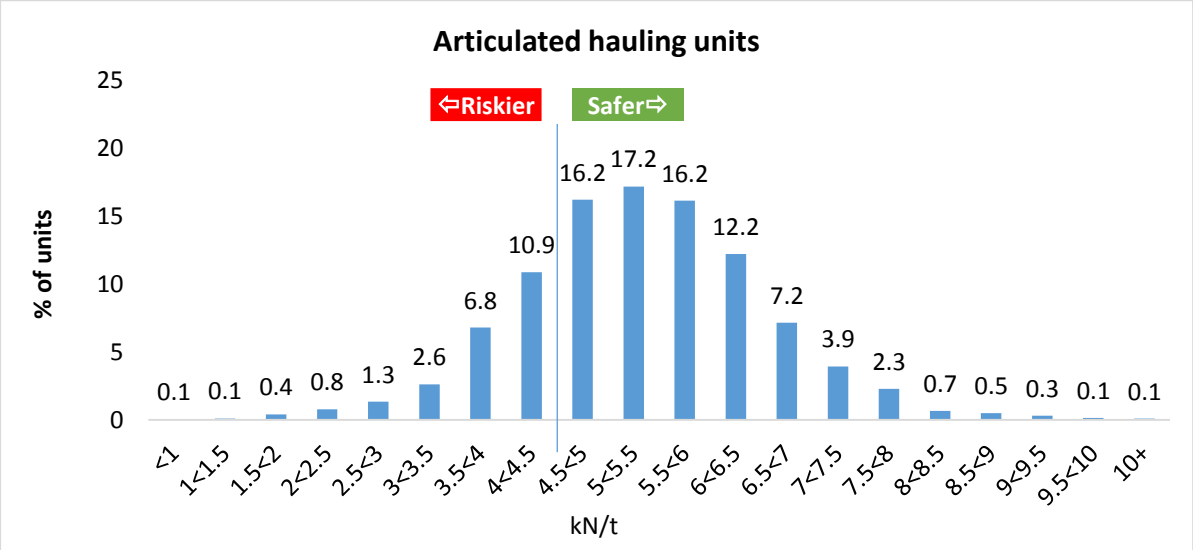


Figure 2-16.
Brake efficiency measured as total kN/tonne for the vehicle: trailers

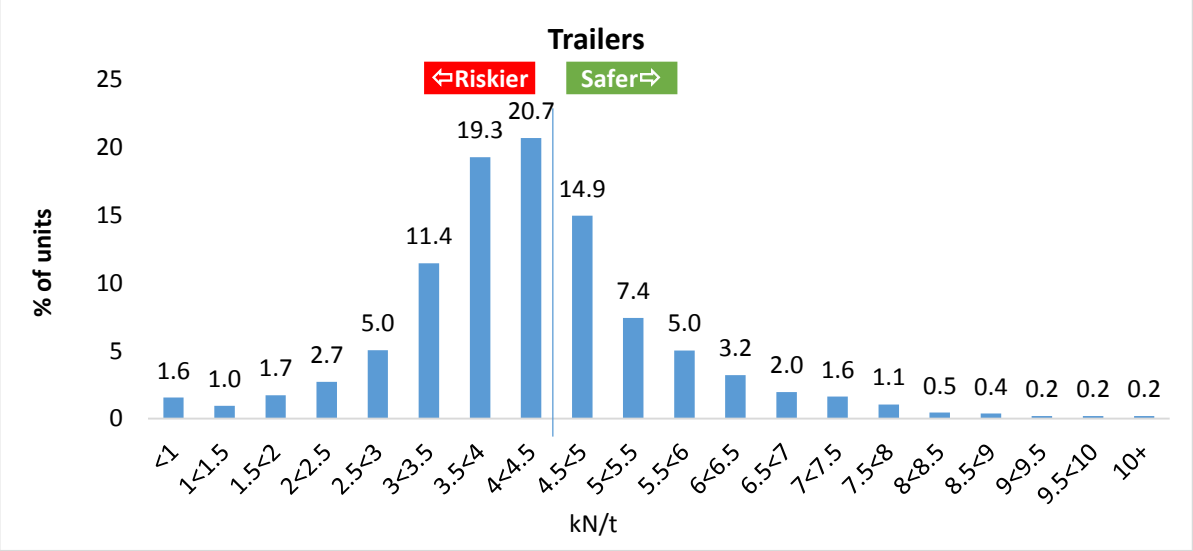
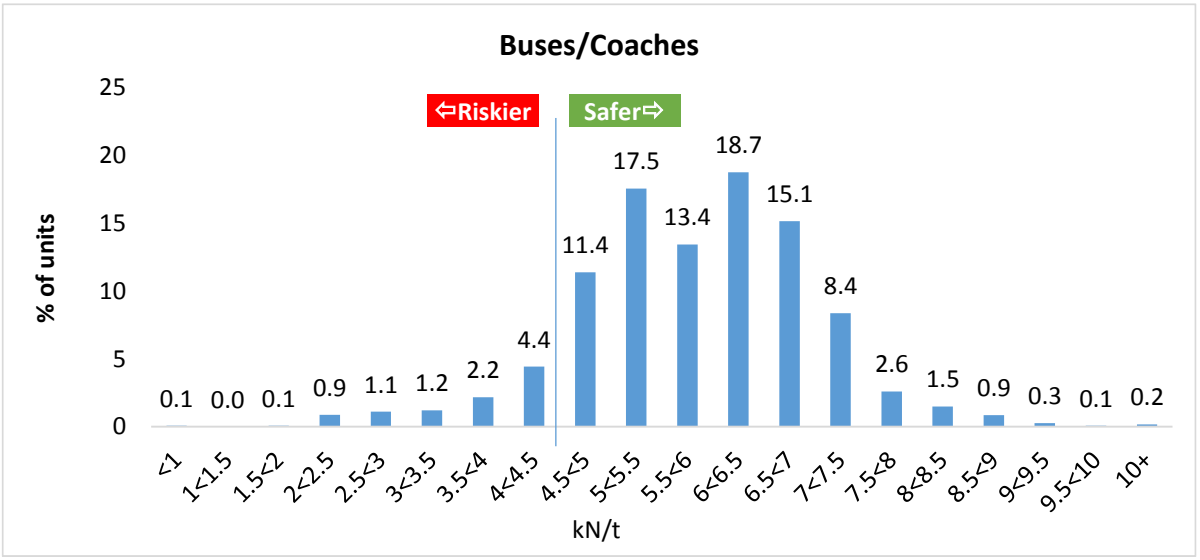


Figure 2-17.
Brake efficiency measured as total kN/tonne for the vehicle: buses/coaches



This analysis shows that 90.1% of buses/coaches and 85.1% of rigid trucks reached the minimum 4.5 kN/tonne level. This incidence declined to 77.0% of articulated hauling units and to 36.6% of trailers. Two-fifths of the trailers were in the range of 3.5<4.5 kN/tonne and this equated to 76.6% reaching a minimum of 3.5 kN/tonne.

3. Conclusion

3.1 Successful completion of the NRBS objectives

Details of the successful completion of the objectives of the NRBS are presented below.

OBJECTIVE: Assess the roadworthiness of the Australian heavy vehicle fleet through planning, coordinating and managing the conduct of a program of inspections on a recommended statistical basis.

This objective was achieved through NHVR consulting extensively with jurisdictions and industry to explain the rationale and objectives of the survey, to present details of how the survey would be implemented, to demonstrate the value of the survey, and to address any concerns about the impact of its implementation.

Resourcing constraints in Western Australia resulted in their inability to participate.

The overall management approach involved three key stakeholders:

- **Jurisdictions**: to manage the inspection logistics, perform inspections and record the survey data.
- **AMR**: as the survey partner, to set up the survey method, consult with the jurisdictions on scheduling, address issues with data collection through the survey period, provide daily reports on progress, and analyse and report on the results.
- **NHVR**: to oversee the survey implementation and liaise with the jurisdictions to address any logistical issues.

The NHVR engaged a statistical consultant, Data Analysis Australia, to recommend a sample size and sampling methodology to ensure the data collected was valid and reliable. The survey sample included quotas for six vehicle types and preferred regions where heavy vehicle inspections would be conducted. The approach generated a matrix of each vehicle type within metropolitan and non-metropolitan areas within jurisdictions.

Key survey development work was undertaken during May-July 2016, involving a series of steps designed to ensure effective implementation:

- liaising with jurisdictions to promote the method and plan resourcing;
- developing the survey instrument and data collection method;
- training inspectors in the jurisdictions;
- distributing survey material;
- planning the survey implementation, including reviewing transport routes and inspection sites, and developing schedules in consultation with the jurisdictions' operations managers;
- testing and refining the survey instrument; and
- piloting the survey in each jurisdiction and making final changes.

OBJECTIVE: Plan, coordinate and manage the conduct of sufficient inspections to establish the extent to which the heavy vehicle fleet meets Heavy Vehicle Safety Standards

This objective was achieved through the development of a sampling mix and schedule to meet Data Analysis Australia's requirements, including surveying at a number of different sites in each jurisdiction to help with the effective coverage and representation of the vehicle fleet.

The inspection method emphasised reporting the outcome of the inspection in a consistent way based on the NHVIM v2.1. Vehicles were inspected by combination, encompassing the hauling unit and all attached trailers. The inspection captured brake performance through a roller brake test on each axle of the vehicle combination.

The survey instrument was based on that used in recent compliance surveys in New South Wales and contained four broad categories of content:

- details of the inspection time and location;
- details about the vehicle combination, and then for each unit;
- details of non-conformities, completed separately for each unit; and
- capturing roller brake test results — printouts/recorded information photographed.

The primary data collection method was through Computer Assisted Personal Interview (CAPI) using tablets. The inspectors entered the survey data into the tablet survey software during the inspection. The survey software allowed the survey to be conducted offline, which facilitated inspections being conducted in some rural locations. Online connectivity was required to download any revisions to the survey and upload data.

Use of electronic data collection provided efficiency of data processing and reduction in administrative time over alternative paper-based methods.

OBJECTIVE: Collect, analyse and report on the findings, results and outcomes of the data collected

This objective was achieved through adherence to the sampling method, managing the survey implementation, creating a database of the inspection results, and post-weighting the data.

The design was intentionally a balance between generating suitable sample sizes for analysing and reporting results for vehicle/jurisdiction sub-groups and effective representation of the relevant population. Smaller vehicle groups and jurisdictions were over-sampled, and corresponding larger groups and jurisdictions were under-sampled. The intention was for the sample structure to be redressed through post-weighting of the data.

The final number of vehicles inspected was 7,130, which was 415 over the original total quota of 6,715 (not including WA). Some of the over-sampling, however, was from the present-for inspection modes freight vehicles, which were required to represent no more than 7% of freight vehicles inspected. In addition, some quotas for plant/SPV in particular were not met as a result of difficulty in accessing vehicles.

Post-weighting of the survey data was conducted using Data Analysis Australia*'s* location distribution as a practical representation of usage of the heavy vehicle fleet, for final weighting of the survey sample to jurisdiction of registration. The weighting also included several adjustments related to specific sampling of sites and vehicle categories.

The survey data was analysed using the IBM SPSS Statistics software.

OBJECTIVE: Work with inspection service providers to ensure sufficient inspections are conducted and performed to assess vehicle safety in a manner that allows comparison between vehicle types and location

This objective was achieved through review of heavy vehicle travel data, consultation with the jurisdictions about survey sites and resources, and detailed selection of sites and scheduling.

AMR reviewed information provided by the NHVR on primary and secondary freight routes and the location of inspection sites, and consulted with each jurisdiction to assist in the development of a schedule of sites and shifts to provide representative coverage of heavy vehicles. The jurisdictions provided guidance around their knowledge of the routes and experience at different sites.

A schedule was put together prior to the survey fieldwork period and revised during the period based on the progress of shifts and coverage of vehicles, with the goal of ensuring quotas were met. The jurisdictions also arranged for present-for inspection vehicles surveys with a range of businesses to meet bus/coach and plant vehicle quotas.

OBJECTIVE: Ensure data is recorded and analysed during the survey in the agreed timeframe to monitor quality

This objective was achieved through ongoing monitoring of the survey and providing feedback to the jurisdictions.

The ongoing steps included:

- daily monitoring of shifts and the number of inspections completed in each jurisdiction;
- troubleshooting any issues with completing the survey;
- providing daily updates to the NHVR and jurisdiction operations managers; and
- revisions to schedules, including further consultation with the NHVR and with jurisdictions to complete the survey.

The summary spreadsheet of daily updates provided to each of the jurisdictions included:

- total completed inspections by vehicle type for each site for each jurisdiction; and
- surveys completed on the previous day by vehicle type for each site.

The operations managers and inspectors were in contact with AMR during the survey to address any issues experienced with the use of the tablets or the survey software. AMR was also in regular contact with the operations managers about any issues with survey shifts, need for rescheduling, or balancing of coverage of different routes to help with representativeness of the sample.

OBJECTIVE: Work with inspection service providers to conduct a program of inspections of randomly selected vehicles using a standardised process, completing an approved inspection form, and reporting the findings from the data collected, as well as on the process itself

This objective was achieved through ongoing liaison with the jurisdictions and intensive training and piloting of the survey.

Training sessions were conducted in each jurisdiction. Each session was over a 6-hour period and included comprehensive coverage of:

- the background to the survey and the rationale and objectives;
- implementation of inspections;
- completing the survey, including use of the tablets and survey software; and
- practice surveys using set scenarios.

The survey instrument was based on that used in recent compliance surveys in New South Wales. The instrument contained four broad categories of content:

- details of the inspection time and location;
- details about the vehicle combination, and then for each unit;
- details of non-conformities, completed separately for each unit; and
- capturing roller brake test results — printouts/recorded information photographed.

OBJECTIVE: Apply management process to the selection of vehicles and conduct of inspections to ensure the validity and reliability of the survey results for analysis and reporting on an Australia-wide comparison

This objective was achieved through implementing a core survey method for the bulk of inspections of random roadside intercepts of vehicles on main and secondary travel routes. This component utilised fixed and mobile inspection stations. This component was supplemented by present-for inspection components to access, in particular, plant/special purpose vehicles and buses/coaches which would otherwise offer much more limited access.

The three modes of selection were:

- **roadside intercept** for rigid trucks and trailers, as well as articulated vehicles and trailers and plant vehicles, where relevant;
- **present-for inspection – by invitation**, for buses, coaches and plant vehicles, including visiting the operator depot or having the vehicle come to an inspection station; and
- **present-for inspection – by periodic inspection**, for all types of vehicles, but again particularly for buses, coaches and plant vehicles.

The use of present-for inspection selection was limited for freight vehicles to no more than 7% of the jurisdiction's overall quota for those vehicles.

While quotas were set for a range of vehicle/location groups, random selection was maximised through selection of the 'next vehicle' for available quotas.

3.2 Concluding points

As a baseline survey, the NRBS establishes a point-in-time snapshot which will support future surveys, providing a suitable basis to build on. The NRBS also provides an avenue for improvement in the roadworthiness of the Australian heavy vehicle fleet, including providing industry with information about opportunities for improvement.

Innovations in the survey method which facilitated efficient implementation included:

- taking advantage of existing cross-jurisdiction operations;
- standardised training and conducting pilots to support delivery;
- utilisation of the NHVIM by all inspectors for a consistent identification and categorisation of non-conformities; and
- electronic data collection using tablets for efficiency of data processing and reduction in administrative time over alternative paper-based methods.

The incidence of non-conformities in heavy vehicles was higher for freight hauling units and trailers, and lower for bus/coach and plant/SPV. A key factor was the age of the unit, with the incidence of non-conformity increasing substantially with age.

The incidence of non-conformities was highest for the brake vehicle system, including specifically for major non-conformities. The brake system is a key area to continue to address in the vehicle fleet to improve roadworthiness and safety. Other systems with higher non-conformity rates across vehicle units were:

- steering and suspension;
- lights and reflectors;
- structure and body; and
- engine, driveline and exhaust.

Future implementation of the survey will benefit from a more consistent application of the NHVIM across jurisdictions.

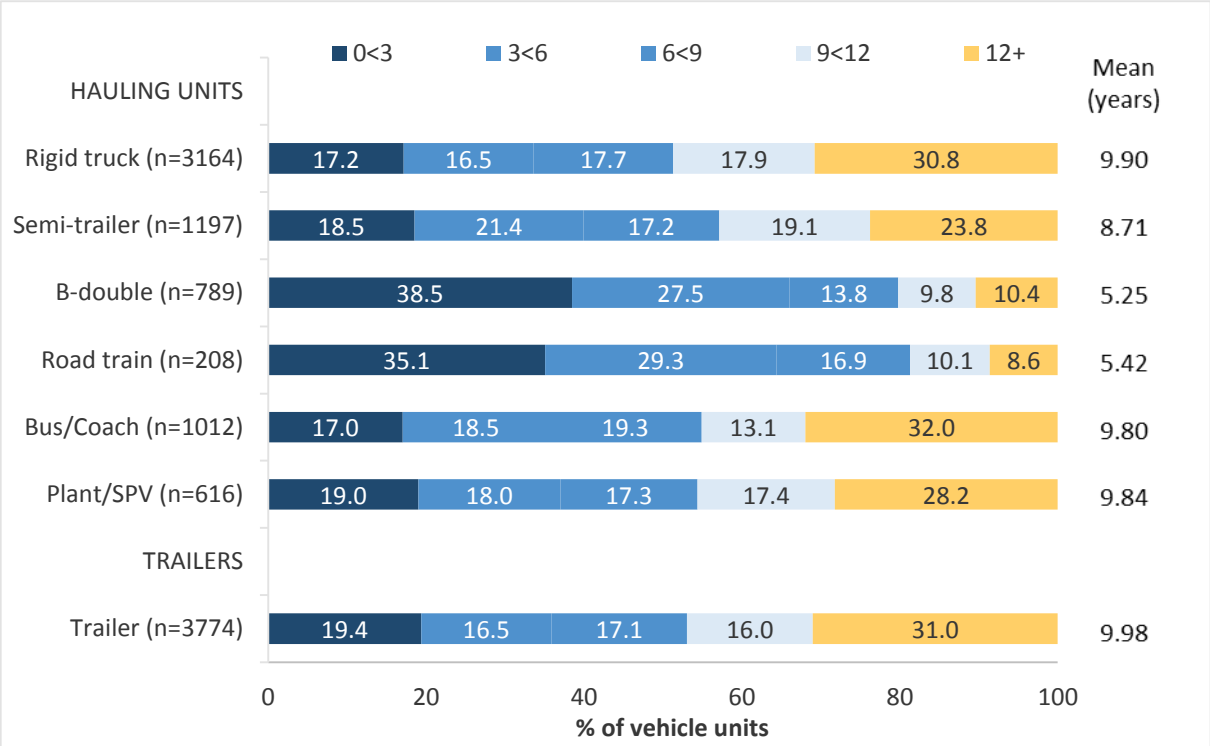
4. Appendix A: Detailed findings

4.1 Age of vehicles

4.1.1 Age profile of vehicles

Vehicle age had been found in earlier compliance surveys conducted in NSW to be strongly associated with the incidence of non-conformities. A profile of age of vehicle units in the NRBS was assessed to provide context to the roadworthiness results. Age was also considered when assessing relationships between other factors and non-conformity. The age of each unit was based on the date of manufacture, referenced to the survey day for the unit.[1] Over a quarter (29.2%) of all units were assessed to be 12 years and older, and over two-fifths (46.0%) of all units were 9 years and older.

Figure 4-1.
Age profile of hauling units and trailers (year groups) (weighted %s)



Sample size: All units where at least the year of manufacture was provided, hauling units (n=6,982) and trailers (n=3,774)

Note: Adding percentage results may give a rounding error of ±0.1% on the total

B-double and road train hauling units were on average the newest units, with the average age below 5.5 years. Rigid trucks, bus/coach and plant/SPV hauling units were on average the oldest with an average exceeding 9.0 years; and the outcome was similar for trailers. Over a quarter of each of these latter units were 12 years and older.

[1] The date of manufacturer was assumed to the 15th of the month for the purposes of calculating age. Where only the year was provided, the date was assumed to be the 30th of June. The year of the vehicle was not provided for 299 units.

4.1.2 Reporting non-conformity

The incidence of non-conformity in a unit or vehicle combination has been reported in three ways:

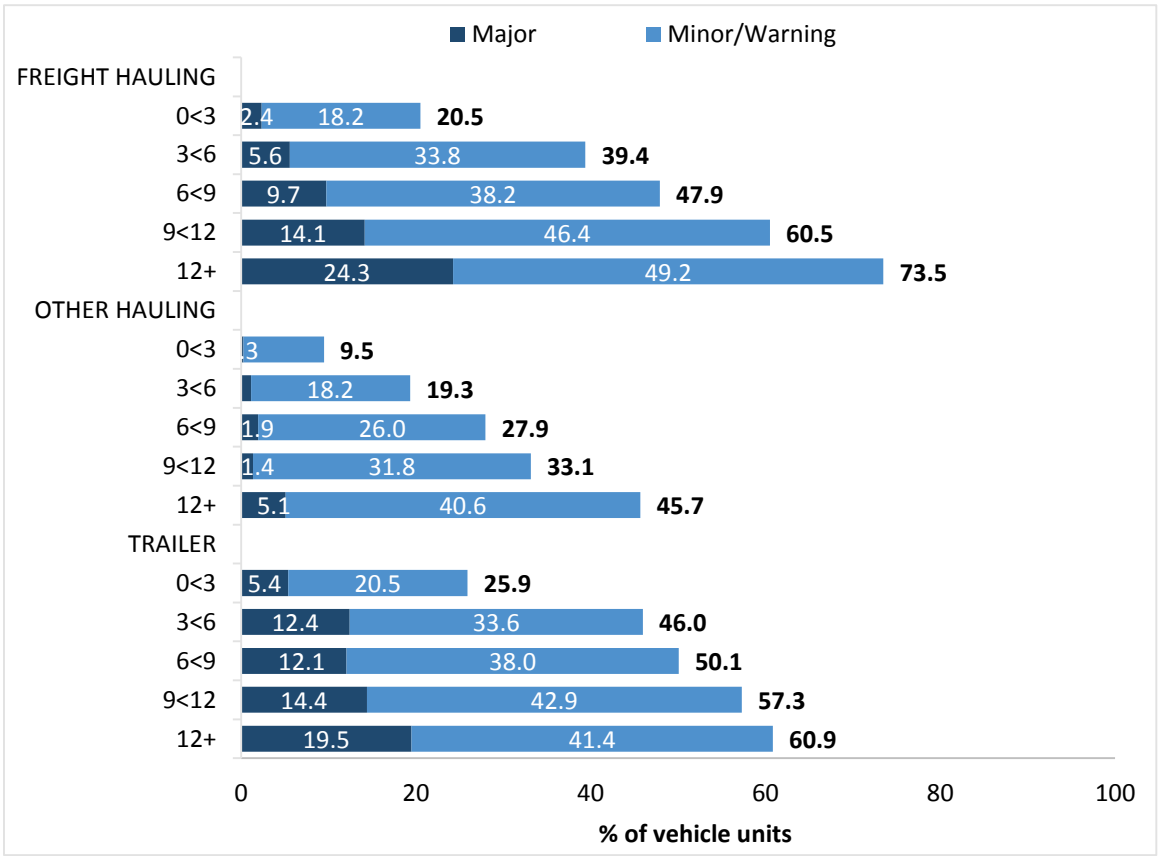
- the incidence of **any** classification of non-conformity for a unit or vehicle combination;
- the incidence of the **highest level** of non-conformity for a vehicle system for three categories: formal warning, minor and major/major grounded combined, along with the total incidence; and
- the incidence of the **highest level** of non-conformity for a vehicle system for two categories: formal warning/minor combined and major/major grounded combined, along with the total incidence.

It was possible for situations where the highest non-conformity identified was minor, however a major defect notice was issued due to the number of minor non-conformities identified.

4.1.3 Relationships between age and non-conformity

The relationship between age and non-conformity was assessed for freight hauling units, other hauling units and trailers for five age groupings. A statistically significant strong positive relationship was found between the age of a unit and the incidence of non-conformities, as shown for five age groupings: the incidence of non-conformities increased with age (Figure 4-2).

Figure 4-2.
Incidence of highest level of non-conformity among units by age group (years) (weighted %s)

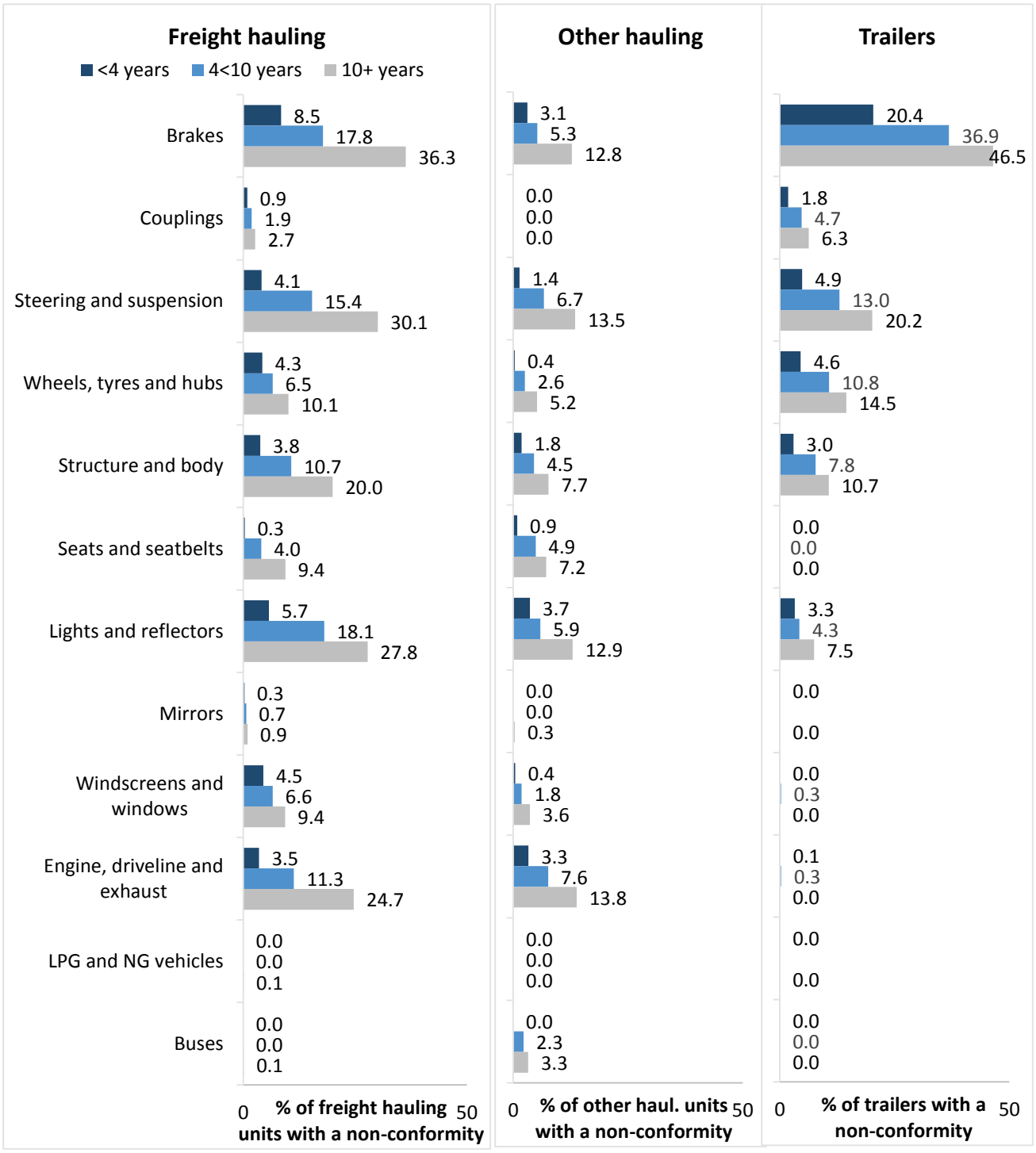


Sample size: Units where age was recorded (Freight hauling n=5,354, Other hauling n=1,628, Trailers n=3,774)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Trailers had a higher non-conformity rate for the newest age group (25.9% in the 0<3 years grouping), while freight hauling units showed the greatest increase (from 20.5% for 0<3 years up to 73.5% for 12+ years age). This outcome was similar for increases in major non-conformities.

The increase in incidence of a non-conformity occurred consistently for the 12 main vehicle system non-conformities covered in the survey, including brakes, and steering and suspension (Figure 4-3).

Figure 4-3.
Incidence of highest level of categories of non-conformity in freight hauling units, non-freight hauling units and trailers, by age group (weighted %s)



SAMPLE SIZE: Freight hauling units where age was known (n=5,354), non-freight hauling units (n=1,628), trailers (n=3,774)
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

The four systems with the highest incidence of non-conformity for units aged 10 years and over were:

- **brakes**: trailers (46.5%) and freight hauling units (36.3%);
- **steering and suspension**: freight hauling units (30.1%); and
- **lights and reflectors**: freight hauling units (27.8%).
- **engine, driveline and exhaust**: freight hauling units (24.7%).

4.2 Non-conformities by hauling units, trailers and combinations

4.2.1 Level of non-conformities

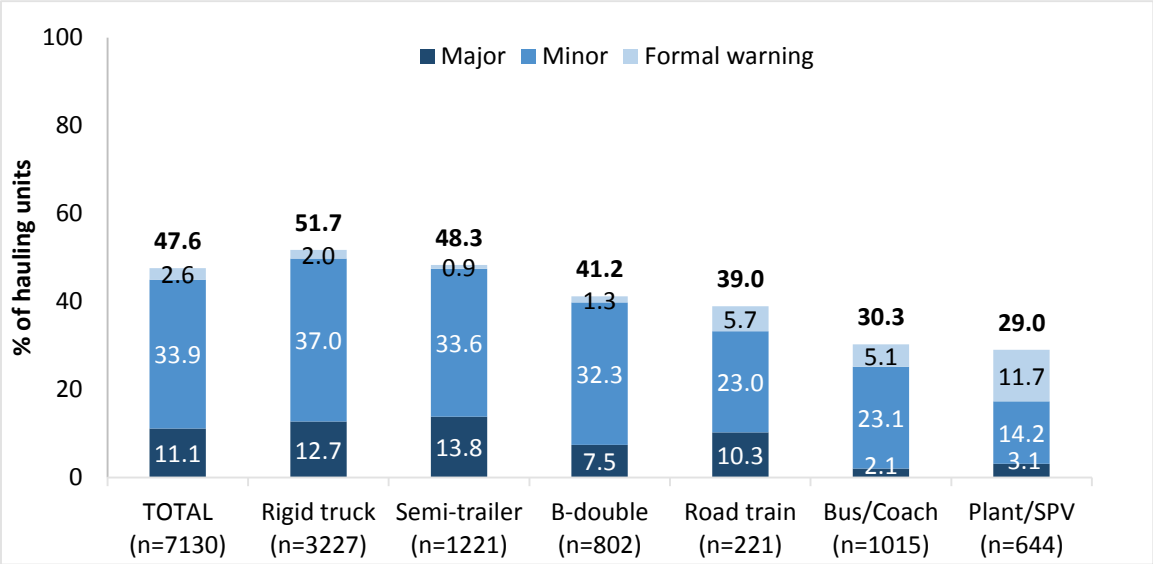
Non-conformity was assessed for:

- each category of hauling unit (Figure 4-4) ;
- trailers associated with each category (Figure 4-5); and
- vehicle combinations covering the hauling unit and any trailers (Figure 4-6).

Non-conformities in hauling units and trailers

Overall, close to half of hauling (47.6%, Figure 4-4) and trailers (48.8%, Figure 4-5) were found to have a non-conformity (i.e., formal warning, minor or major). The incidence of one or more non-conformities was statistically significantly highest for rigid truck hauling units (51.7%), and the prime mover in a semi-trailer combination (48.3%) (Figure 4-5). The incidence of non-conformities was lower for the hauling unit in B-double (41.2%) and road train (39.0%) combinations, and statistically significantly lowest for bus/coach (30.3%) and plant vehicles (29.0%) (Figure 4-4).

Figure 4-4.
Incidence of highest level of non-conformity in hauling units, by category of vehicle (weighted %s)



Sample size: All hauling units (n=7,130)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

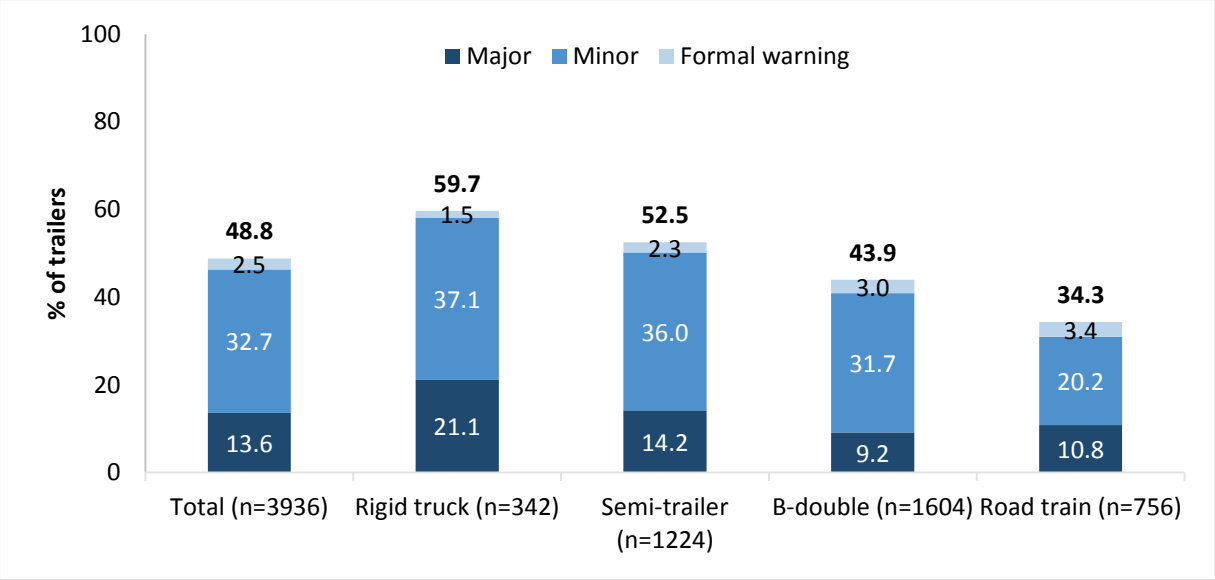
The most common highest level of non-conformity for all types of vehicles was a minor non-conformity, representing about half of each vehicle category. About one in nine (11.1%) hauling units had a major non-conformity, with the highest four categories being semi-trailers (13.8%), rigid trucks

(12.7%), road trains (10.3%) and B-doubles (7.5%) (Figure 4-4). Hauling units in the relatively small group of rigid truck and trailer combinations were found to have the highest incidence of major non-conformities (18.1%).

The proportion of non-conforming units having a major non-conformity was lowest for bus/coach hauling units (7% of non-conforming units) and plant hauling units (11% of non-conforming units) (based on results shown in Figure 4-4). In contrast, a formal warning made up two-fifths of the highest level of non-conforming units for plant hauling units.

The outcome for the incidence of any classification of non-conformity to decrease with the size of freight combinations was similar for trailers: the incidence was statistically significantly highest among trailers in rigid truck and trailer combinations (59.7%) and lowest among trailers in road train combinations (34.3%) (Figure 4-5). About one in seven trailers (13.6%, Figure 4-5) had a major non-conformity, representing about a quarter of units with a non-conformity.

Figure 4-5.
Incidence of highest level of non-conformity in trailers, by classification (weighted %s)



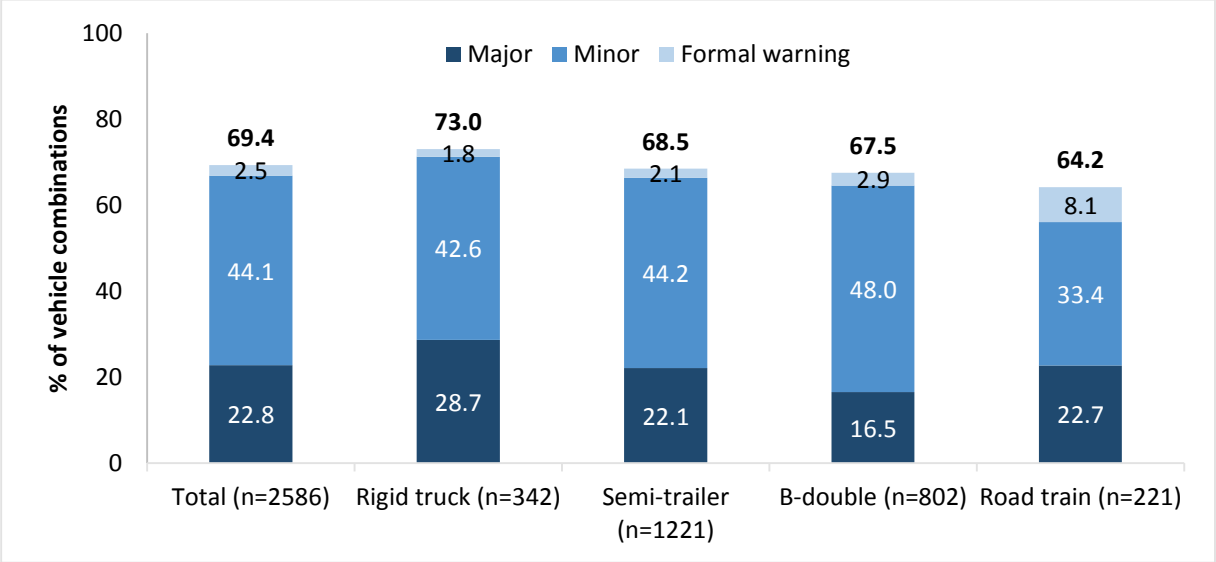
Sample size: All trailers (n=3,936); 10 trailers were attached to bus/coach or plant vehicles, and are not shown separately

Note: Adding percentage results may give a rounding error of ±0.1% on the total

Non-conformities in freight combinations

The incidence of any classification of non-conformity increased statistically significantly when considering any unit in a freight vehicle combinations, with over two-thirds (69.4%) of all such combinations having a non-conformity (Figure 4-6). There was a trend for the incidence to decrease with the size of the freight combinations, similar to hauling units and trailers.

Figure 4-6.
Incidence of highest level of non-conformity for freight vehicle combination by category



Sample size: All freight vehicle combinations (n=2,586)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.2.2 Relationship with age

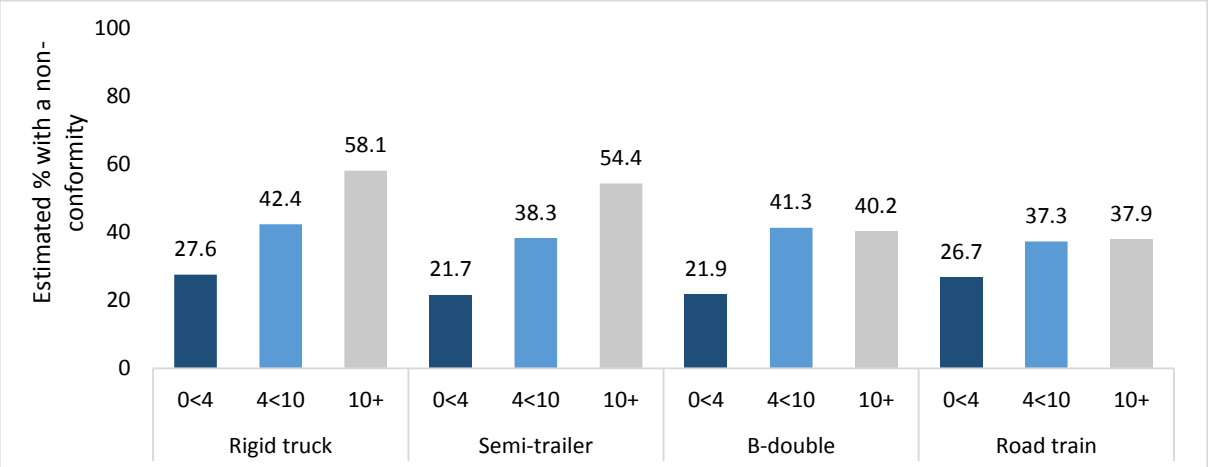
As discussed earlier, the average age of freight hauling units was shown to differ by vehicle category, with rigid trucks and semi-trailer prime movers being older on average than B-double and road train prime movers, when considering the hauling unit only. The incidence of any classification of non-conformity was found to be statistically significantly higher among rigid trucks and semi-trailer prime movers.

As age had been found to be strongly associated with the incidence of non-conformity, the relationship between vehicle category and non-conformity was assessed for freight hauling units taking into account age, and several other factors including state of inspection.[2]

Once age of the unit was taken into account, there was significantly less difference between the four categories of hauling units than observed originally (as shown previously in Figure 4-4). There was, however, a statistically significant interaction between age group and category of hauling unit (Figure 4-7). The estimated incidence of any non-conformity was similar for each of the four categories at 0<4 years of age, and increased by a similar amount at 4<10 years of age. The incidence increased by a similar level again at 10+ years of age for rigid truck and semi-trailer hauling units, but did not increase for B-double and road train hauling units.

[2] The analysis produces estimated of the incidence, adjusting for other factors. See Section 5.4.3 in Appendix B.

Figure 4-7.
Estimated incidence of non-conformities in freight hauling vehicles by category of unit and age, adjusting for other factors*



Sample size: All freight hauling vehicles in NSW, VIC, QLD, and SA where age was known (n=4,798)
**Estimated incidences adjusting for hauling unit category, state, type of inspection and age group*

4.2.3 Incidence of non-conformity in multi-unit freight vehicle combinations

The incidence of non-conformities in multi-unit vehicle combinations were assessed in more detail to see how incidences increased with number of units.

Freight vehicle combinations had a statistically significantly higher incidence of any classification of non-conformity (73.0%) than rigid trucks with no trailer (51.7%) (Table 4-1). There was an overall statistically significant variation in the average number of non-conforming units between the vehicle types being measured: he average was highest for 3-unit (1.29) and 4-unit (1.49) combinations.[3]

When assessing the *rate* of non-conformity, dividing the number of non-conforming units by the number of units in the combination, there was again an overall statistically significant variation between the groups. The rate was higher for the *smaller* combinations, ranging from 0.50-0.56 for single unit and 2-unit combinations, peaking at 0.56 for truck and trailer combinations, and *lower* for 3-unit combinations (0.43) and 4-unit combinations (0.37).

Table 4-1.
Incidences of non-conformities in vehicle combinations, by number of units (weighted results)

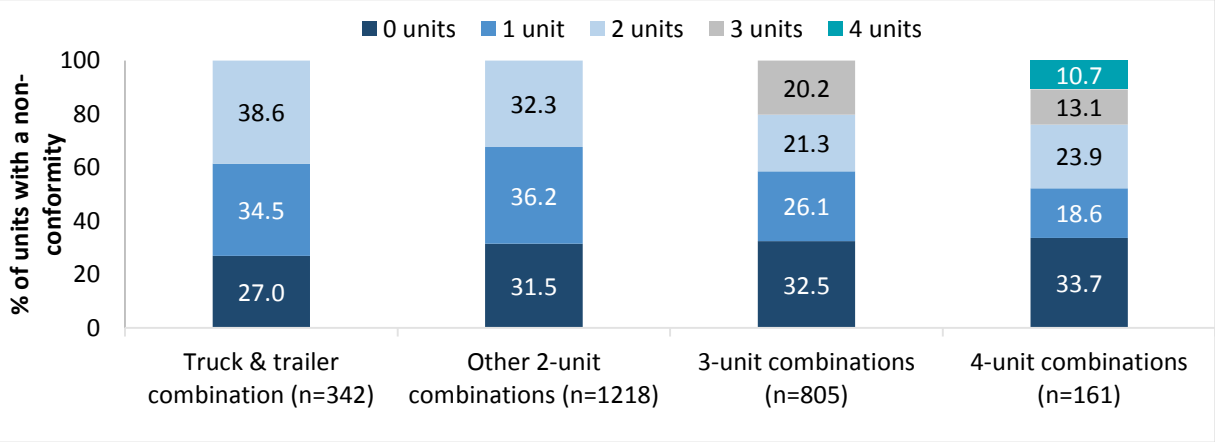
VEHICLE TYPE	Any unit with a non-conformity	Average number of non-conforming units	Rate of non-conforming per unit	
	%	Mean	Rate per unit	*Sample*
Rigid truck (no trailer)	51.7	0.52	0.52	*2885*
Truck & trailer combination	73.0	1.12	0.56	*342*
Other 2-unit combination	68.5	1.01	0.50	*1218*
3-unit combination	67.5	1.29	0.43	*808*
4-unit combination	66.3	1.49	0.37	*161*

Sample size: All rigid trucks with no trailer (n=2,885) and freight hauling combinations with 2-4 units (n=2,526)

[3] 57 vehicle combinations with 5-7 units are not included in this analysis, due to low sample sizes.

For multi-vehicle freight combinations, the number of non-conforming units was relatively well distributed, such that there was no outcome for a non-conformity in one unit being associated with non-conformity in multiple units (Figure 4-8).

Figure 4-8.
Incidence of number of units with a non-conformity in multi-unit freight vehicle combinations (weighted %s)



Sample size: All freight hauling combinations with 2-4 units (n=2,526)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.3 Non-conformity by vehicle category by inspection jurisdiction

4.3.1 Assessing non-conformity by inspection jurisdiction

The incidence of non-conformity was shown in Section 4.2 for vehicle categories. In this section, the incidence is shown by inspection jurisdiction. The sample sizes for vehicle categories inspected in each state are shown in Table 4-2. Results for sub-groups with sample sizes of less than 30 are highlighted: results for these sub-groups have not been reported separately.

Table 4-2.
Sample sizes for vehicle categories by state of inspection

	STATE OF INSPECTION						
VEHICLE TYPE	**NSW**	**VIC**	**QLD**	**SA**	**TAS**	**NT**	**ACT**
	n	**n**	**n**	**n**	**n**	**n**	**n**
Vehicle units							
Rigid truck	854	792	756	419	175	110	121
No trailer	*772*	*706*	*655*	*380*	*158*	*104*	*110*
Truck & trailer	*82*	*86*	*101*	*39*	*17*	*6*	*11*
Semi-trailer	286	362	279	178	65	30	21
B-double	159	284	195	122	29	4	9
Road train	60	8	59	51	0	43	0
Articulated	*505*	*654*	*533*	*351*	*94*	*77*	*30*
Bus/Coach	247	242	265	136	34	51	40
Plant/SPV	155	229	142	77	13	3	25
Total vehicle units	**1761**	**1917**	**1696**	**983**	**316**	**241**	**216**
Trailers	**876**	**1043**	**972**	**622**	**140**	**233**	**50**
TOTAL UNITS	*2637*	*2960*	*2668*	*1605*	*456*	*474*	*266*

Highlighting small sample sizes <30 – results for these cells have not been reported in the detailed results

4.3.2 Non-conformity by inspection jurisdiction

The incidence of the highest level of non-conformity is shown in this Section by state of inspection for:

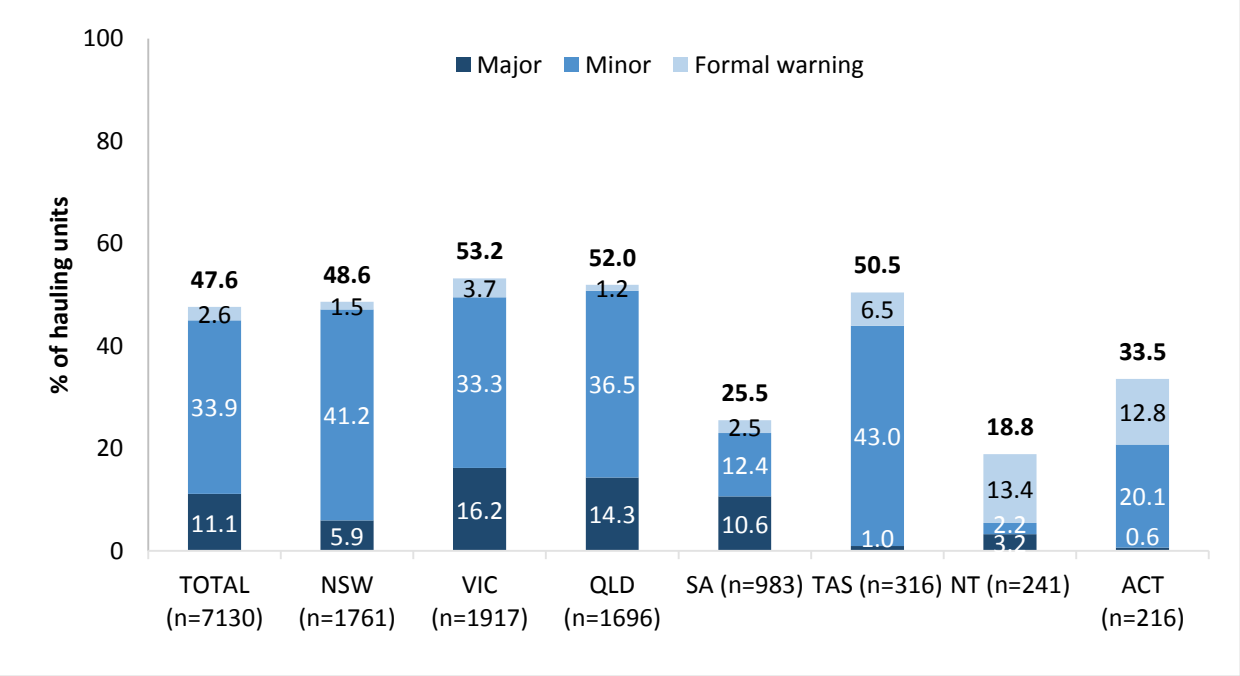
- hauling units (Figure 4-9);
- trailers (Figure 4-10); and
- vehicle combinations (Figure 4-11).

Non-conformities in hauling units

The incidences of any classification of non-conformity for hauling units were at similar levels in NSW, VIC, QLD and TAS (ranging from 48.6% to 52.0%) (Figure 4-9). The incidences in particular in SA (25.5%) and NT (18.8%) were statistically significantly lower than the other states; and the incidence was also below average in the ACT (33.5%). The lower incidence of plant/SPV being non-conforming had some influence on the overall lower results for SA, which had a higher proportion of plant/SPV (refer to Table 5-6 in Appendix B).

The proportion of non-conforming units with a major non-conformity was statistically significantly highest in SA (42%) and relatively low in NSW (12%), TAS (2%) and the ACT (2%). A formal warning as the highest level made up a much greater proportion of non-conforming units in NT (71% of non-conforming units) and the ACT (38%), compared with the other states (<15%).

Figure 4-9.
Incidence of highest level of non-conformity in hauling unit, by state of inspection (weighted %s)



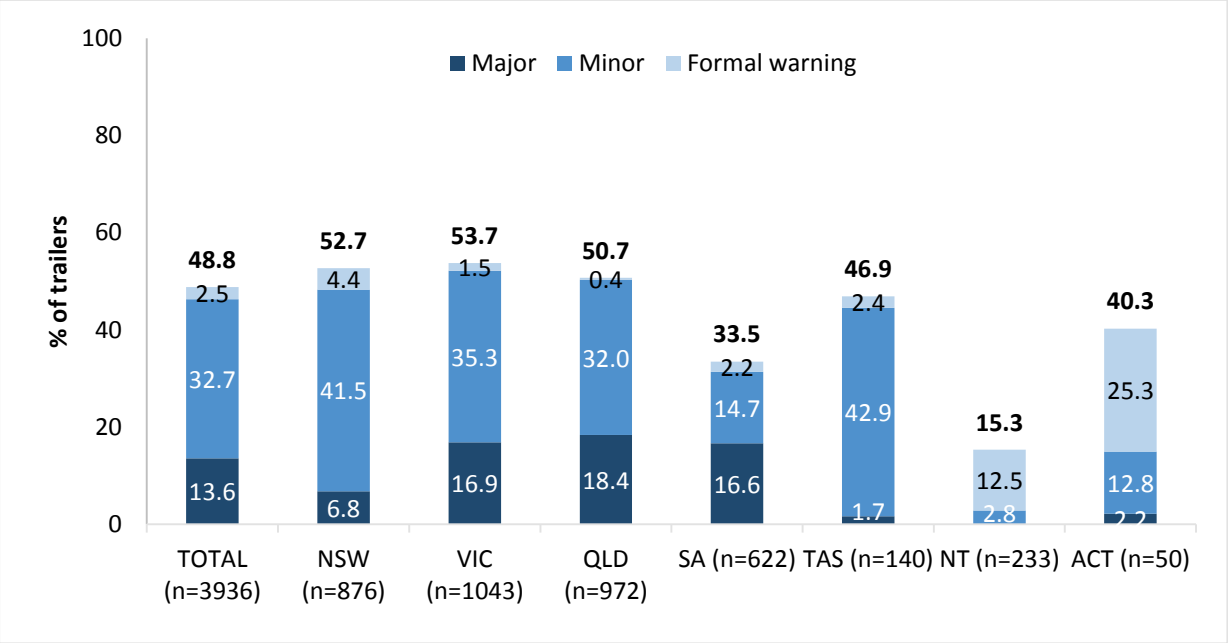
Sample size: All hauling units (n=7,130)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Non-conformities in trailers

There was a similar outcome for trailers, with a marginally lower incidence for TAS (46.9%) compared with NSW, VIC and QLD (ranging from 50.7% to 53.7%) (Figure 4-10). The incidences were again statistically significantly lower in SA (33.5%) and NT (15.3%); and below average in the ACT (40.3%).

The proportion of non-conforming units having a major non-conformity was again statistically significantly highest in SA (50% of non-conforming trailers) and relatively low in NSW (13%), TAS (4%), the ACT (5%) and NT (0%). A formal warning made up a much greater proportion of non-conforming trailers in NT (82% of non-conforming trailers) and the ACT (63%), compared with the other states (<10%).

Figure 4-10.
Incidence of highest level of non-conformity in trailers, by state of inspection (weighted %s)

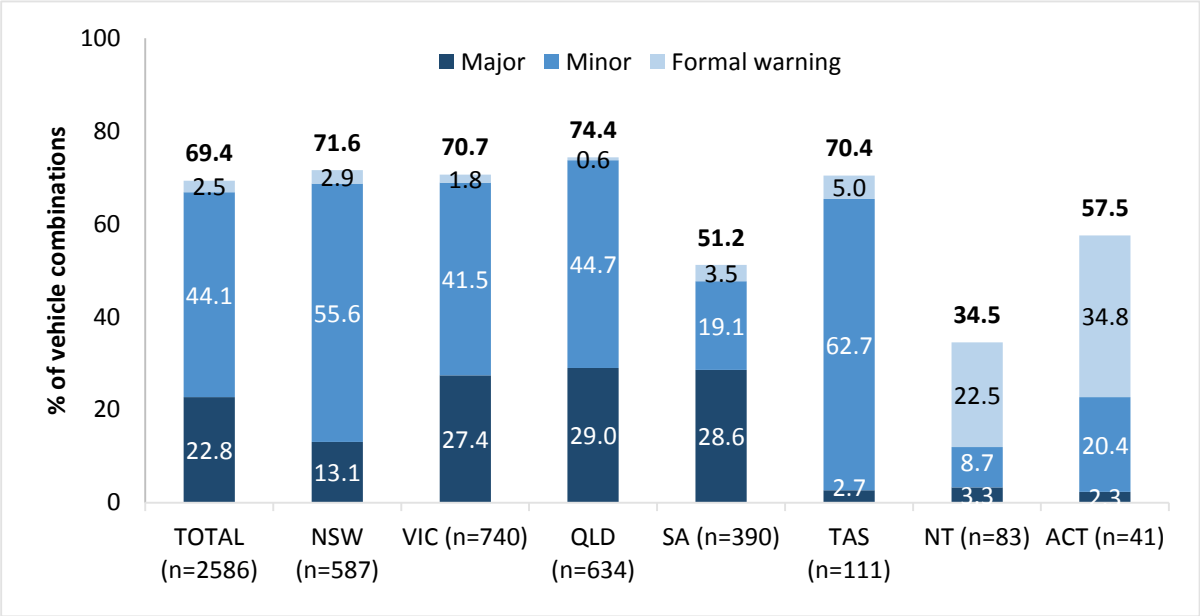


Sample size: All trailers (n=3,936)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Non-conformities in freight vehicle combinations

The incidence of non-conformity for freight vehicle combinations (Figure 4-11) was of a similar outcome to hauling units: similarly higher in NSW, VIC, QLD and TAS (ranging from 70.4% to 74.4%), lowest in NT (34.5%), and relatively low in SA (51.2%) and the ACT (57.5%). Among units with a non-conformity, the proportion with a major non-conformity was again statistically significantly highest in SA (56%), and the proportion being a formal warning was again very high among the smaller sample of combinations in NT (65%) and the ACT (61%).

Figure 4-11.
Incidence of highest level of non-conformity in freight vehicle combinations, by state of inspection (weighted %s)



Sample size: Freight vehicle combinations (2,586)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.3.3 Non-conformity by vehicle category by state of inspection

Non-conformity by state of inspection was assessed by vehicle category and combinations for:

- each category of hauling unit and trailers (Table 4-3); and
- vehicle combination (Table 4-4).

Results for individual vehicle categories or combinations have not been reported separately for each state where the sample size is less than 30 (sample sizes as shown previously in Table 4-2). Results have also been presented separately for the grouping of *articulated vehicles* such that some information is still provided for the smaller states where sample sizes of the constituent vehicle categories are less than 30.

Assessment of non-conformity

The incidences of any classification of non-conformity for each category of hauling unit and trailers (Table 4-3) and vehicle combination (Tables 4-4) confirmed the broadly lower incidences in SA and NT, and below average incidence in the ACT. However, the results for NT and SA were influenced to some extent by very low non-conformity rates among bus/coach and plant vehicles. There were no non-conformities recorded in NT for these vehicles, and a low incidence in SA (7.4% for bus/coach and 11.4% for plant).

Overall non-conformity in hauling units

Overall, the incidence of any classification of non-conformity for hauling units was highest for these hauling units in each state (Table 4-3):

- **QLD**: rigid truck, semi-trailer, B-double, road train;
- **VIC**: rigid truck, bus/coach;

- **NSW**: rigid truck, semi-trailer; and
- **TAS**: rigid truck.

Overall non-conformity in hauling unit categories

The following statistically significant differences were observed among the states with the more consistent, higher overall rates of non-conformity (NSW, VIC, QLD and TAS),[4] focusing on hauling units (Table 4-3):

- **B-double**: highest incidence of any non-conformity in QLD (53.6%), compared with NSW (41.1%) and VIC (34.4%);
- **Bus/coach**: highest incidence of non-conformities in VIC (60.0%), compared with NSW (23.6%), QLD (19.4%), and TAS (35.3%, from a sample of 34);
- **Plant**: higher incidences in VIC (41.3%) and NSW (36.3%), and lowest incidence in QLD (24.3%); and
- **Articulated units** overall: highest incidence of any non-conformity in QLD (55.5%) and lowest in VIC (42.7%).

The incidence of major non-conformities in hauling units in TAS was very low (<2%). The following statistically significant differences were observed for the incidence of a *major* non-conformity, among the four largest states:

- **Rigid truck** hauling units: higher in VIC (20.3%) and QLD (15.7%), lower in SA (11.9%), and lowest in NSW (6.2%);
- **B-double** hauling units: a trend for higher rates in SA (10.4%) and in QLD (11.2%), and lower rates in VIC (6.6%) and NSW (3.3%); and
- **Road train** hauling units**:** higher in SA (18.0%) and QLD (15.3%), and lowest in NSW (1.2%).
- **Articulated units** overall: higher in QLD (15.5%), SA (13.1%) and VIC (13.0%), and lowest in NSW (6.8%).

Overall non-conformity in trailers

For trailers, the incidence of major non-conformities was statistically significantly higher in QLD (18.4%), SA (16.6%) and VIC (16.9%), compared with NSW (6.8%) and TAS (1.7%) (Table 4-3).

Non-conformity by vehicle combinations

The incidence of any non-conformity for each of the vehicle combination categories in NSW, VIC, QLD and TAS ranged from 63.1% to 73.2% (Table 4-4). A similar incidence was observed in SA for the rigid truck and trailer combination (65.5%).

The incidence of vehicle combinations with the highest level of non-conformity being major showed a similar outcome to hauling units, with the overall rate being lowest in NSW and TAS (Table 4-4). Among **articulated combinations** overall, the incidence of a major non-conformity was statistically significantly higher in QLD (26.0%), SA (24.0%) and VIC (23.5%), lower in NSW (13.2%), and lowest in TAS (1.2%).

[4] TAS is only included where the sample size for the category was 30 or more.

Table 4-3

Incidence of highest level of non-conformity in hauling units, by state of inspection (weighted %s)

UNITS		STATE OF INSPECTION																		
		NSW			VIC			QLD			SA			TAS			NT			ACT		
		Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total
HAULING UNIT																						
Hauling unit - Main types																						
Rigid	%	6.2	46.1	**52.3**	20.3	36.5	**56.8**	15.7	39.9	**55.6**	11.9	18.9	**30.8**	1.1	53.2	**54.4**	3.8	19.5	**23.3**	0.0	30.8	**30.8**
Semi-trailer	%	9.2	41.0	**50.1**	16.0	31.0	**47.0**	18.7	38.4	**57.1**	13.6	17.1	**30.7**	1.5	46.2	**47.7**	5.8	8.7	**14.6**	4.9	32.5	**37.4**
B-double	%	3.3	37.9	**41.1**	6.6	27.8	**34.4**	11.2	42.4	**53.6**	10.4	12.3	**22.7**									
Road Train	%	1.2	39.5	**40.7**				15.3	39.6	**54.8**	18.0	7.7	**25.7**				0.0	19.1	**19.1**			
Bus/Coach	%	1.7	21.9	**23.6**	2.8	57.2	**60.0**	2.2	17.2	**19.4**	2.5	4.9	**7.4**	0.0	35.3	**35.3**	0.0	0.0	**0.0**	2.5	40.0	**42.5**
Plant/SPV	%	3.8	32.5	**36.3**	0.5	40.7	**41.3**	2.8	21.6	**24.3**	6.7	4.7	**11.4**									
Supplementary group																						
Articulated hauling units	%	7.1	40.0	**47.1**	13.0	29.7	**42.7**	15.5	40.0	**55.5**	13.1	14.5	**27.6**	1.0	45.8	**46.7**	4.1	14.4	**18.5**	4.0	35.9	**39.9**
TRAILERS																						
Trailers	%	6.8	45.9	**52.7**	16.9	36.9	**53.7**	18.4	32.3	**50.7**	16.6	16.9	**33.5**	1.7	45.2	**46.9**	0.0	15.3	**15.3**	2.2	38.1	**40.3**

Refer to Table 4-2 for sample sizes

Major and Total non-conformities highlighted: 10<20%, 20<40%, 40<60%, 60+%

Note: Adding percentage results may give a rounding error of ±0.1% on the total

Table 4-4.

Incidence of highest level of non-conformity in combinations, by state of inspection (weighted %s)

COMBINATION		STATE OF INSPECTION																			
		NSW			VIC			QLD			SA			TAS			NT			ACT		
		Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total
Vehicle category																					
Rigid truck and trailer	%	12.7	57.7	**70.3**	38.0	40.9	**78.8**	35.4	38.9	**74.3**	44.9	21.7	**66.5**								
Semi-trailer	%	14.7	58.8	**73.6**	27.5	41.5	**69.0**	25.1	47.0	**72.0**	26.9	21.9	**48.8**	1.5	61.5	**63.1**	5.8	11.7	**17.5**	4.9	46.8	**51.6**
B-double	%	11.0	58.2	**69.2**	14.9	50.2	**65.1**	24.0	51.7	**75.7**	16.6	28.4	**45.0**								
Road Train	%	5.8	64.8	**70.6**				36.8	44.2	**80.9**	29.2	12.8	**41.9**				0.0	44.4	**44.4**		
Articulated	%	13.2	58.9	**72.1**	23.5	44.1	**67.5**	26.0	48.4	**74.4**	24.0	22.9	**46.9**	1.0	69.4	70.3	4.1	31.5	**35.6**	5.7	51.2	**56.9**

Refer to Table 4-2 for sample sizes

Major and Total non-conformities highlighted: 10<20%, 20<40%, 40<60%, 60+%

Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.4 Profile of major-grounded non-conformities

A *major grounded* non-conformity is the highest level of non-conformity. It is defined as creating critical concern over the safety of a vehicle and the vehicle must not be used on a road while the non-conformity exists.

A total of 117 vehicle combinations or single unit vehicles were reported grounded. There were a total 146 vehicle units grounded, including 82 hauling units and 64 trailers. The units are profiled in Table 4-5. The most common type of non-conformity causing the grounding for hauling units was brakes (56 units), followed by steering and suspension (19 units). The most common non-conformity trailer was also brakes (54 trailers), followed by couplings (7).

Table 4-5.
Profile of major grounded units (unweighted)

Profile	Hauling unit	Trailer
	Sample	*Sample*
Type of inspection		
Interception	75	63
PFI – invitation	3	1
PFI – periodic	4	0
Type of vehicle		
Rigid truck	56	18
Semi-trailer	15	25
B-Double	7	12
Road Train	2	9
Bus/Coach	2	0
Plant/SPV	0	0
Type of non-conformity*		
Brakes	56	54
Couplings	5	7
Steering and suspension	19	5
Wheels, tyres and hubs	2	0
Structure and body	5	3
Seats and seatbelts	4	0
Lights and reflectors	4	1
Mirrors	0	0
Engine, driveline and exhaust	7	0

Profile	Hauling unit	Trailer
	Sample	*Sample*
State of Inspection		
NSW	5	3
VIC	36	26
QLD	36	28
SA	5	7
TAS	0	0
NT	0	0
ACT	0	0
State of Registration		
NSW	7	3
VIC	35	30
QLD	35	25
SA	4	4
WA	1	0
TAS	0	0
NT	0	2
ACT	0	0
Area		
Metropolitan	40	29
Non-metropolitan	42	35

**Note: A non-conformity that caused the vehicle to be grounded was not specified for 3 hauling units and 1 trailer*

4.5 Incidence of vehicle system non-conformity by vehicle categories

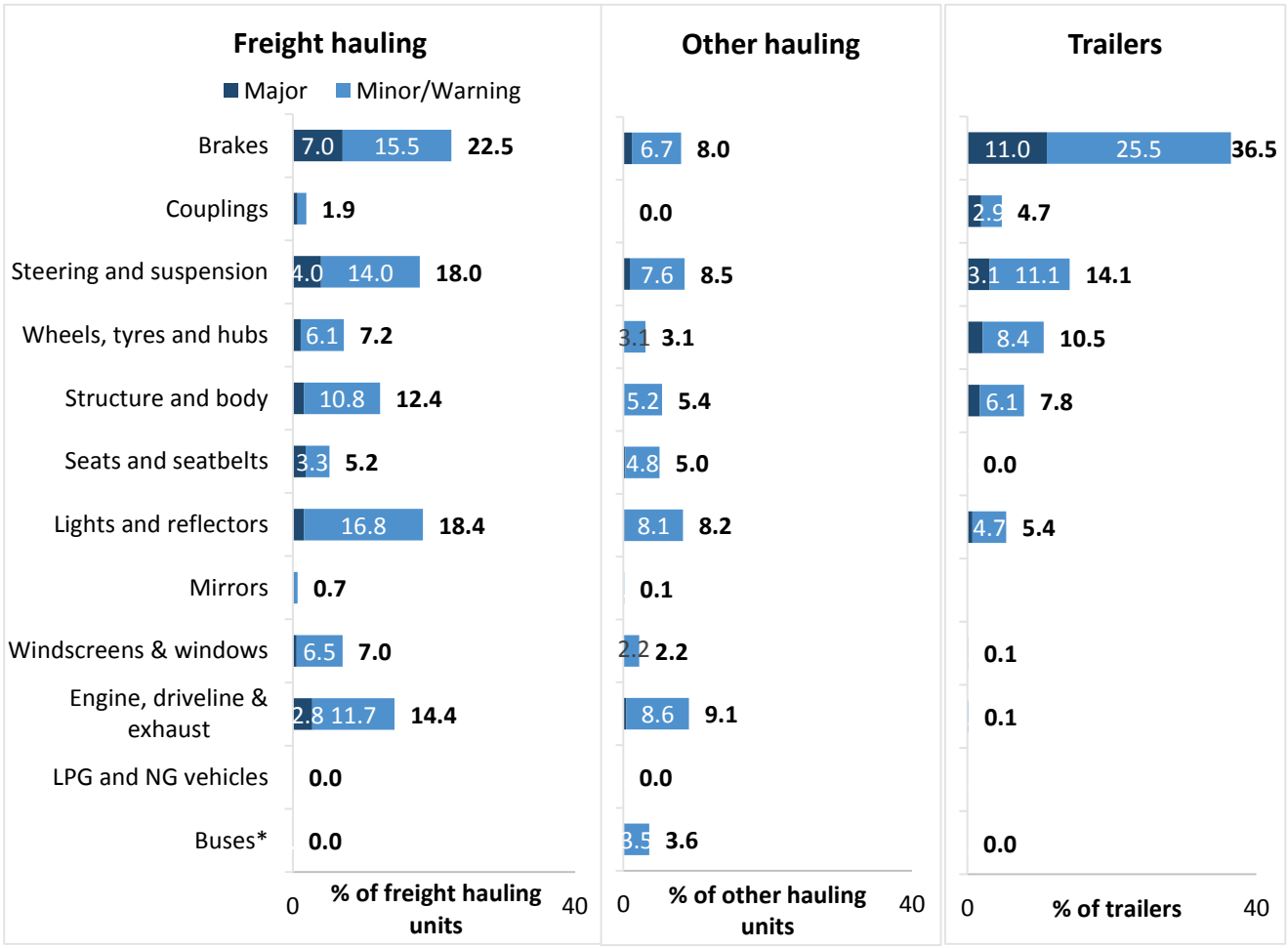
The incidences of the vehicle systems of non-conformities are shown for:

- **freight hauling units**: freight units as a group (Figure 4-12) and by individual categories (Table 4-6);
- **other hauling units**: non-freight units as a group (Figure 4-12) and by individual categories (Table 4-7); and
- **trailers** (Figure 4-12).

System non-conformities in vehicle groupings

A brake non-conformity was the most common system non-conformity among freight hauling units and trailers, including for over one-third (36.5%) of trailers and about a quarter (22.5%) of freight hauling units (Figure 4-12).

Figure 4-12.
Incidence of highest level of categories of non-conformity in freight hauling units, other hauling units and trailers (weighted %s)



SAMPLE SIZE: Freight hauling units (n=5471), non-freight hauling units (n=1,659), trailers (n=3,936)
** Incidence based on bus/coach vehicles only (n=1,015)*
Note: Major and minor/warning incidences <2% are not labelled
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit
Note: Adding percentage results may give a rounding error of ±0.1% on the total

For trailers, a brake non-conformity was also the most common, for over a third of units (36.5%) (Figure 4-12). The four systems with the highest incidence of non-conformity were:

- **brakes** (36.5%, including 11.0% major);
- **steering and suspension** (14.1%);
- **wheels, tyres and hubs** (10.5%) and
- **structure and body** (7.8%).

System non-conformities in freight hauling units

The four systems with the highest incidence of non-conformity for freight hauling units were:

- **brakes** (22.5%, including 7.0% major);
- **lights and reflectors** (18.4%);
- **steering and suspension** (18.0%); and
- **engine, driveline and exhaust** (14.4%).

As the overall results for freight hauling vehicles were potentially influenced substantially by the high proportion of rigid trucks, non-conforming systems are shown in a more detailed breakdown by type of vehicle category in Table 4-6. The rate was substantively highest in rigid trucks for three of the systems, and substantively lowest for road train hauling units for three of the systems.

Among the higher incidence vehicle system non-conformities, brakes remained the highest for all the vehicle types at greater than 20% (ranging from 21.5% to 27.7%), being marginally higher among semi-trailer and road train hauling units; and engine, driveline and exhaust non-conformities were at broadly similar incidences (ranging from 10.8% to 16.2%). The incidence was highest for rigid trucks for steering and suspension (19.1%) and structure and body (14.1%), with both decreasing with overall vehicle size; and also highest for lights and reflectors (19.6%).

Table 4-6.
Incidence of highest level of categories of non-conformity in freight hauling units (weighted %s)

TYPE OF NON-CONFORMITY		Rigid truck			Semi-trailer			B-double			Road train		
		Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total
Brakes	%	6.8	14.8	**21.5**	9.5	18.2	**27.7**	5.1	17.4	**22.5**	8.2	19.1	**27.4**
Couplings	%	0.6	0.8	**1.5**	0.9	3.4	**4.2**	0.7	1.7	**2.5**	1.4	0.6	**1.9**
Steering and suspension	%	4.2	14.9	**19.1**	4.0	12.0	**16.0**	1.8	9.3	**11.1**	2.7	4.7	**7.5**
Wheels, tyres and hubs	%	1.1	6.7	**7.7**	1.3	5.2	**6.5**	1.1	3.1	**4.1**	0.0	1.1	**1.1**
Structure and body	%	1.8	12.3	**14.1**	0.7	6.1	**6.8**	0.8	3.7	**4.5**	0.0	2.4	**2.4**
Seats and seatbelts	%	2.0	3.8	**5.8**	1.3	1.9	**3.2**	0.9	1.0	**1.9**	1.4	0.4	**1.7**
Lights and reflectors	%	1.7	18.0	**19.6**	1.5	15.0	**16.5**	1.2	8.1	**9.3**	0.7	10.8	**11.4**
Mirrors	%	0.0	0.7	**0.8**	0.1	0.3	**0.4**	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Windscreens and windows	%	0.6	6.5	**7.1**	0.1	6.7	**6.8**	0.2	6.4	**6.6**	2.1	6.3	**8.4**
Engine, driveline and exhaust	%	2.8	11.6	**14.4**	3.1	13.1	**16.2**	1.2	9.6	**10.8**	3.0	11.0	**14.0**
LPG and NG vehicles	%	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Sample		*3,227*			*1,221*			*802*			*221*		

Major and Total non-conformities highlighted: 10<20%, 20<40%, 40<60%, 60+%
Note: Adding percentage results may give a rounding error of ±0.1% on the total

System non-conformities in non-freight hauling units

Given the much lower incidences of non-conformities among non-freight hauling units, the incidence of system non-conformity was lower than for freight hauling units (Figure 4-12). The four most common non-conformities were similar to freight hauling units, although within a narrower band of incidences (7.9% to 9.1%):

- **engine, driveline and exhaust** (9.1%);
- **steering and suspension** (8.5%);
- **lights and reflectors** (8.2%); and
- **brakes** (7.9%).

A more detailed breakdown of the two categories of vehicle shows the highest incidence of non-conformity being engine, driveline and exhaust (11.1%) for bus/coach; and lights and reflectors (10.5%) for plant/SPV for (Table 4-7). The most common four vehicle system non-conformities were:

BUS/COACH:

- **engine, driveline and exhaust** (11.1%);
- **brakes** (8.7%);
- **steering and suspension** (8.3%); and
- **lights and reflectors** (6.7%).

PLANT/SPV:

- **lights and reflectors** (10.5%);
- **steering and suspension** (8.7%);
- **structure and body** (7.5%); and
- **brakes** (6.7%).

Table 4-7.
Incidence of highest level of categories of non-conformity in non-freight hauling units (weighted %s)

TYPE OF NON-CONFORMITY		Bus/Coach			Plant/SPV		
		Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total
Brakes	%	1.2	7.5	**8.7**	1.3	5.3	**6.7**
Couplings	%	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Steering and suspension	%	0.2	8.1	**8.3**	1.9	6.8	**8.7**
Wheels, tyres and hubs	%	0.0	1.4	**1.4**	0.1	5.4	**5.5**
Structure and body	%	0.1	3.8	**3.9**	0.2	7.3	**7.5**
Seats and seatbelts	%	0.1	6.0	**6.1**	0.5	3.0	**3.5**
Lights and reflectors	%	0.0	6.6	**6.7**	0.3	10.2	**10.5**
Mirrors	%	0.0	0.0	**0.0**	0.0	0.3	**0.3**
Windscreens and windows	%	0.0	2.5	**2.5**	0.0	1.7	**1.7**
Engine, driveline and exhaust	%	0.4	10.7	**11.1**	0.5	5.7	**6.2**
LPG and NG vehicles	%	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Buses*	%	0.1	3.5	**3.6**			
Sample			*1,015*			*644*	

Major and Total non-conformities highlighted: 10<20%, 20<40%, 40<60%, 60+%
** Incidence based on bus/coach vehicles only (n=1,015)*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.5.1 System non-conformities in freight vehicle combinations

Classification of non-conformities

Freight vehicle combinations are defined as a vehicle with a freight hauling unit towing one or more trailers. This includes truck and trailer, semi-trailer, B-double and road train combinations.

The incidence of the different types of classification of non-conformities are presented for:

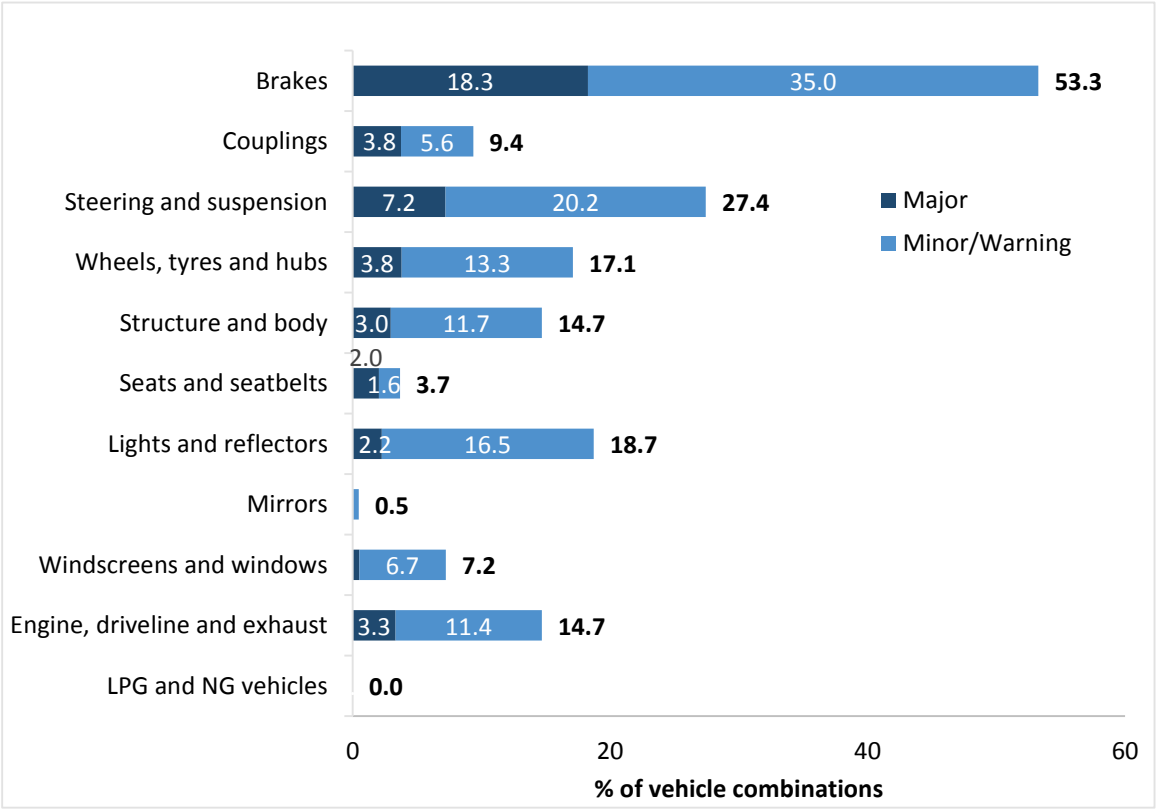
- freight combinations as a group (Figure 4-13); and
- individual combination categories (Table 4-8).

Incidence of non-conformities in combinations as a group

Brakes remained the vehicle system with the highest incidence of non-conformities among over half of vehicle combinations (53.3%, including 18.3% major) (Figure 4-13). Overall, the four most common system non-conformities were:

- **brakes** (53.3%);
- **steering and suspension** (27.4%);
- **lights and reflectors** (18.7%); and
- **wheels, tyres and hubs** (17.1%).

Figure 4-13.
Incidence of highest level of categories of non-conformity in freight vehicle combinations (weighted %s)



Sample size: All freight vehicle combinations (n=3,586)
Note: Major and minor/warning incidences <2% are not labelled
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Non-conformities in freight vehicle combinations

A brake non-conformity occurred in over half of each vehicle category (ranging from 51.3% to 56.8%) (Table 4-8). Rigid truck and trailer combinations had the highest incidence of major non-conformities including a higher incidence for brakes (24.0%), similar to road trains (22.2%); and the highest incidence for most of the other systems, including couplings (9.2%) and steering and suspension (9.2%).

Looking at the overall incidence of non-conformities, statistically significant differences between the vehicle combinations occurred for the following systems (Table 4-8):

- **coupling** non-conformities were highest for rigid truck and trailer combinations (19.1%) and lowest for semi-trailer (4.9%) and B-double (5.2%) combinations; and
- **seat and seatbelt** non-conformities, although relatively low overall, and focused on the hauling unit, were also highest for rigid truck and trailer combinations (6.1%) and lower for B-double (1.9%) and road train (1.7%) combinations.

Table 4-8.
Incidence of highest level of categories of non-conformity in freight vehicle combinations (weighted %s)

TYPE OF NON-CONFORMITY		Rigid truck & trailer			Semi-trailer			B-Double			Road Train		
		Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total
Brakes	%	24.0	32.9	**56.8**	16.9	34.5	**51.3**	12.9	39.1	**52.0**	22.2	33.4	**55.6**
Couplings	%	9.2	9.9	**19.1**	1.2	3.7	**4.9**	1.7	3.6	**5.2**	3.9	6.3	**10.3**
Steering and suspension	%	9.2	19.1	**28.3**	7.4	21.2	**28.6**	4.7	20.3	**24.9**	5.2	18.6	**23.7**
Wheels, tyres and hubs	%	4.8	12.3	**17.1**	3.7	14.3	**18.1**	3.1	13.6	**16.7**	1.4	9.2	**10.5**
Structure and body	%	4.6	11.7	**16.3**	2.3	12.2	**14.5**	2.4	12.0	**14.5**	1.4	6.3	**7.6**
Seats and seatbelts	%	4.1	2.0	**6.1**	1.3	1.9	**3.2**	0.9	1.0	**1.9**	1.4	0.4	**1.7**
Lights and reflectors	%	3.0	16.6	**19.6**	1.9	18.7	**20.6**	2.2	12.1	**14.4**	0.9	16.6	**17.4**
Mirrors	%	0.0	1.0	**1.0**	0.1	0.3	**0.4**	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Windscreens and windows	%	1.0	7.1	**8.1**	0.1	6.7	**6.8**	0.2	6.4	**6.6**	2.1	6.3	**8.4**
Engine, driveline and exhaust	%	5.3	9.7	**15.0**	3.1	13.3	**16.4**	1.2	9.6	**10.8**	3.0	12.3	**15.3**
LPG and NG vehicles	%	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Sample		*342*			*1,221*			*802*			*221*		

Major and Total non-conformities highlighted: 10<20%, 20<40%, 40<60%, 60+%
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.6 Classification of non-conformities by inspection jurisdiction

Classification of non-conformities

The incidence of non-conformities for hauling units, trailers and combinations are shown for each state of inspection in the following figures:

- NSW and VIC (Figure 4.14);
- QLD and SA (Figure 4.15);
- TAS and NT (Figure 4.16); and
- the ACT (Figure 4.17).

Comparisons have been made for freight hauling units, trailers and combinations between the states with the more consistent levels of non-conformities, as noted previously (i.e., NSW, VIC, QLD and TAS). For other freight hauling units, comparisons haven been made between the three largest states (NSW, VIC and QLD).

Overall non-conformities in freight hauling units

For freight hauling units, the incidence of a vehicle system non-conformity averaged across the systems was highest in VIC (highest for three systems) and QLD (highest for two systems) and lowest in TAS. For the top four non-conforming systems, consistently high or statistically significant differences between the states occurred for the following:

- **brake** non-conformities were found in over one-fifth of freight hauling units in each of the four states;
- **steering and suspension** non-conformities were highest in VIC (23.5%), and lowest in NSW (14.8%) and TAS (14.8%);
- **lights and reflectors** non-conformities were highest in QLD (24.8%) and lowest in VIC (15.4%); and
- **engine, driveline and exhaust** non-conformities were highest in QLD (21.1%) and lowest in TAS (3.6%).

Overall non-conformities in other hauling units

For other hauling units, the incidence of a vehicle system non-conformity averaged across the systems was highest in VIC (highest for six systems), influenced by the higher incidence of non-conformity in the bus/coach category. For the top four non-conforming systems, statistically significant differences between the states occurred for the following:

- **brake** non-conformities were highest in NSW (12.8%), and lower in VIC (7.3%) and QLD (5.9%);
- **wheels, tyres and hubs non-conformities** were highest in VIC (7.2%) and lowest in QLD (0.6%);
- **structure and body** non-conformities were highest in VIC (10.7%) and lowest in QLD (1.6%);
- **engine, driveline and exhaust** non-conformities were highest in VIC (18.8%), and lower in NSW (6.9%) and QLD (6.6%).

Overall non-conformities in trailers

For trailers, the incidence of non-conformities averaged lowest overall in TAS. Consistently high or statistically significant differences occurred between the states for the following systems:

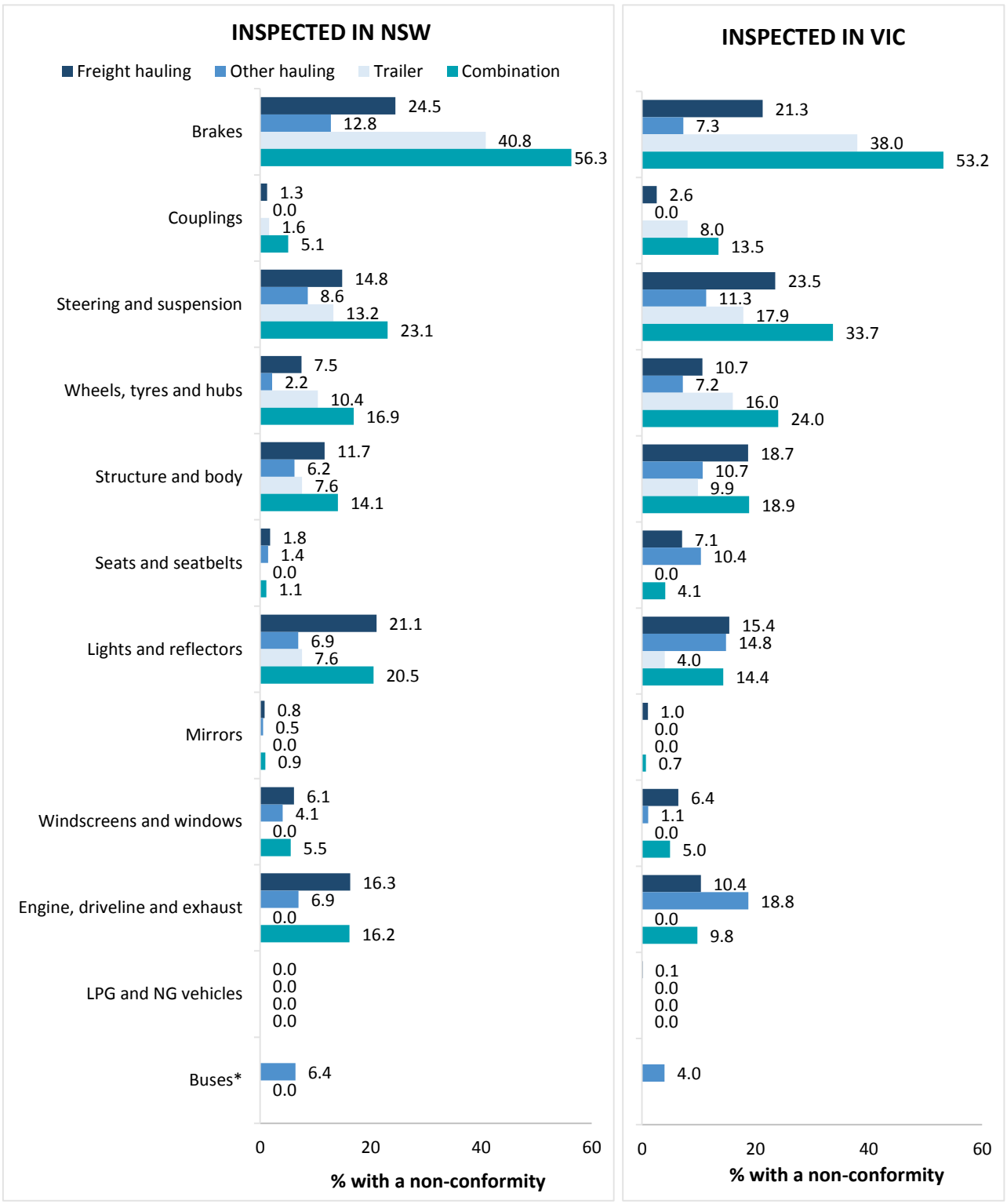
- **brake** non-conformities were found in over a third of trailers in each of the four states being reported;
- **couplings** non-conformities were highest in VIC (8.0%) and TAS (8.0%), and lowest in NSW (1.6%);
- **steering and suspension** non-conformities were highest in VIC (17.9%), and lowest in TAS (2.4%); and
- **wheels, tyres and hubs non-conformities** were highest in VIC (16.0%) and lowest in TAS (3.2%).

Overall non-conformities in freight vehicle combinations

For combinations, the incidence of a system non-conformity averaged across the systems was highest in QLD (highest for four systems) and also relatively high in VIC (also highest for four systems); the incidence was lowest in TAS, similar to the outcome for freight hauling units. For the top four non-conforming systems, consistently high or statistically significant differences between the states occurred for the following:

- **brake** non-conformities were found in over half of combinations in each of the four states being reported (ranging from 53.2% to 56.3%);
- **steering and suspension** non conformities were highest in VIC (33.7%) and QLD (32.6%), and lowest in TAS (9.4%);
- **wheels, tyres and hubs non-conformities** were highest in VIC (24.0%) and lowest in TAS 6.7%); and
- **lights and reflectors** non-conformities were highest in QLD (27.9%) and lowest in VIC (14.4%).

Figure 4-14.
Incidence of categories of non-conformity in hauling units, trailers and combinations: inspected in NSW and VIC (weighted %s)



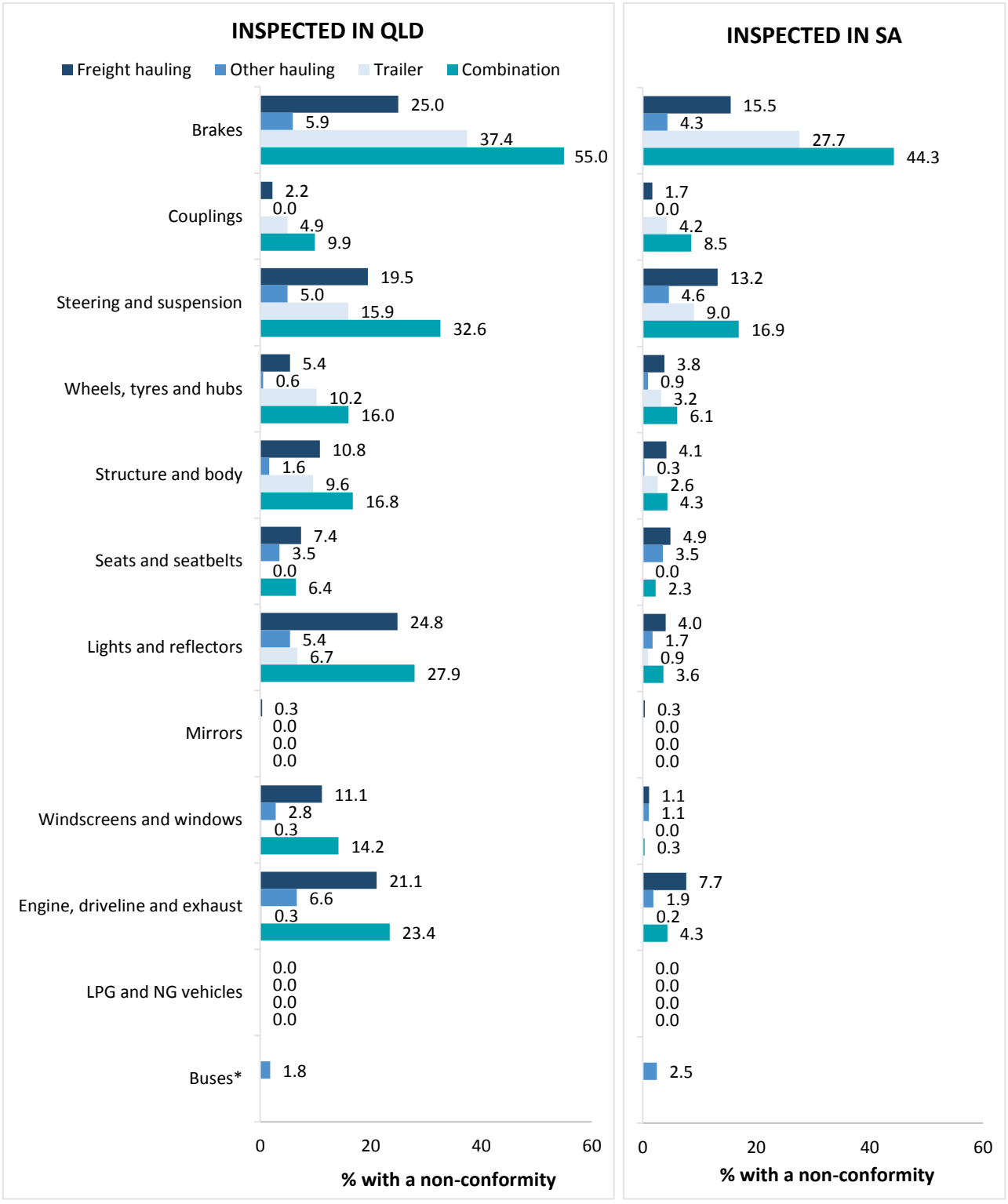
Sample size: Freight hauling units (n=1,359), other hauling units (n=402), trailers (n=876), combinations (n=587)

Freight hauling units (n=1,446), other hauling units (n=471), trailer

** Calculated on bus/coach only (n=1,043), combinations (n=740)*

Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

Figure 4-15.
Incidence of categories of non-conformity in hauling units, trailers and combinations: inspected in QLD and SA (weighted %s)



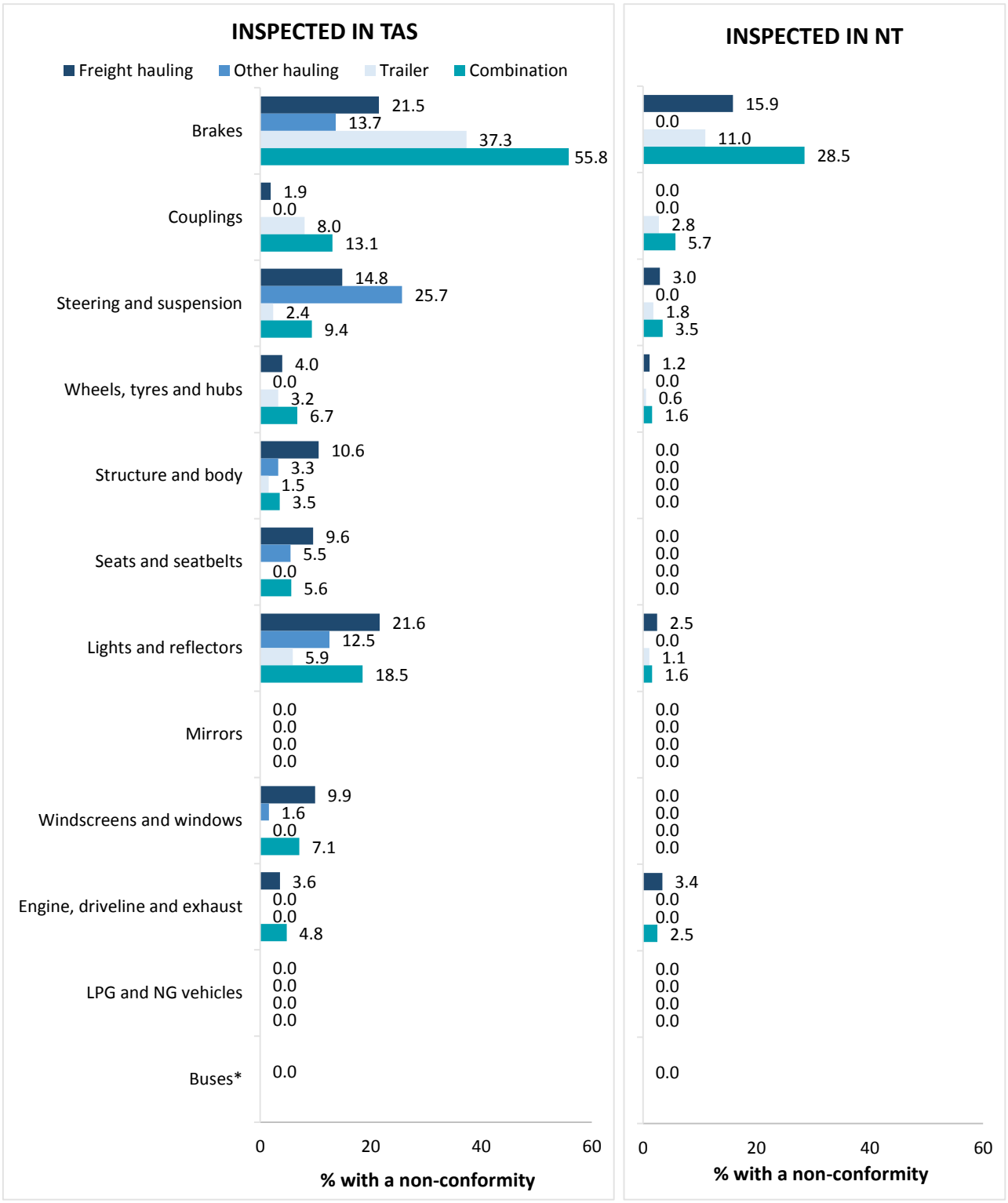
Sample size: Freight hauling units (n=1,289), other hauling units (n=407), trailers (n=972), combinations (n=634)

Freight hauling units (n=770), other hauling units (n=213), trailers (n=622) combinations (n=390)

**Calculated on bus/coach only*

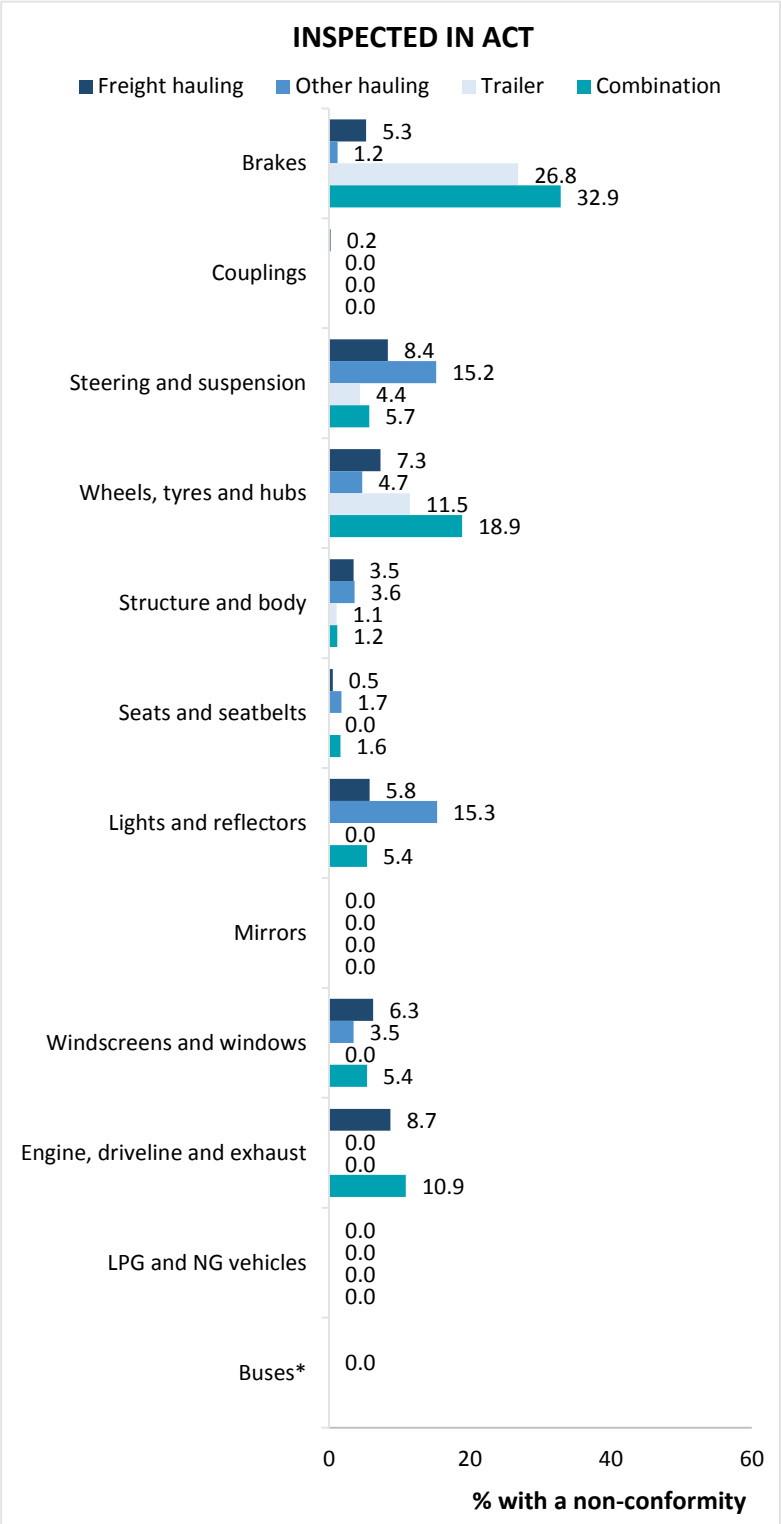
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

Figure 4-16.
Incidence of categories of non-conformity in hauling units, trailers and combinations: inspected in TAS and NT (weighted %s)



Sample size: Freight hauling units (n=269), other hauling units (n=47), trailers (n=140), combinations (n=111)
**Calculated on bus/coach only*
Freight hauling units (n=187), other hauling units (n=54), trailers (n=233), combinations (n=83)
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

Figure 4-17.
Incidence of categories of non-conformity in hauling units, trailers and combinations: inspected in ACT (weighted %s)



Sample size: Freight hauling units (n=151), other hauling units (n=65), trailers (n=50), combinations (n=41)
**Calculated on bus/coach only*
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

4.7 State of registration

4.7.1 Incidence of state of registration by inspection

The incidences of non-conformities were shown in Section 4.3 for inspection jurisdiction. In this section, the incidence is shown by registration jurisdiction. The profile of the state of inspection by state of registration is presented, along with sample sizes for state and vehicle category combinations.

During the NRBS, there were 11,066 vehicle units inspected through three intercept methods, with 79.9% (8,841 units) of vehicle inspections being conducted in the state of registration. The large majority (~80+%) of freight hauling units were registered in the state of inspection for all states (Table 4-9). The incidence was 89% or more in each state for non-freight hauling vehicles. For trailers, the incidence was lower particularly for the largest four states—NSW, VIC, QLD, and SA—at about two thirds (64.8-71.2%) (Table 4-9). This outcome reflected a greater proportion of multi-unit freight vehicles on long-haul trips travelling through the inspection state.[5]

Table 4-9.
Incidence of registration of units in the state of inspection (home state) (unweighted %s)

	STATE OF REGISTRATION						
STATE OF INSPECTION	NSW	VIC	QLD	SA	TAS	NT	ACT
	%	%	%	%	%	%	%
Freight hauling units							
NSW	83.8	9.1	11.2	2.2	0.4	0.0	9.6
VIC	5.0	79.8	1.3	7.3	2.2	2.1	0.0
QLD	3.1	2.1	85.5	1.3	0.0	2.1	0.0
SA	1.7	7.6	0.4	86.2	0.4	4.3	1.4
TAS	0.0	0.6	0.0	0.0	97.0	0.0	0.0
NT	0.2	0.3	1.6	2.6	0.0	91.5	1.4
ACT	6.1	0.5	0.1	0.4	0.0	0.0	87.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Sample	*1,222*	*1,633*	*1,405*	*696*	*268*	*141*	*73*
Trailers							
NSW	70.7	15.0	20.1	5.1	1.5	0.0	9.1
VIC	15.9	64.8	3.9	12.1	5.3	0.8	0.0
QLD	5.8	2.8	71.2	2.5	0.0	1.7	0.0
SA	1.9	15.2	1.8	66.3	1.5	9.2	0.0
TAS	0.0	1.3	0.1	0.0	91.7	0.0	0.0
NT	0.0	0.4	2.8	13.6	0.0	88.3	0.0
ACT	5.6	0.4	0.1	0.4	0.0	0.0	90.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Sample	*567*	*1,274*	*1,241*	*528*	*133*	*120*	*11*

Sample size: All freight hauling units (n=5,438) and trailers (n=3,874) other than registered in WA
Note: Adding percentage results may give a rounding error of ±0.1% on the total

[5] When the survey was weighted, there was a much lower incidence of freight hauling units and trailers registered in the ACT that were inspected there. The trend was influenced by almost all inspections conducted at the Department of Motor Vehicle Registry in Canberra being present-for inspection (which were limited to be limited to 7% of freight inspections in the sampling structure) rather than also including intercept inspections, as was intended. Freight intercept inspections were conducted mainly at highway sites, where vehicles were more likely to be registered outside the ACT.

4.7.2 Incidence of freight hauling units being inspected in home or other state

B-double and road train hauling units were the most likely type of freight hauling units to be registered outside the state of inspection (Table 4-10). Furthermore, less than half of trailers inspected in NT and the ACT were registered there.

Table 4-10.
Incidence of freight hauling units being inspected in home or other state, by vehicle type (weighted %s)

VEHICLE TYPE	Rigid truck	Semi-trailer	B-double	Road train
	%	*%*	*%*	*%*
Inspected in home state	91.9	81.3	67.1	69.8
Inspected outside home state	8.1	18.7	32.9	30.2
Total	***100***	***100***	***100***	***100***
Sample	*3227*	*1221*	*802*	*221*

4.8 State of Registration

4.8.1 Sample sizes for vehicle types by state of registration

Sample sizes for vehicle types by state of registration are shown in Table 4-11 for reference. Results for sub-groups with sample sizes of less than 30 are highlighted: results for these sub-groups have not been reported separately.

Table 4-11.
Sample sizes for vehicle types by state of registration

	STATE OF REGISTRATION							
VEHICLE TYPE	NSW	VIC	QLD	SA	TAS	NT	ACT	WA
	Sample	*Sample*	*Sample*	*Sample*	*Sample*	*Sample*	*Sample*	*Sample*
Vehicle type								
Rigid truck	830	874	802	387	169	84	65	16
No trailer	751	775	697	355	152	82	60	13
Truck & trailer	79	99	105	32	17	2	5	3
Semi-trailer	242	412	301	155	70	29	7	5
B-double	135	334	198	100	29	4	0	2
Road train	15	13	104	54	0	24	1	10
Articulated	*392*	*759*	*603*	*309*	*99*	*57*	*8*	*17*
Bus/Coach	243	245	271	135	34	45	39	3
Plant/SPV	144	204	179	71	15	3	22	6
Total vehicle units	***1609***	***2082***	***1855***	***902***	***317***	***189***	***134***	***42***
Trailers	**567**	**1274**	**1241**	**528**	**133**	**120**	**11**	**62**

Highlighting small sample sizes, <30 – results for these cells have not been reported

4.8.2 Incidence of non-conformity by state of registration

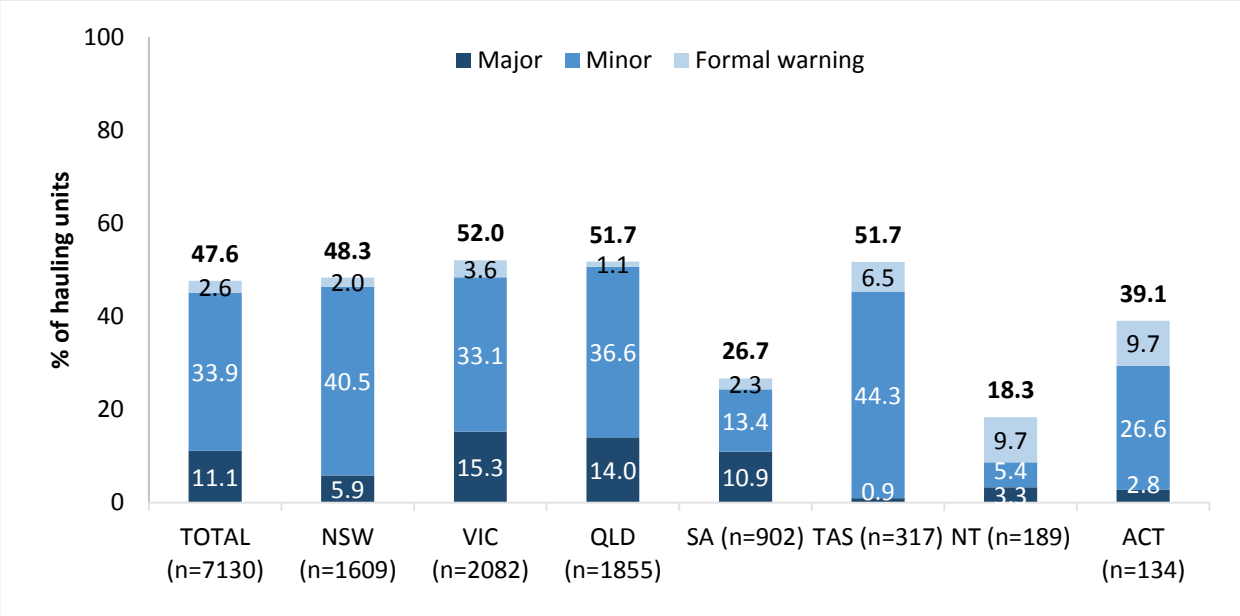
Assessment of non-conformity

The incidence of units with a non-conformity is shown by state of registration for both hauling units (Figure 4-18) and trailers (Figure 4-19). As with the analysis by state of inspection, the incidences in particular for SA (hauling: 26.7%, trailers: 33.9%) and NT (hauling: 18.3%, trailers: 20.3%) were substantially lower than the other states; and the incidence was also below average in the ACT (hauling: 39.1%, trailers: 30.2%).

Non-conformities in hauling units

The incidences of non-conformities for hauling units were broadly high in NSW, VIC, QLD and TAS (ranging from 48.3% to 52.0%) (Figure 4-18), very similar to the results by state of inspection. The incidences were statistically significantly lower in SA (26.7%) and NT (18.3%), and below average in the ACT (39.1%). The proportion of non-conforming units with a major non-conformity was statistically significantly higher for SA (40% of non-conforming units).

Figure 4-18.
Incidence of highest level of non-conformity in hauling unit, by state of registration (weighted %s)*

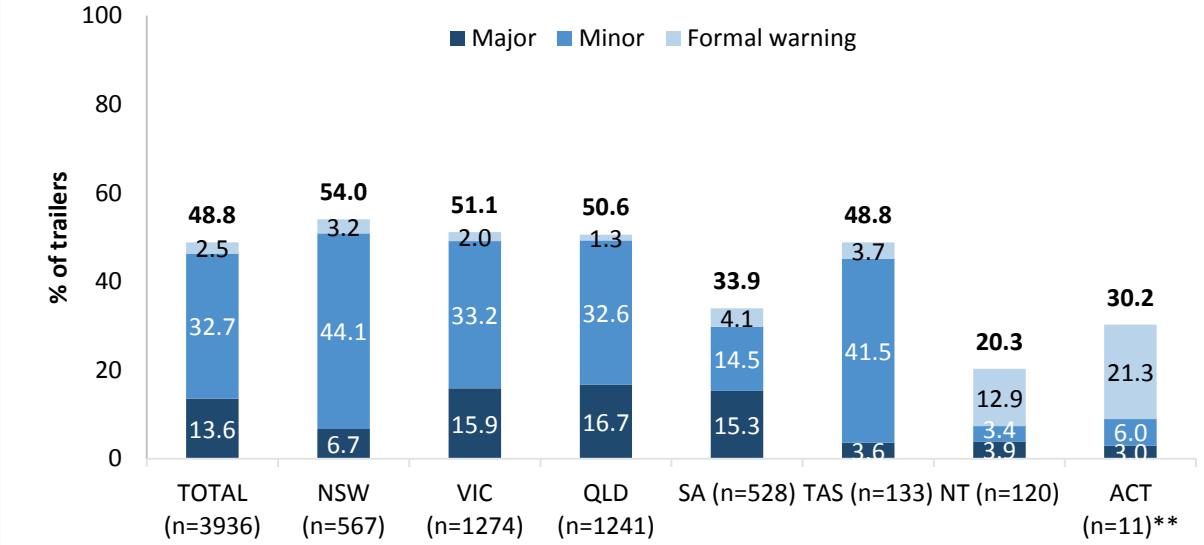


Sample size: All hauling units (n=7,130)
**42 hauling units registered in WA are included in the total*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Non-conformities in trailers

The outcome for non-conforming trailers, was similar to that for hauling units, showing broadly higher incidences in NSW, VIC, QLD and TAS, but with the trend for SA for the rate to be higher than for hauling units (33.9% vs 26.7%) (Figure 4-19). This difference is likely to reflect that SA trailers were more likely than hauling units overall to be inspected outside the home state, and that non-conformity rates were on average higher outside SA.

Figure 4-19.
Incidence of highest level of non-conformity in trailers, by state of registration (weighted %s)

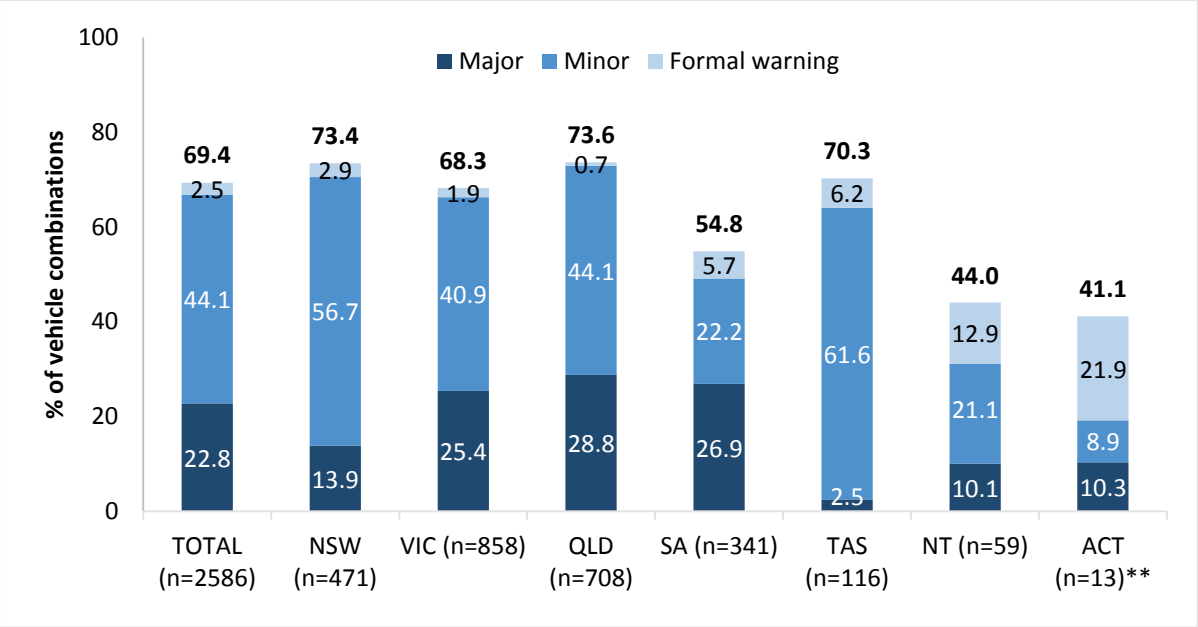


Sample size: All trailers (n=3,936)
**62 trailers registered in WA are included in the total*
***Small sample*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Non-conformities in vehicle combinations

The outcome for vehicle combinations by state of registration (Figure 4-20) showed trends for increases in incidences in non-conformity over hauling units (with the exception of the ACT, although this was based on a very small sample size). The proportion of non-conforming units with a major non-conformity was again statistically significantly highest for SA (49% of non-conforming combinations).

Figure 4-20.
Incidence of highest level of non-conformity in freight vehicle combinations, by state of registration (weighted %s)



Sample size: All freight vehicle combinations (2,586)
**20 combinations where the hauling unit was registered in WA are included in the total*
***Small sample size*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.8.3 Incidence of non-conformity by hauling unit, trailers and combinations by state of registration

Assessment of non-conformity

Assessing the incidence of non-conformities by state of registration for each type of hauling unit (Table 4-12) and vehicle combination (Table 4-13) again confirmed the broadly lowest incidences in SA and NT, and below average incidence in the ACT (although this was based on a small sample size).

Overall non-conformity for hauling units

The overall incidence of non-conformities for hauling units was greatest in the following five hauling unit and state groups (Table 4-12):

- VIC: **bus/coach** (59.8%), **rigid truck** (55.5%);
- QLD: **semi-trailer** (57.2%), **rigid truck** (55.3%); and
- TAS: **rigid truck** (56.3%).

Non-conformity by hauling unit categories

The following statistically significant differences were observed among the states with the more consistent, higher non-conformity rates (NSW, VIC, QLD and TAS), focusing on hauling units (Table 4-12):

- **B-double**: highest incidence of non-conformities for QLD (53.5%), compared with, NSW (42.6%) and VIC (31.8%);
- **Bus/coach**: highest incidence of non-conformities for VIC (59.8%), compared with NSW (22.9%), QLD (20.2%), and TAS (35.3%, from a sample of 34 units); and
- **Plant**: higher incidences for VIC (39.7%) and NSW (36.3%), and lowest incidence for QLD (28.3%).

Among the four largest states, the outcome for major non-conformities in hauling units was statistically significant for (Table 12):

- **Rigid truck** hauling units: highest for VIC (18.8%) and lowest for NSW (6.3%); and
- **Road train** hauling units: relatively high rates for QLD (15.2%) and SA (12.5%).

While the overall incidence of non-conformities was lower for SA units, the incidence of a *major non-conformity* was again relatively high for hauling units, above that of NSW and TAS (as well as NT and the ACT) (Tables 4-12). Major non-conformities in hauling units from TAS were again very low (<2%).

Non-conformity for trailers

For trailers, the incidence of major non-conformities was also relatively high for SA, above that of NSW and TAS (as well as NT and the ACT). The incidences were similarly higher for QLD (16.7%), SA (15.3%) and VIC (15.9%), and statistically significantly higher than for NSW (6.7%) and TAS (3.6%) (Table 4-13).

Major non-conformity for vehicle combinations by state

Overall, the incidence of major non-conformities in vehicle combinations was highest for the following six vehicle and state groups in the four largest states (Table 4-13):

- VIC: **Rigid truck and trailer** (75.6%);
- QLD: **Rigid truck and trailer** (74.8%); **road train** (75.4%), **B-double** (73.2%); and
- NSW: **Semi trailer** (73.4%), **road train** (73.1%).

Table 4-12.
Incidence of highest level of non-conformity in hauling units, by state of registration (weighted %s)

UNITS		STATE OF INSPECTION																		
		NSW			VIC			QLD			SA			TAS			NT			ACT		
		Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total
HAULING UNIT																						
Hauling unit - Main types																						
Rigid	%	6.3	45.8	**52.0**	18.8	36.7	**55.5**	15.4	39.9	**55.3**	12.7	19.6	**32.3**	1.2	55.1	**56.3**	3.1	16.9	20.0	1.7	36.9	**38.6**
Semi-trailer	%	8.6	40.8	**49.4**	15.4	31.4	**46.7**	18.9	38.3	**57.2**	14.0	19.3	**33.3**	1.3	45.3	**46.6**						
B-double	%	3.1	39.5	**42.6**	7.0	24.8	**31.8**	11.0	42.5	**53.5**	8.1	18.1	**26.2**									
Road Train	%							15.2	36.5	**51.6**	12.5	7.8	**20.3**									
Bus/Coach	%	2.0	20.9	**22.9**	2.8	57.0	**59.8**	2.1	18.1	**20.2**	1.7	5.0	**6.7**	0.0	35.3	**35.3**	0.0	0.0	0.0	2.6	41.0	**43.6**
Plant/SPV	%	2.8	33.5	**36.3**	0.3	39.4	**39.7**	3.1	25.2	**28.3**	7.1	4.2	**11.3**									
Supplementary groups																						
Articulated	%	6.6	40.7	**47.3**	12.6	28.9	**41.5**	15.7	39.6	**55.3**	12.0	17.6	**29.6**	0.9	46.9	**47.8**	7.3	22.6	29.8	19.2	6.6	**25.7**
TRAILERS																						
Trailers	%	6.7	47.3	**54.0**	15.9	35.2	**51.1**	16.7	33.9	**50.6**	15.3	18.6	**33.9**	3.6	45.2	**48.8**	3.9	16.4	20.3	3.0	27.3	**30.2**

Refer to Table 4-2 for sample sizes
Major and Total non-conformities highlighted: 10<20%, 20<40%, 40<60%, 60+%
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Table 4-13.
Incidence of highest level of non-conformity in combinations, by state of registration (weighted %s)

COMBINATION		STATE OF INSPECTION																				
		NSW			VIC			QLD			SA			TAS			NT			ACT		
		Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total	Major	Minor/ Warn.	Total
Vehicle categories																						
Rigid truck and trailer	%	16.4	56.1	**72.6**	31.5	44.1	**75.6**	35.7	39.1	**74.8**	49.4	18.4	**67.7**	5.9	64.7	**70.6**						
Semi-trailer	%	14.1	59.4	**73.4**	27.3	39.8	**67.1**	24.5	48.0	**72.5**	24.7	31.1	**55.8**	1.3	61.9	**63.2**						
B-double	%	9.8	63.3	**73.1**	14.9	48.3	**63.2**	25.2	48.0	**73.2**	15.1	33.4	**48.5**	0.0	83.3	**83.3**	25.0	17.9	**42.9**			
Road Train	%							31.6	43.9	**75.4**	23.7	17.1	**40.7**				6.6	50.1	**56.7**			
Articulated	%	12.8	61.0	**73.8**	23.1	42.3	**65.4**	25.6	47.5	**73.1**	21.5	30.2	**51.7**	0.9	69.2	**70.1**	11.2	37.7	**48.9**			

Refer to Table 4-2 for sample sizes
Major and Total non-conformities highlighted: 10<20%, 20<40%, 40<60%, 60+%
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.8.4 Vehicle system non-conformity by state of registration

Assessment of non-conformity

Non-conformity by vehicle category and combinations is assessed in this section by state of registration. The incidence of non-conformities for hauling units, trailers and combinations are shown for each state of registration in the following figures:

- NSW and VIC (Figure 4-21);
- QLD and SA (Figure 4-22);
- TAS and NT (Figure 4-23); and
- The ACT (Figure 4-24);

Comparisons have been made between the states with the more consistent levels of non-conformities, as noted previously (i.e., NSW, VIC, QLD and TAS).

Overall non-conformities in freight hauling units

The key results were very similar to the outcome described above for state of inspection. For freight hauling units, the incidence of a vehicle system non-conformity averaged across the systems was highest overall for QLD and lowest for NSW and TAS. For the top four non-conforming systems, consistently high or statistically significant differences between the states occurred for:

- **brake** non-conformities were found in over one-fifth of freight hauling units for each of the four states;
- **steering and suspension** non-conformities were higher for VIC (21.8%) and QLD (19.4%), and lower for NSW (15.5%) and TAS (16.9%);
- **lights and reflectors** non-conformities were highest for QLD (24.1%) and lowest for VIC (15.7%); and
- **engine, driveline and exhaust** non-conformities were highest for QLD (20.2%) and lowest for TAS (3.9%).

Overall non-conformities in other hauling units

For other hauling units registered in NSW, VIC and QLD, the following consistently high or statistically significant differences between the states occurred or the top four non-conforming systems:

- **brake** non-conformities were broadly similar (ranging from 6.9% to 12.1%);
- **steering and suspension** non-conformities were broadly similar (ranging from 5.3% to 11.0%);
- **lights and reflectors** non-conformities were highest for VIC (14.3%) compared with NSW (6.8%) and QLD (6.7%); and
- **engine, driveline and exhaust** non-conformities were highest for VIC (19.0%) and compared with NSW (7.0%) and QLD (6.2%).

Overall non-conformities in trailers

For trailers, the incidence of non-conformities averaged lowest across the systems for TAS. Consistently high or statistically significant differences between the states occurred for:

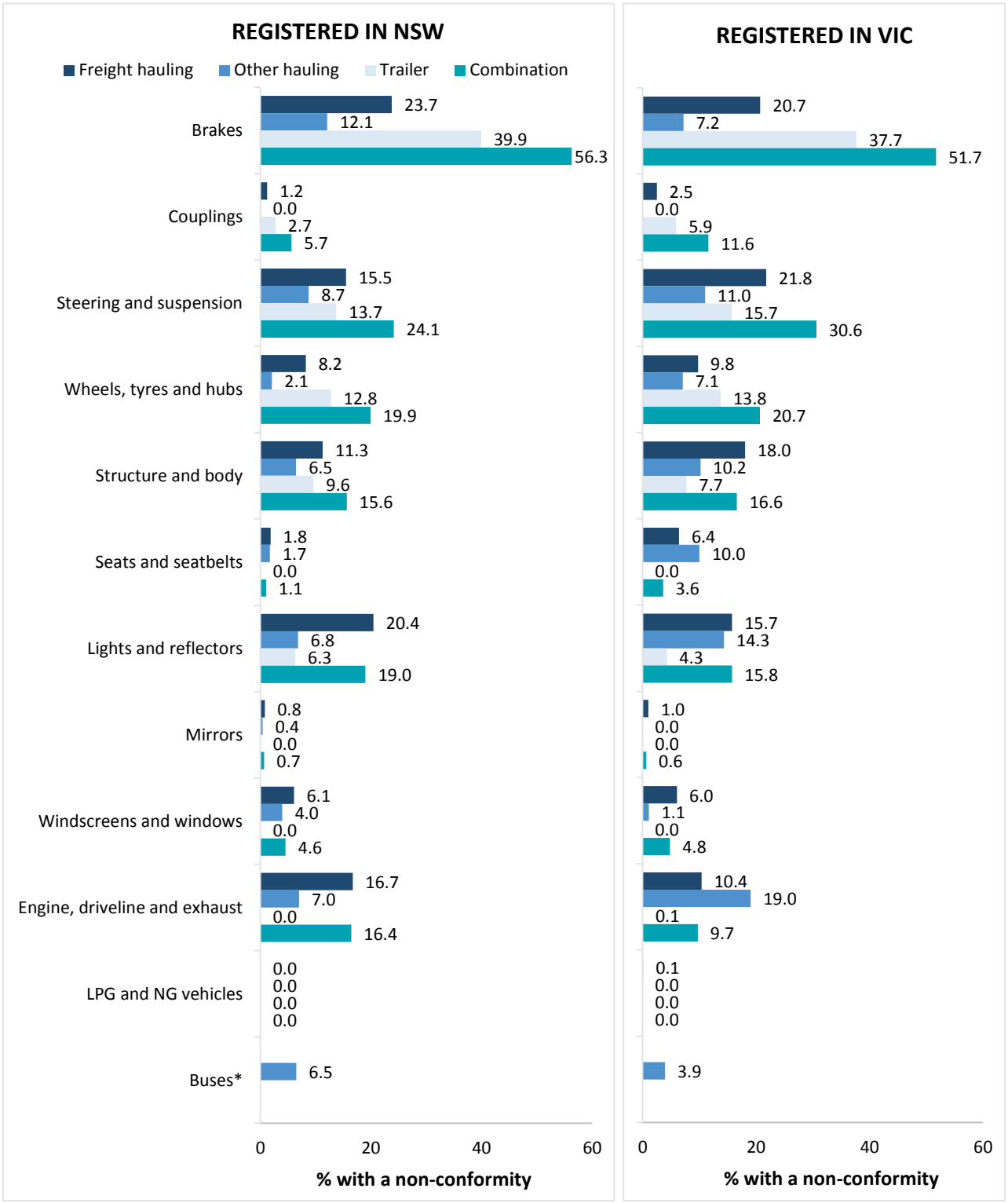
- **brake** non-conformities were found in over a third of trailers for each of the four states being reported;
- **couplings** non-conformities were highest for TAS (9.1%) and lowest for NSW (2.7%); and
- **wheels, tyres and hubs non-conformities** were highest for VIC (13.8%) and NSW (12.8%), and lowest for TAS (3.6%).

Overall non-conformities in freight vehicle combinations

For freight vehicle combinations, the incidence of a vehicle system non-conformity was highest overall in QLD (highest or similarly high for five systems) and VIC (highest or similarly high for four systems), and lowest overall in TAS. For the top four non-conforming systems, consistently high or statistically significant differences between the states occurred for (Figures 4-21 to 4-24):

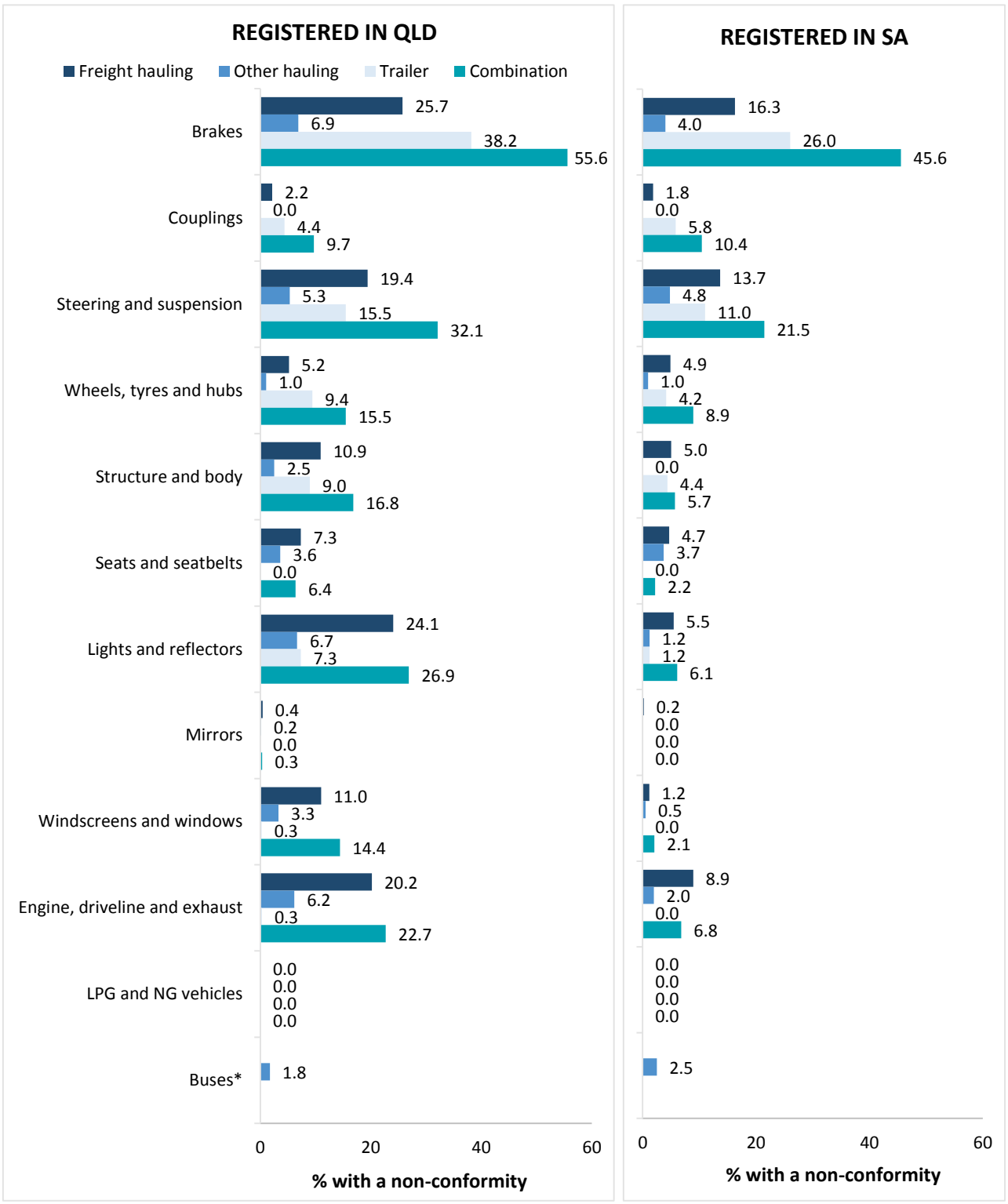
- **brake** non-conformities were found in over half of combinations for each of the four states being reported (ranging from 51.7% to 56.3%);
- **steering and suspension** non-conformities were highest for QLD (32.1%) and VIC (30.6%), and lowest for TAS (9.8%);
- **lights and reflectors** non-conformities were highest in QLD (26.9%) and lowest for VIC (15.8%);
- **engine, driveline and exhaust** non-conformities were highest for QLD (22.7%) and lower for VIC (9.7%) and TAS (6.0%).

Figure 4-21.
Incidence of categories of non-conformity in hauling units, trailers and combinations#: registered in NSW and VIC (weighted %s)



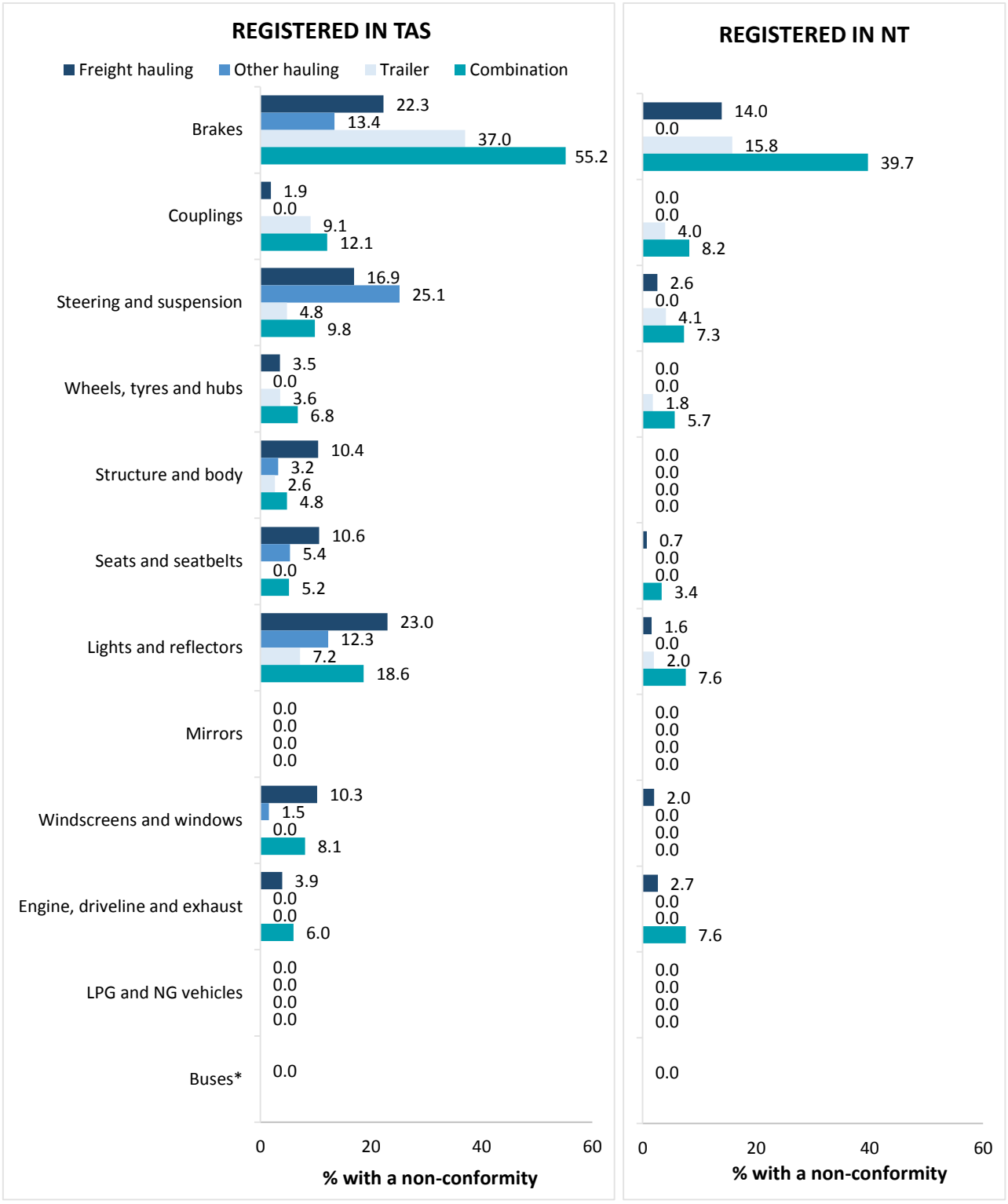
Sample size: Freight hauling units (n=1,222), other hauling units (n=387), trailers (n=567), combinations (n=471)
Freight hauling units (n=1,633), other hauling units (n=449), trailer (n=1,274), combinations (n=858)
#Based on state of registration of hauling unit
**Calculated for bus/coach only*
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

Figure 4-22.
Incidence of categories of non-conformity in hauling units, trailers and combinations#: registered in QLD and SA (weighted %s)



Sample size: Freight hauling units (n=1,405), other hauling units (n=450), trailers (n=1,241), combinations (n=708)
Freight hauling units (n=696), other hauling units (n=206), trailers (n=528), combinations (n=341)
#Based on state of registration of hauling unit
**Calculated for bus/coach only*
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

Figure 4-23.
Incidence of categories of non-conformity in hauling units, trailers and combinations[#]: registered in TAS and NT (weighted %s)



Sample size: Freight hauling units (n=268), other hauling units (n=49), trailers (n=133), combinations (n=116)

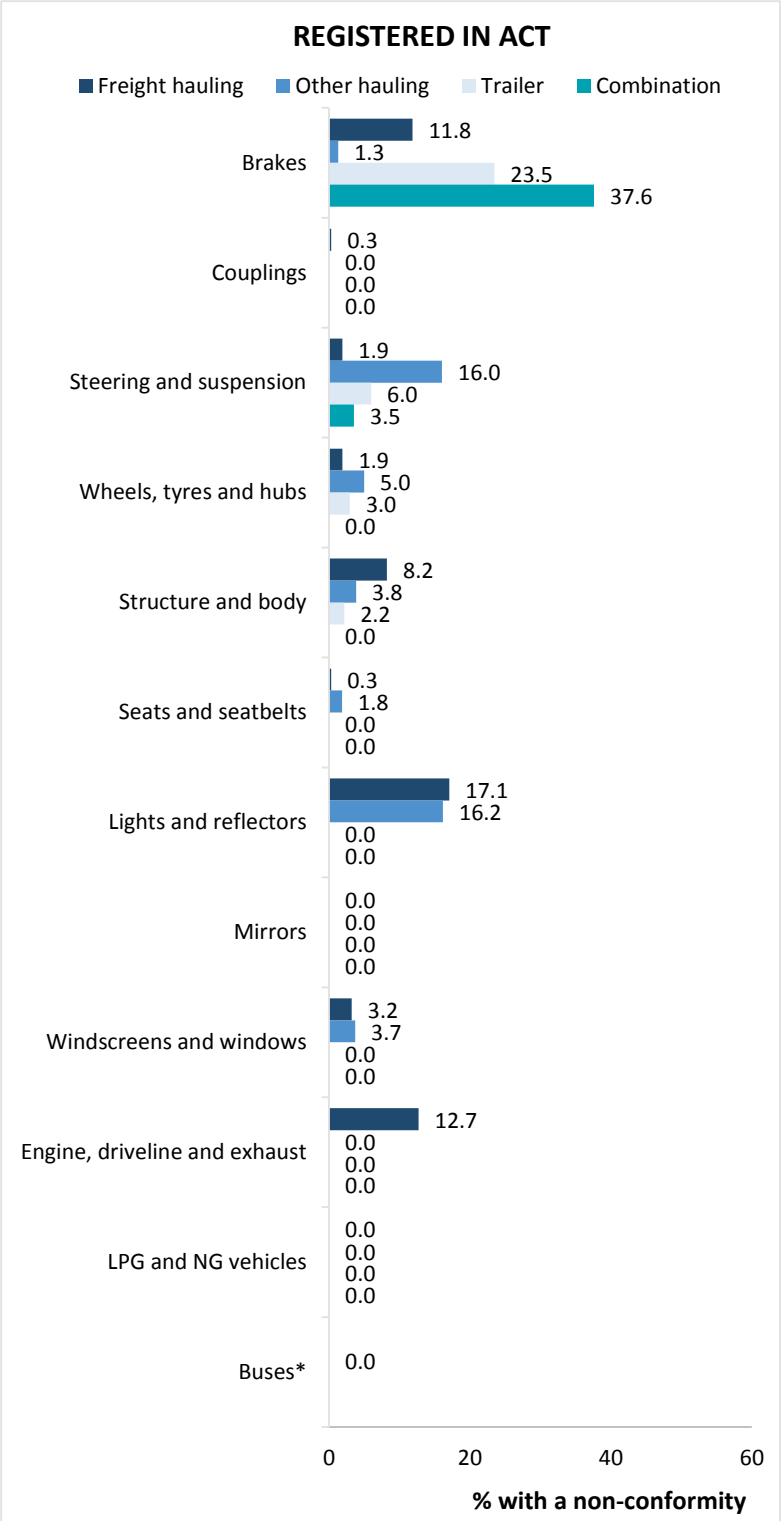
Freight hauling units (n=141), other hauling units (n=48), trailers (n=120) combinations (n=59)

#Based on state of registration of hauling unit

**Calculated for bus/coach only*

Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

Figure 4-24.
Incidence of categories of non-conformity in hauling units, trailers and combinations#: registered in ACT (weighted %s)



Sample size: Freight hauling units (n=73), other hauling units (n=61), trailers (n=11), combinations (n=13)
#Based on state of registration of hauling unit
**Calculated for bus/coach only*
Note: There may be cases of a system non-conformity recorded which is atypical for the type of unit

4.9 Location of inspection and state of registration

4.9.1 Overall non-conformity by state of registration and location of inspection

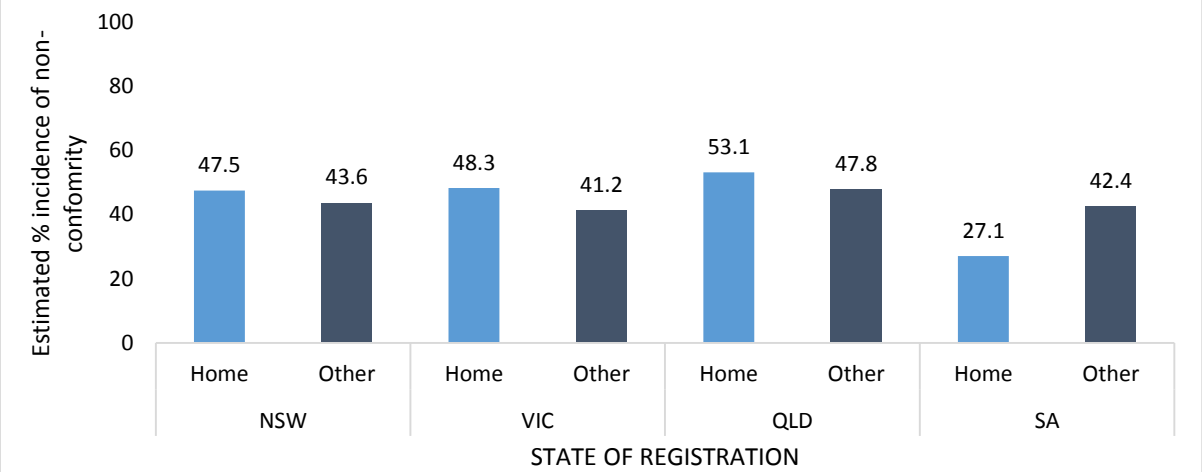
There was a general trend for vehicles inspected in the home state to have a higher incidence of non-conformities than those vehicles registered in that state but inspected outside the home state. Among the four larger states, this trend differed only in SA. SA-registered freight hauling units inspected outside SA were more likely to have non-conformities identified than those inspected in their home state (39.4% vs. 30.4%) (see Figure 4.26 on next page).

Freight hauling units inspected in their home state were on average statistically significantly older than units inspected outside the state. This outcome was broadly consistent with the observed non-conformity rates, and the observed relationship between age and non-conformity rates, with the continuing exception of the results for SA.

The higher non-conformity rate for SA-registered vehicles inspected outside SA remained as a statistically significant difference when taking into account age, type of hauling unit and type of inspection (Figure 4-25).[6] The result suggests that overall non-conformity rates from inspections in SA were lower than expected, and which could be explained by differences in inspection practices.

A similar outcome was found for NSW in regard to a major non-conformity as the highest classification in a hauling unit.

Figure 4-25.
Estimated incidence of non-conformity of freight hauling units by state of registration and location of inspection, adjusting for other factors*



Sample size: Freight hauling units registered and inspected in NSW, VIC, QLD or SA (n=4,812)
**Estimated incidences adjusting for unit category, state, type of inspection and age group (unweighted)*

[6] The analysis produces estimated of the incidence, adjusting for other factors. See Section 5.4.3 in Appendix B.

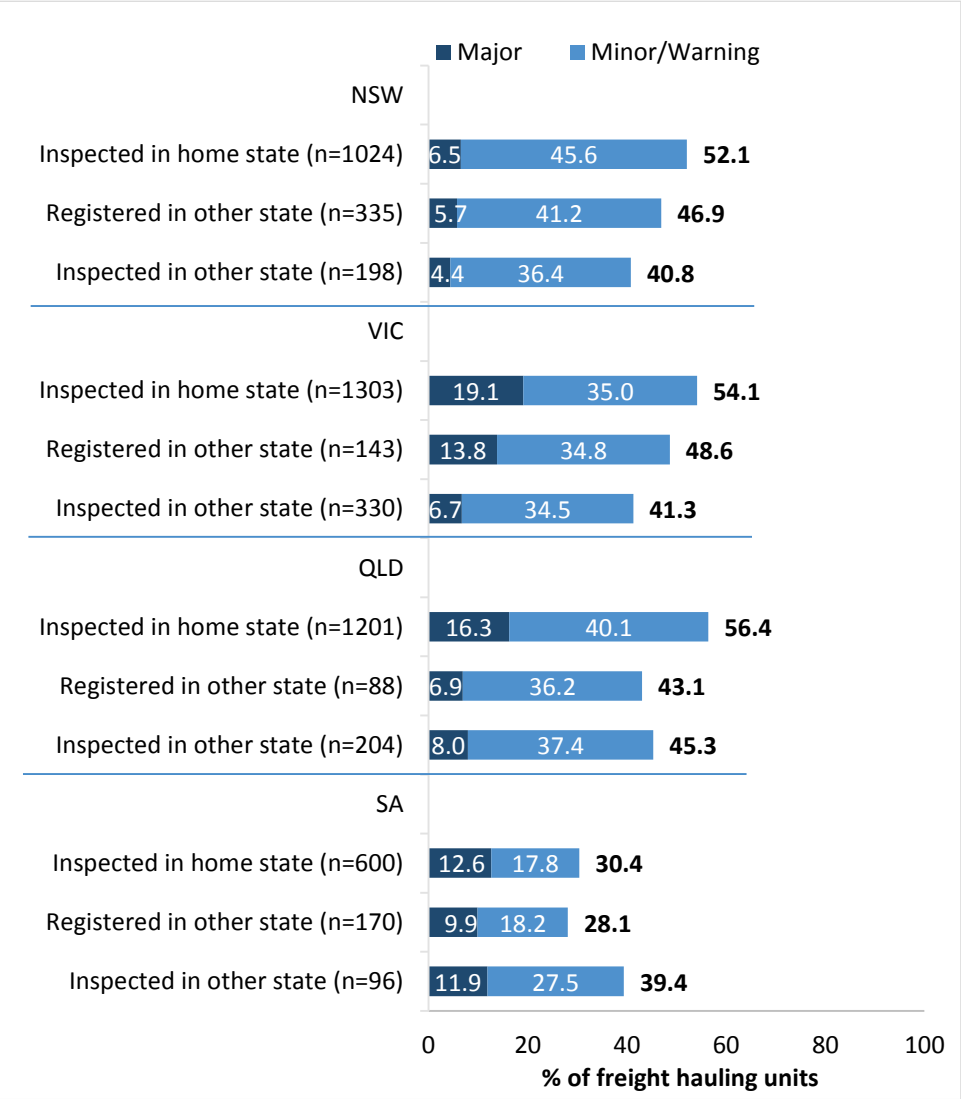
4.9.2 Rates of non-conformities in home registered vs. other state

Home registered vs. other state and classification of non-conformities

The incidence of non-conformities was assessed for freight hauling vehicles based on whether or not the vehicle was inspected in its home state of registration. Other hauling units were not included as they were almost exclusively inspected in the state of registration. This assessment was based on three groupings of vehicles with reference to each state (Figure 4-26):

- inspected in home state (e.g., a vehicle registered in QLD being inspected in QLD);
- registered in another state (e.g., a vehicle inspected in QLD that is registered in NSW, Victoria, SA, etc.); and
- inspected in another state (e.g. a vehicle registered in QLD being inspected in NSW, Victoria, SA, etc.).

Figure 4-26.
Incidence of highest level of non-conformity for freight hauling units, by state of inspection vs. registration* (weighted %s)



**Not shown for TAS, NT and ACT – at least one sample size <20*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

The three groupings are exclusive *within each state* as presented, and represent a full coverage of freight hauling units registered in the state or inspected in the state. This set up allows for an additional level of insight into the profile of non-conforming vehicles.

There was a general trend for vehicles inspected in the home state to have a higher incidence of non-conformities than those inspected outside of their home state (Figure 4-26). These results were statistically significantly different for NSW, VIC and QLD. The trend differed in SA, where SA-registered freight hauling units inspected outside SA tended to be more likely to have non-conformities (39.4% vs. 30.4%).

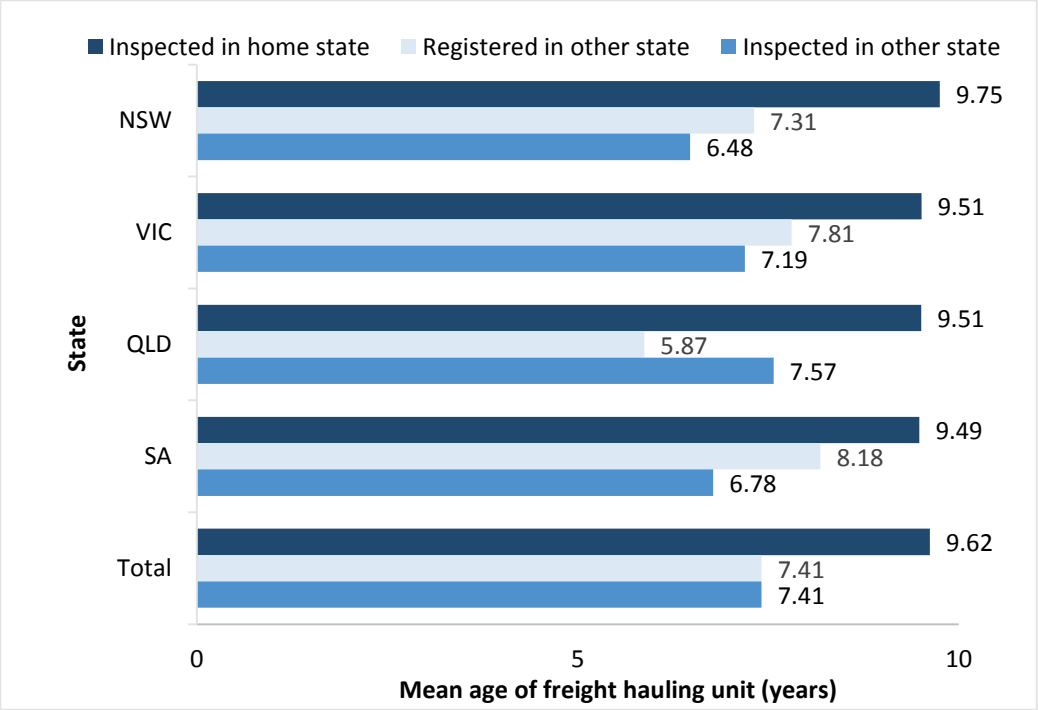
Home registered vs. other state and vehicle age

Freight hauling units inspected in the home state were on average statistically significantly older compared with those inspected outside the home state (Figure 4-27). This outcome is consistent with articulated hauling units, which on average were newer (as shown previously in Figure 4-2), being more likely to be used on long-haul trips and inspected outside the home state (as shown previously in Figure 4-10).

This outcome was also broadly consistent with the observed non-conformity rates (Figure 4-26), and the relationship between increasing age and increasing non-conformity rates, with the continuing exception of the results for SA.

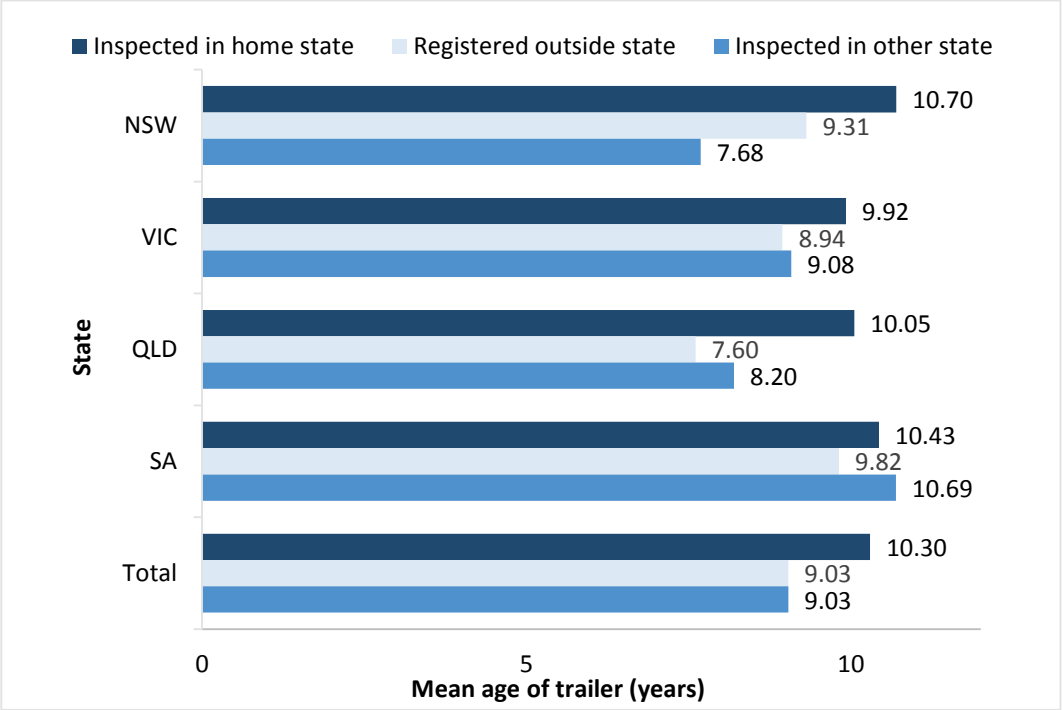
There was a further outcome for hauling units registered outside QLD and inspected in QLD to be newer (mean of 5.87, Figure 4-27).

Figure 4-27.
Mean age of freight hauling units by location of inspection and location of registration (weighted %s)



The outcome for trailers was broadly similar overall, with the difference that trailers associated with both inspection and registration in VIC and SA had similar average ages (Figure 4-28).

Figure 4-28.
Mean age of trailers by location of inspection and location of registration (weighted %s)



4.10 Brake test outcomes

4.10.1 Roller brake tests

An important component of the NRBS was the collection of data from roller brake tests. The data provided a set of objective measures associated with roadworthiness.

Roller brake testing was intended to be conducted on all axles of all units, unless it was not the practice of the inspector to undertake a test of that nature for safety or practical reasons. This applied mainly to plant/SPV units. In some additional cases the roller brake tester did not function properly. Table 4-14 shows the incidence of roller brake tests *not* conducted on hauling units and trailers, and specifically plant/SPV.

Table 4-14.
Incidence of roller brake tests by hauling units by state of inspection, and plant/SPV within state of inspection (unweighted %s)

Vehicle category	Unit	
	Sample	%
Rigid truck	*3227*	1.0
Semi-trailer	*1221*	0.3
B-double	*802*	0.4
Road train	*221*	1.4
Bus/Coach	*1015*	0.4
Plant/SPV	*644*	49.2
Trailers	*3936*	0.7

State of Inspection	Hauling units other than Plant/SPV	Plant/SPV	Trailers
	%	%	%
NSW	0.2	3.2	0.1
VIC	0.5	92.1	0.7
QLD	0.3	50.0	0.3
SA	1.5	9.1	0.3
TAS	0.0	0.0	0.0
NT	5.5	66.7	6.4
ACT	1.6	84.0	2.0
Sample	*6486*	*644*	*3936*

For hauling unit groups other than plant/SPV, no more than 1.4% overall did not have a roller brake test. Around half (49.2%) of plant/SPV overall did not have a brake test conducted. This incidence was very low in TAS (0%) and NSW (3.2%) and was half or more of units in VIC (92.1%), the ACT (84.0%), QLD (50.0%) and NT (66.7%). While conducting roller brake tests was not required if there was a safety issue or the vehicle was unsuitable for testing, the actual implementation for plant/SPV was influenced by the availability and/or utilisation of mobile testing units.

4.10.2 Issues with tests

In practice, there were a number of issues observed with the tests, in addition to the lack of tests being conducted. These issues were identified through comments recorded for the inspection, examination

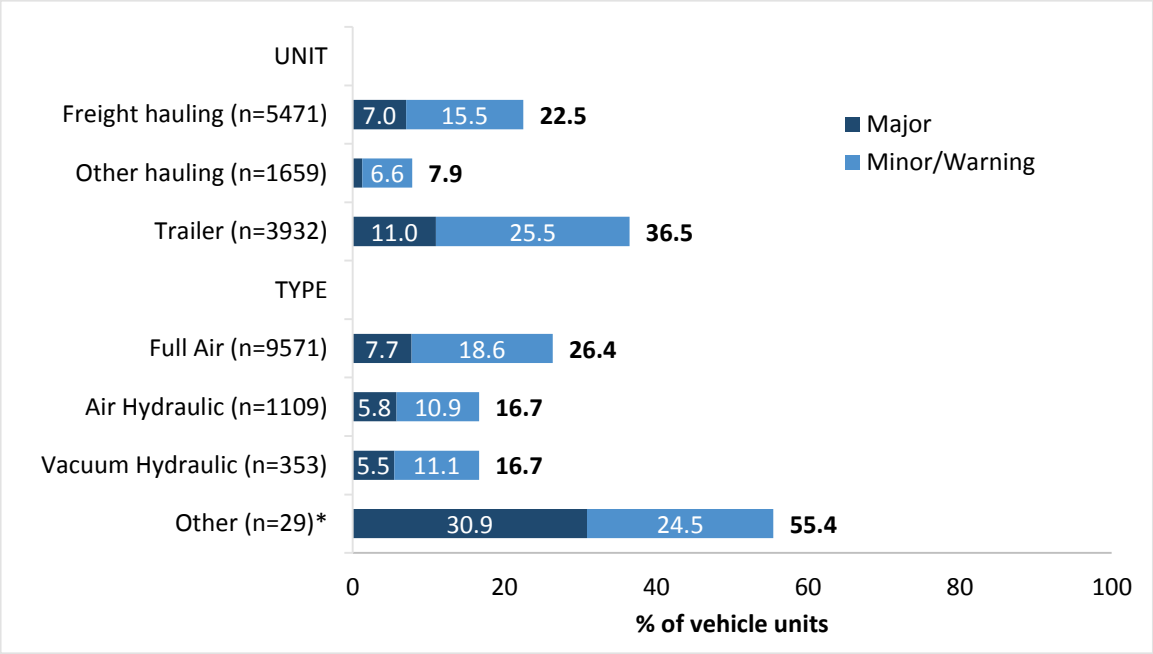
of the test print-outs, and comparisons between test prints and axle information recorded in the survey.

There were issues with faulty tests, influenced by factors associated with vehicles as well as the brake test unit, and some operator error in recording each axle sequentially and accurately. In some cases, axles were missed or re-tested and sufficient information was not always available by which to interpret which results were relevant. In some cases, the inspectors had utilised a system which only displayed dynamic weights instead of static weights. In addition, the results of the brake tests were not always accessible, where neither legible photographs of the test print-outs nor paper copies were provided. Where these types of issues were identified, the unit was not included in the analysis.

4.10.3 Types of brake systems

Figure 4-29 shows the number of vehicle units with brake non-conformities by the type of brake system. The large majority had full air brakes. The non-conformity rate was relatively high (55.4%) in the small sample of units with a brake system other than the three main types. This group was largely trailers (24 of the 29), and mainly with an electric system (19, including one described as electric hydraulic), with a further five described as hydraulic. The sample size for this group was small and the results should be treated with caution.

Figure 4-29.
Incidence of highest level of brake non-conformities in units, and by type of brake system (weighted %s)



Sample size: All vehicle units with brakes (4 trailers did not have brakes)
**Small sample size*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.10.4 Brake efficiency

The NHVR requirement is for brake efficiency for a vehicle unit as measured in the roller brake test, measured as kiloNewtons per tonne (kN/t), to be at a minimum of level of 4.5 kN/t. Earlier research by the former Roads and Traffic Authority of NSW around the safety levels associated braking requirements looked at the relationship between brake efficiency measured by roller brake tests and actual braking performance.[7] That research took into consideration that setting a standard that would in practice be applied to both heavily laden and lightly laden vehicles may lead to a compromise in adequacy in the two cases. The paper reported that there was a strong relationship between brake performance as measured in roller brake tests and braking performance of a vehicle on the road.

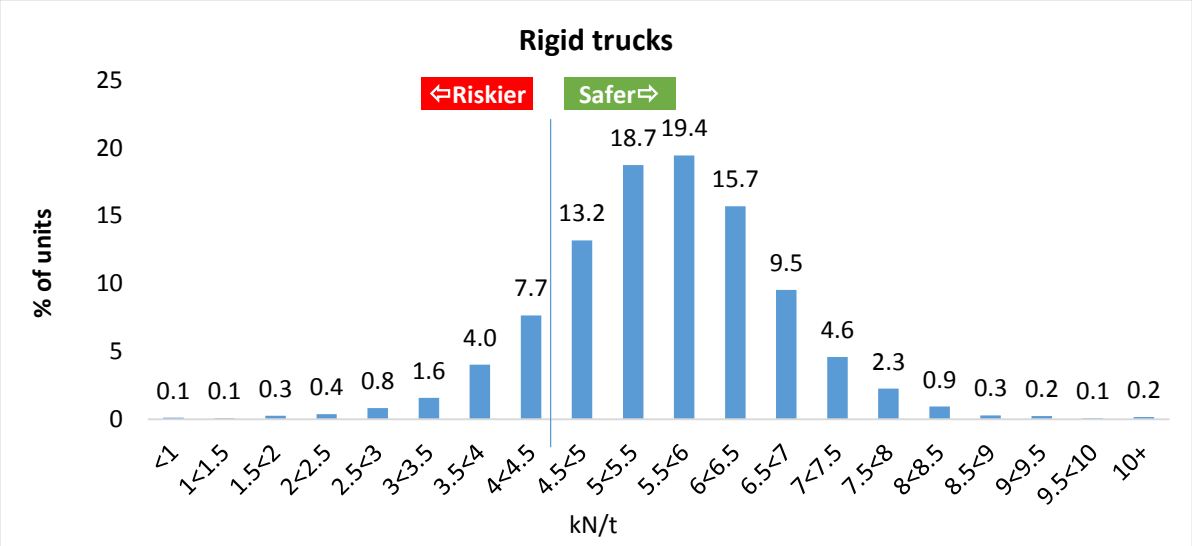
The percentages of units meeting the standard of 4.5 kN/tonne, along with additional summary statistics, are shown in Table 4-15. This analysis shows that 90.1% of buses/coaches and 85.1% of rigid trucks reached the minimum 4.5 kN/tonne level. This incidence declined to 77.0% of articulated hauling units and to 36.6% of trailers. Two-fifths (40.0%) of the trailers were in the range of 3.5<4.5 kN/tonne and this equated to 76.6% reaching a minimum of 3.5 kN/tonne.

Table 4-15.
Summary of brake efficiency results by type of vehicle (weighted results)

		Rigid truck	Articulated hauling unit	Trailer	Bus/ Coach
4.5+ kN/t	%	85.1%	77.0%	36.6%	90.1%
kN/t	mean	5.58	5.34	4.27	5.87
	standard deviation	1.21	1.22	1.36	1.55
Sample		*2,709*	*2,191*	*3,489*	*931*

The distributions of brake efficiency are shown in charts for rigid trucks (4-30), articulated hauling units (Figure 4-31), trailers (Figure 4-32), and buses/coaches (Figure 4-33).

Figure 4-30.
Brake efficiency measured as total kN/tonne for the vehicle: rigid trucks



[7] Dowdell, B. and Vertsonis, H. (Roads and Traffic Authority of NSW) and Smith, S (Air Brake Engineering and Design Pty Ltd Australia). *Heavy vehicle in service brake requirements*. Paper Number 96-S11-W-19.

Figure 4-31.
Brake efficiency measured as total kN/tonne for the vehicle: articulated hauling units

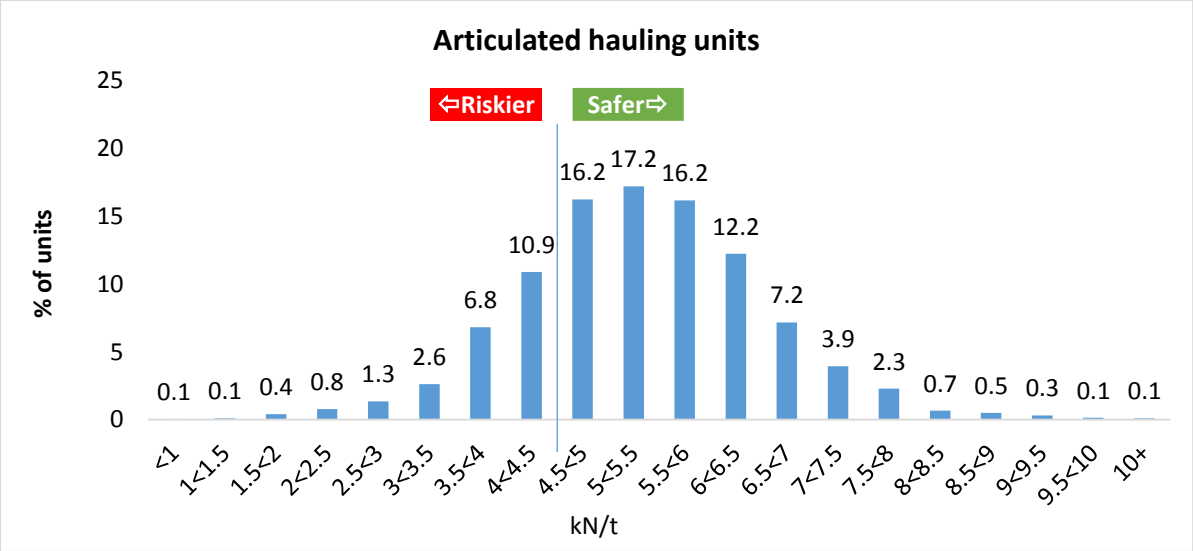


Figure 4-32.
Brake efficiency measured as total kN/tonne for the vehicle: trailers

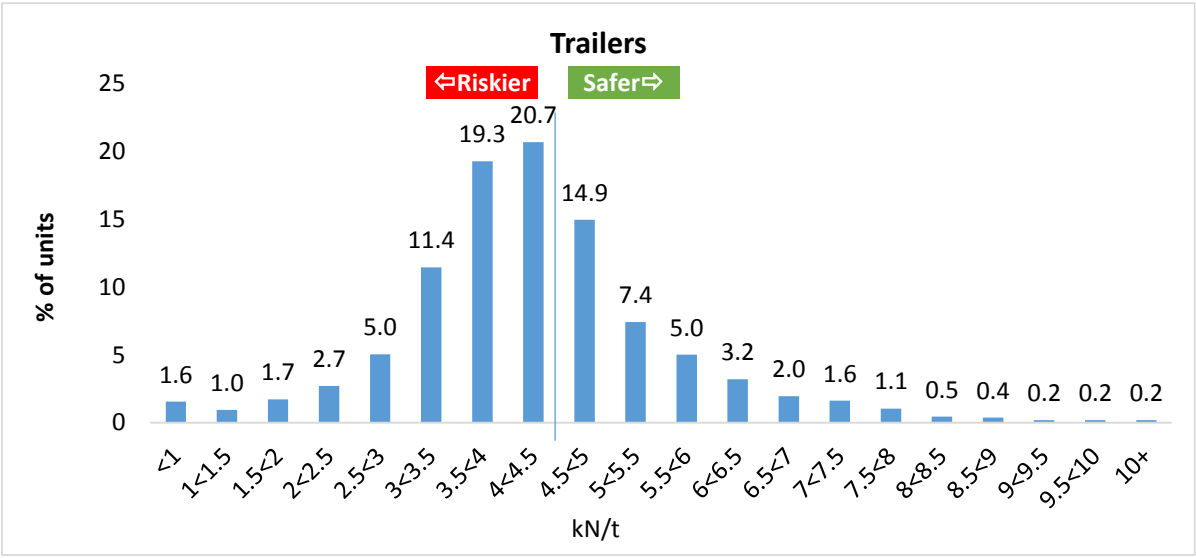
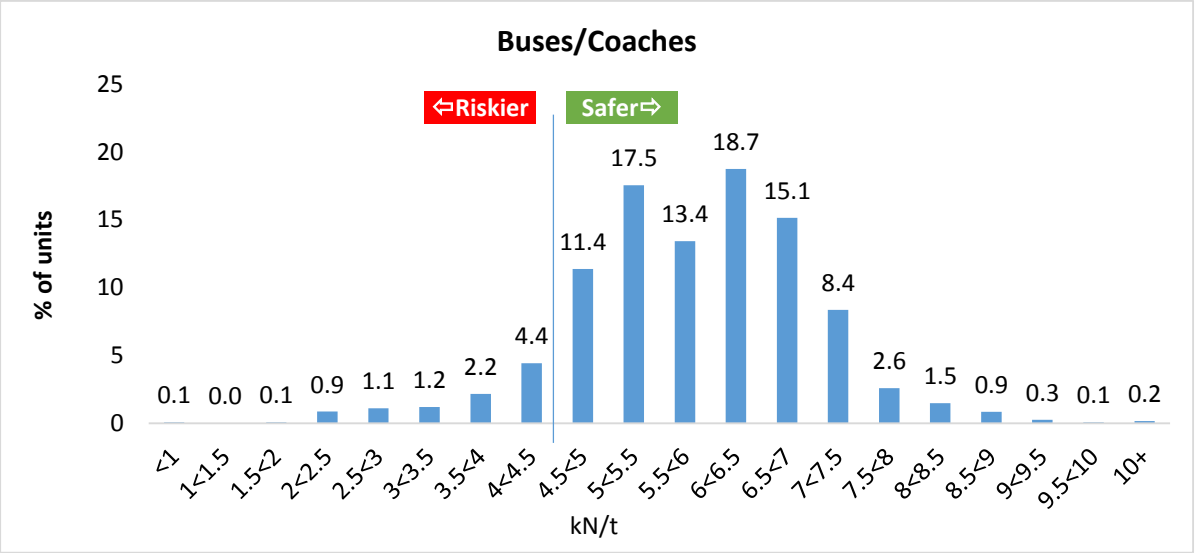


Figure 4-33.
Brake efficiency measured as total kN/tonne for the vehicle: buses/coaches



4.11 Participation in compliance schemes

4.11.1 Assessment of schemes

The relationship between participation in certain compliance schemes and the incidence of non-conformity was assessed. The target schemes assessed were:

- the National Heavy Vehicle Accreditation Scheme (NHVAS)–maintenance module;
- TruckSafe–maintenance, a business and risk management system; and
- CraneSafe, a national, industry-initiated voluntary crane assessment program.

Participation was asked in the survey:

- for hauling units: the vehicle or driver; and
- for trailers: the unit.

4.11.2 Participation in the schemes

About one in eight (12.6%) freight hauling units were participating in the NHVAS maintenance scheme or the TruckSafe maintenance scheme, with the large majority in the former (Table 4-16). Participation was greatest for road trains (61.2%), decreasing progressively for B-doubles (54.1%), semi-trailers (26.8%), and rigid trucks (5.9%). About a third (34.4%) of trailers were participating. Participation in CraneSafe represented about a quarter (23.7%) of plant/SPV vehicles, and equated to close to half (47%) of cranes in the survey.

Table 4-16.
Participation of drivers units in alternative compliance schemes (weighted %s)

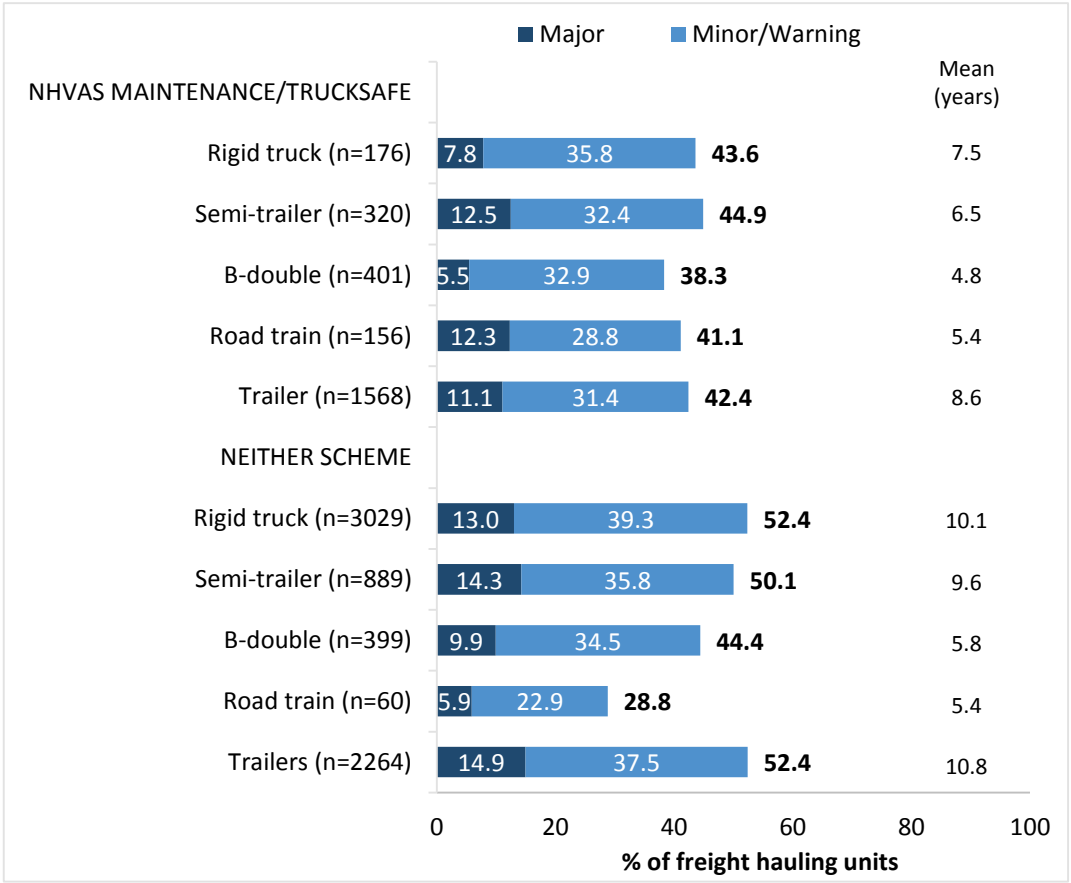
SCHEME	Freight	Artic-ulated	Rigid truck	Semi-trailer	B-double	Road train	Bus/ Coach	Plant/ SPV	Trailers
	%	%	%	%	%	%	%	%	%
NHVAS – Maintenance	12.5	37.7	5.9	26.6	53.7	61.2	0.0	2.0	34.1
TruckSafe – Maintenance	0.3	0.5	0.2	0.5	0.7	0.0	0.0	0.0	0.4
Either scheme	*12.6*	*37.9*	*5.9*	*26.8*	*54.1*	*61.2*	*0.0*	*2.0*	*34.4*
CraneSafe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.7	0.0
Total (nett) participation	***12.6***	***37.9***	***5.9***	***26.8***	***54.1***	***61.2***	***0.0***	***25.7***	***34.4***
Sample	*5571*	*2244*	*3227*	*1221*	*802*	*221*	*1015*	*644*	*3936*

Sample size: All hauling units (n=7,130)
Note: A driver/ unit could be participating in more than one scheme
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.11.3 NHVAS–maintenance and TruckSafe–maintenance, for freight vehicles

The overall incidence of any non-conformity was statistically significantly lower overall for units participating in either of the NHVAS or TruckSafe maintenance schemes, with this overall trend observed for rigid truck, semi-trailer and B-double hauling units (Figure 4-34).

Figure 4-34.
Incidence of highest level of non-conformity and age, by participation in a scheme, by category of hauling unit (weighted %s)



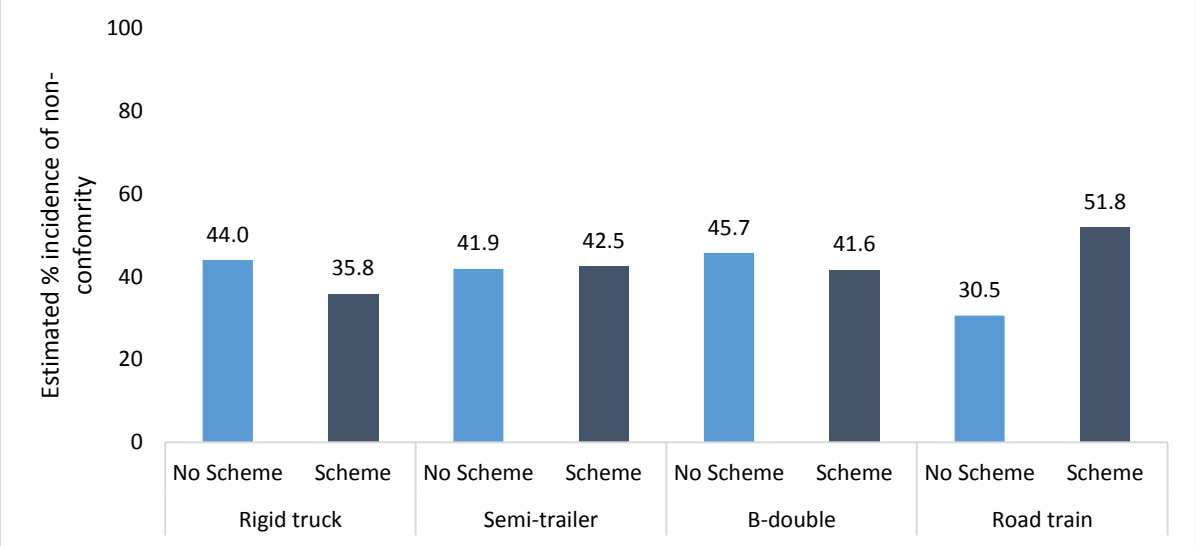
Sample size: Rigid truck, semi-trailer, B-double and road train hauling units (n=5,430), and trailers (n=3,832), where scheme participation was known
Note: Adding percentage results may give a rounding error of ±0.1% on the total

The incidence, however, was relatively low for the small group of road train hauling units not in the schemes (28.8%) Units in the schemes were on average statistically significantly newer for all categories other than road trains, which suggested that lower non-conformity could be associated with age.

Further analysis was conducted taking into account additional factors including vehicle category, age and state of inspection. Age, along with state of inspection, were the most important factors influencing incidence of non-conformity. There was less difference in non-conformity associated with participation, and a lower overall incidence was not confirmed for participation (Figure 4-35).[8] A higher incidence for road trains participating in a scheme, however, was maintained.

The additional analysis indicated that, overall, part of the lower observed rates of non-conformity associated with participation in a maintenance scheme was related to the units being newer.

Figure 4-35.
Estimated incidence of non-conformity in freight hauling vehicles by category of unit and scheme participation, adjusting for other factors*



Sample size: Freight hauling units in NSW, VIC, QLD, SA and TAS where participation and age were known (n=5,044)
**Estimated incidences adjusting for unit category, state, type of inspection and age group (unweighted)*

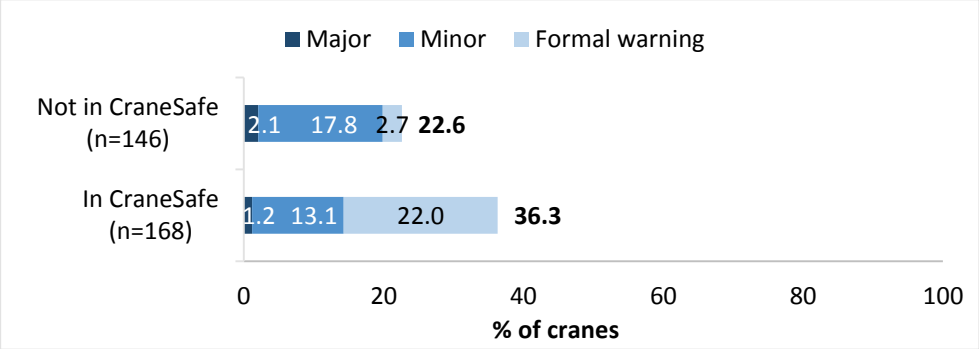
[8] The analysis produces estimated of the incidence, adjusting for other factors. See Section 5.4.3 in Appendix B.

4.11.4 CraneSafe

The relationship was also assessed between participation in the CraneSafe scheme and the incidence of non-conformity. CraneSafe is a national, industry-initiated voluntary crane assessment program, with the aim of supplementing existing safety standards with annual assessments. Of the 314 cranes inspected in the survey, about half (47%) were participating in CraneSafe.

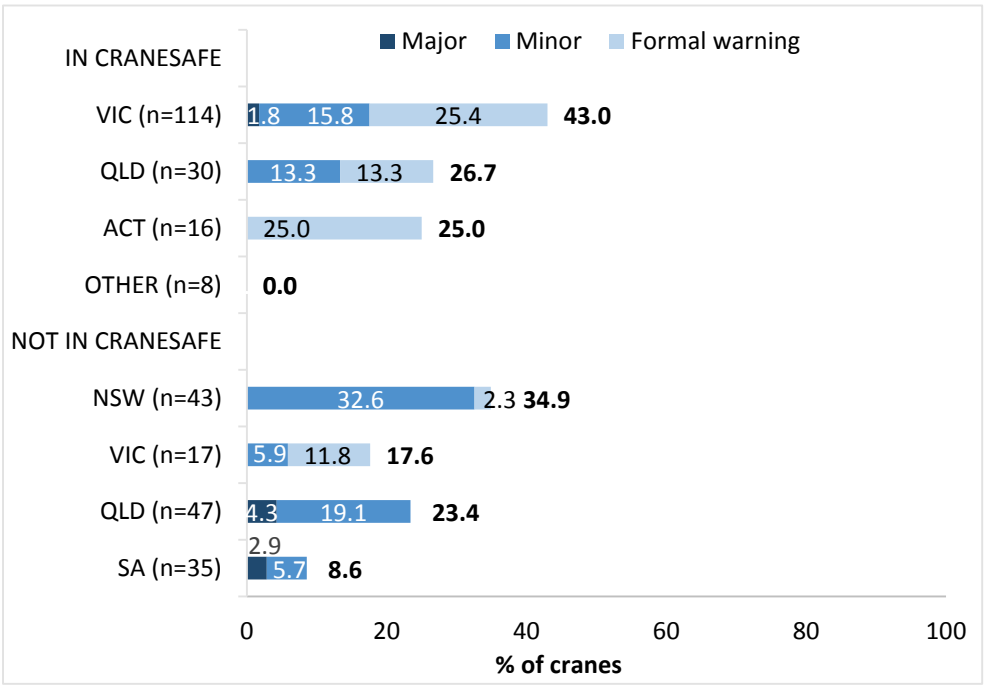
The incidence of minor or major non-conformities was only marginally lower for participation (14.3%) than non-participation (19.9%). The incidence of any classification of non-conformity, however, was found to be statistically significantly higher among participating cranes (36.3% vs. 22.6%) (Figure 4-36). The difference was related primarily to the incidence of formal warnings issued to vehicles in CraneSafe particularly in VIC, but also in QLD and the ACT (Figure 4-37).

Figure 4-36.
Incidence of highest level of non-conformity for cranes, by participation in CraneSafe (unweighted %s)



Sample size: Cranes (n=314)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

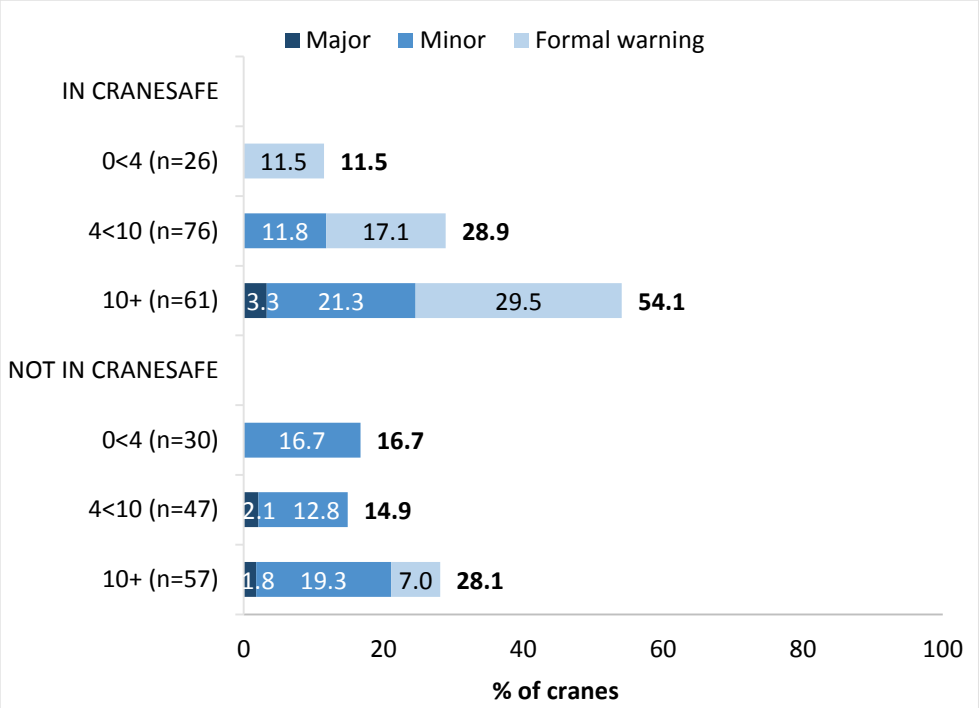
Figure 4-37.
Incidence of highest level of non-conformity for cranes, by participation in CraneSafe and location of inspection (unweighted %s)



Sample size: Cranes (n=314)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

A higher incidence of any non-conformity associated with CraneSafe remained when taking into account age of vehicle, and was associated more with vehicles aged four years and over (Figure 4-38.)

Figure 4-38.
Incidence of highest level of non-conformity for cranes, by participation in CraneSafe and age group (unweighted %s)



Sample size: Cranes where age was known (n=297)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

4.12 Analysis of additional factors

4.12.1 Daytime vs. night-time inspections

There had been a weak outcome observed in the earlier NSW compliance surveys for some differences in non-conformity rates at different times of the day. The relationship with time of day was assessed in the NRBS by focussing on intercepted freight hauling units inspected at specific sites in NSW. Only NSW conducted sufficient night-time shifts to enable an analysis. Of the 7,130 vehicle inspections, 277 (3.9%) were conducted between 8 pm and 6 am. Of these, 231 were in NSW. To enable a more focused analysis, the inspections were restricted to NSW and the following profile of vehicles (Table 4-17)

- the 5 main sites where night-time intercepts occurred;[9]
- rigid trucks, semi-trailers and B-double hauling units; and
- intercept inspections.

Table 4-17.
Time distribution of intercept inspections of hauling units (rigid trucks, semi-trailers and B-doubles) at specific sites in NSW

START TIME	Freight hauling unit – Rigid truck, aemi-trailer, B-double intercept inspections
	Sample
12 midnight<6 am	106
6 am<8 am	39
8 am<10 am	57
10 am<12 noon	57
12 noon<2 pm	37
2 pm<4 pm	57
4 pm<6 pm	66
6 pm<8 pm	53
8 pm<12 midnight	76
Total	***548***

The incidences of major non-conformities and other non-conformities were assessed. Time of day was assessed initially without any other variables, and found not to have a direct relationship with the incidence of non-conformities. The variables included in the final analysis were:

- time of day;
- category of hauling unit;
- home vs. outside registered; and
- age group of hauling unit.

No relationship was confirmed between time of day and incidence of non-conformities. Only age group was found to be statistically significantly related to the non-conformity rate (Table 4-18). It should be

[9] The 5 sites were Mt. White, Mt Boyce, South Nowra, Wagga Wagga, and Marulan

noted that this analysis was based on NSW results with limited sites, so the absence of a relationship here should be treated as tentative.

Table 4-18.
Variables assessed to identify relationship between time of day and non-conformity rates

Step	Variables	Outcome
1	• Time period	No relationship
2	• Time period • Type of hauling unit • Age group of hauling unit • Site • Home registration	Age group only

4.12.2 Metropolitan and non-metropolitan areas

Assessment of non-conformities

The incidences of non-conformities for hauling units and trailers are shown for inspections in NSW, VIC, QLD and SA comparing metropolitan and non-metropolitan areas. The focus of the analysis was on these areas to provide a specific comparison of areas (TAS, NT and the ACT were each categorised as only one type of area). Sample sizes are shown for reference in Table 4-19. As with previous reporting, results where the original sample size was less than 30 have not been reported separately.

Table 4-19.
Sample sizes for categories of hauling units and trailers, by state of inspection and metro/non-metro areas

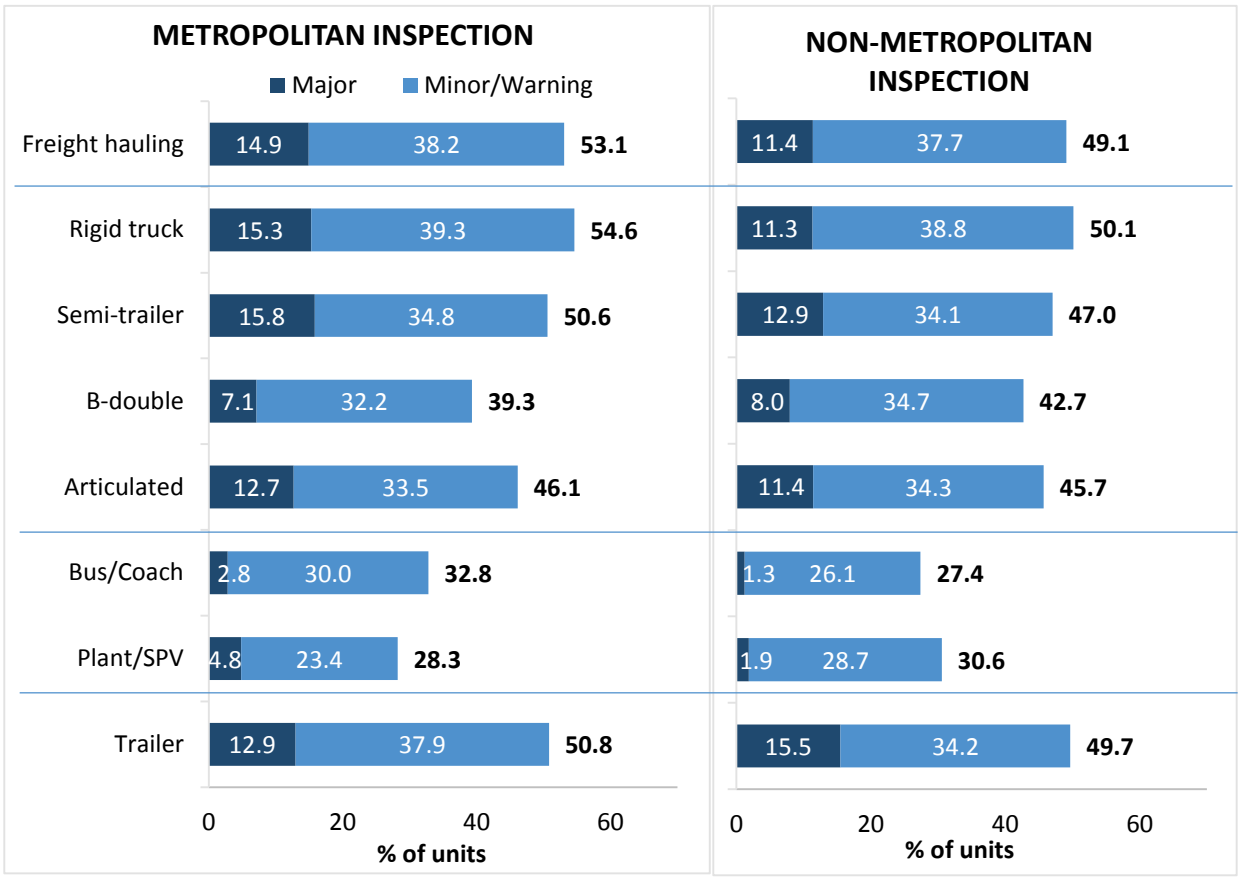
VEHICLE TYPE	STATE OF INFSPECTION							
	NSW		VIC		QLD		SA	
	Metro	Non-Metro	Metro	Non-Metro	Metro	Non-Metro	Metro	Non-Metro
Vehicle unit								
Rigid truck	469	385	410	382	352	404	218	201
Semi-trailer	135	151	181	181	138	141	68	110
B-double	70	89	144	140	79	116	23	99
Road train	0	60	5	3	0	59	3	48
Articulated	*205*	*300*	*330*	*324*	*217*	*316*	*94*	*257*
Bus/Coach	135	112	105	137	135	130	86	50
Plant/SPV	62	93	157	72	70	72	40	37
Total vehicle units	***871***	***890***	***1002***	***915***	***774***	***922***	***438***	***545***
Trailers	**339**	**537**	**521**	**522**	**345**	**627**	**137**	**485**

Highlighting small sample sizes, <30 – results for these cells have not been reported

Non-conformities by hauling units and trailers

Overall, freight hauling units were only marginally more likely to have a non-conformity in metropolitan areas (14.9% vs. 11.4% for a major non-conformity, and 53.1% vs. 49.1% for any classification of non-conformity) (Figure 4-39). This margin of difference was consistent for rigid trucks and semi-trailers in particular. At this overall level, B-doubles did not follow the same trend, having a marginally lower overall incidence of non-conformities in metropolitan areas (39.3% vs. 42.7%).

Figure 4-39.
Incidence of highest level of non-conformity in hauling units and trailers by region (weighted %s)



Sample size: Inspections in NSW, VIC, QLD and SA
See Table 4-19 for sample sizes
Note: Adding percentage results may give a rounding error of ±0.1% on the total

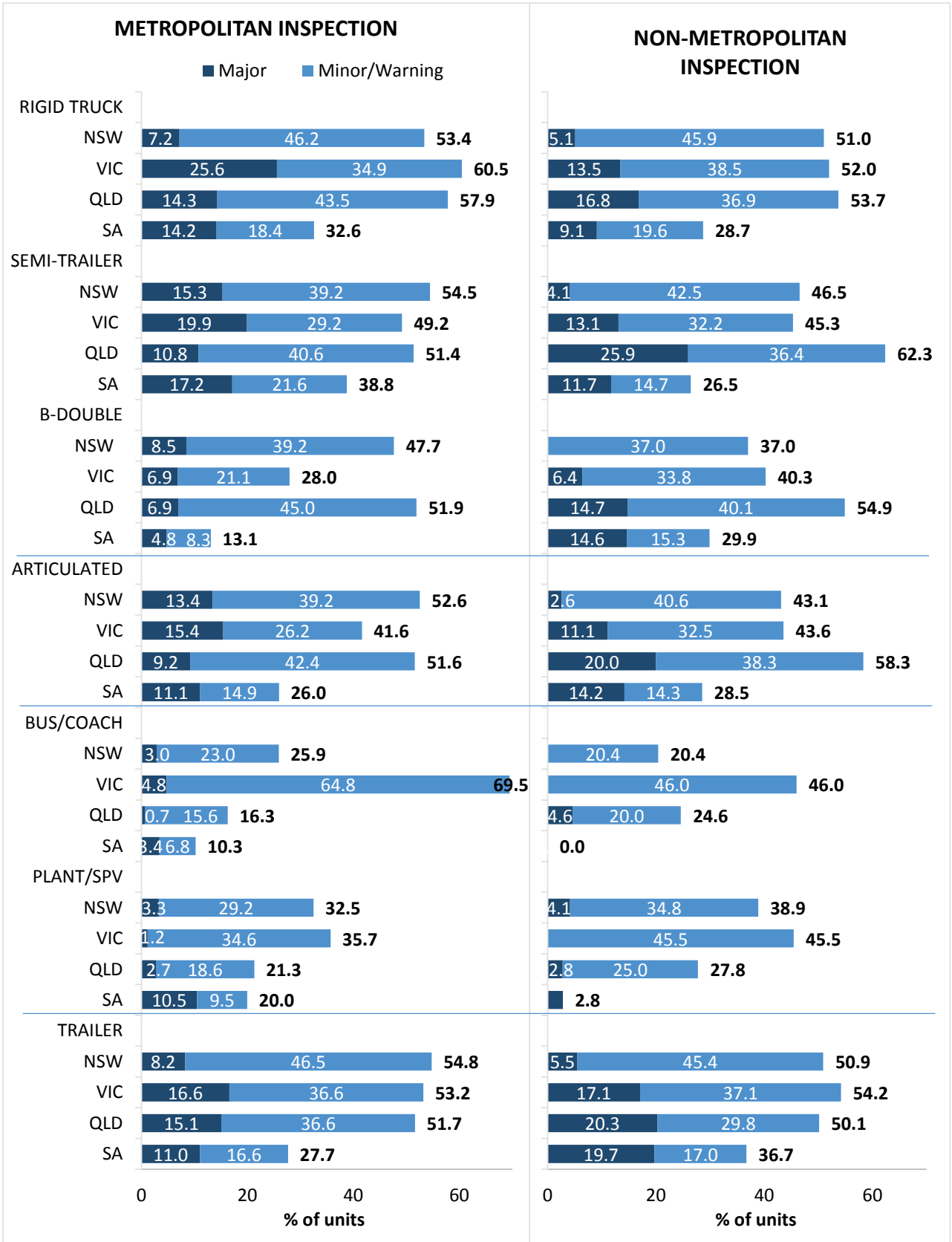
Non-conformities by hauling units and trailers by state of inspection

Confirmation of a statistically significantly higher incidence of the highest level of non-conformity in metropolitan areas occurred for hauling units in the following states of inspection (Figure 4-40):

- **rigid truck**: higher incidence of major non-conformities in metropolitan areas in VIC (25.6% vs, 13.5%), and total non-conformities (60.5% vs. 52.0%), with a consistent similar trend in all four states;
- **semi-trailer**: higher incidence of major non-conformities in metropolitan areas in NSW (15.3% vs, 4.1%), with a consistent similar trend in VIC and SA, and
- **bus/coach**: higher incidence of non-conformities in metropolitan areas in VIC (69.5% vs. 46.0%).

In contrast, the incidence of non-conformities for **semi-trailers** in QLD was confirmed as statistically significantly higher in non-metropolitan areas (25.9% vs. 10.8% for major non-conformities, and 62.3% vs. 51.4% for total non-conformities) (Figure 4-40). The incidences for a major non-conformity among **articulated** hauling units followed the same outcome as for semi-trailers in NSW (higher in metro areas) and QLD (higher in non-metro areas).

Figure 4-40.
Incidence of highest level of non-conformity in hauling units and trailers by region within state of inspection (weighted %s)



Sample size: Units inspected in NSW, VIC, QLD and SA. *See Table 4-19 for sample sizes*
Note: Adding percentage results may give a rounding error of ±0.1% on the total

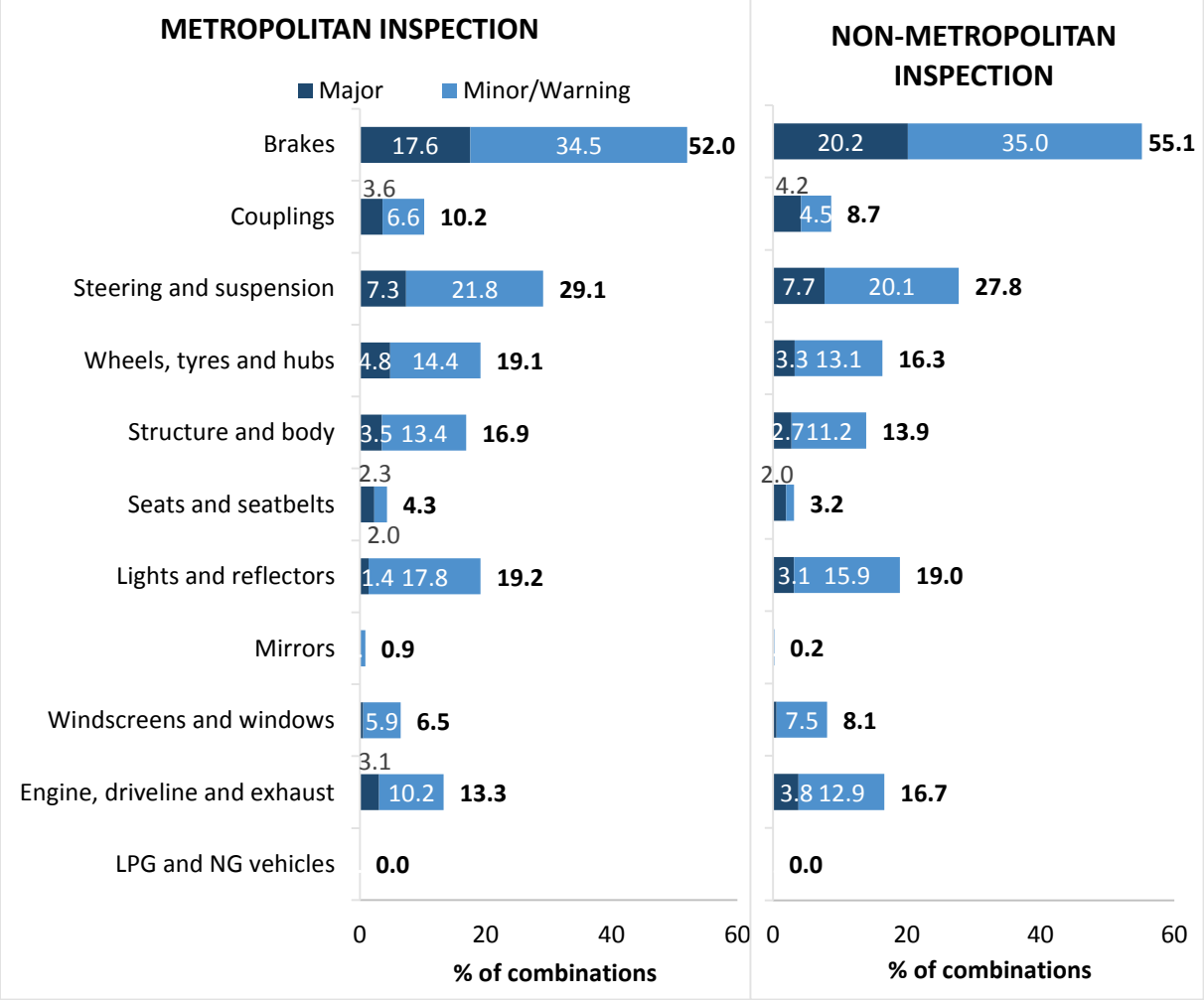
Non-conformities by vehicles systems for freight vehicle combinations

Assessing non-conforming systems among freight vehicle combinations in the four states showed similar overall incidences in both metropolitan and non-metropolitan areas, being highest for brake non-conformities (52.0% in metropolitan areas and 55.1% in non-metropolitan areas, Figure 4-41). The top three systems, for both areas, were:

- **brakes** non-conformities (52.0% metropolitan, 55.1% non-metropolitan);
- **steering and suspension** non-conformities (29.1% metropolitan, 27.8% non-metropolitan); and
- **lights and reflectors** non-conformities (19.2% metropolitan, 19.0% non-metropolitan).

One difference between the areas was for a higher incidence of **bus** non-conformities in metropolitan areas (5.7%) compared with non-metropolitan areas (1.3%).

Figure 4-41.
Incidence of highest level of categories of non-conformity by system in freight vehicle combinations by region (weighted %s)



Sample size: Freight combinations inspected in NSW, VIC, QLD and SA, metropolitan (n=2,295) and non-metropolitan (n=2,838)
Note: Major and minor/warning incidences <2% are not labelled
Note: Adding percentage results may give a rounding error of ±0.1% on the total

Non-conformities by vehicle systems for freight vehicle combinations by state of inspection

The incidence of any non-conformity in freight vehicle combinations was statistically significantly higher in **metropolitan areas in VIC** for the following vehicle systems (Figure 4-42):

- **steering and suspension** (38.2% in metropolitan vs. 30.1% in non-metropolitan);
- **wheels, tyres and hubs** (27.9% vs. 20.9%); and
- **seats and seatbelts** (8.0% vs. 0.9%).

The incidence of any non-conformity in freight vehicle combinations was statistically significantly higher in **non-metropolitan areas in** QLD and SA for the following vehicle systems (Figure 4-42):

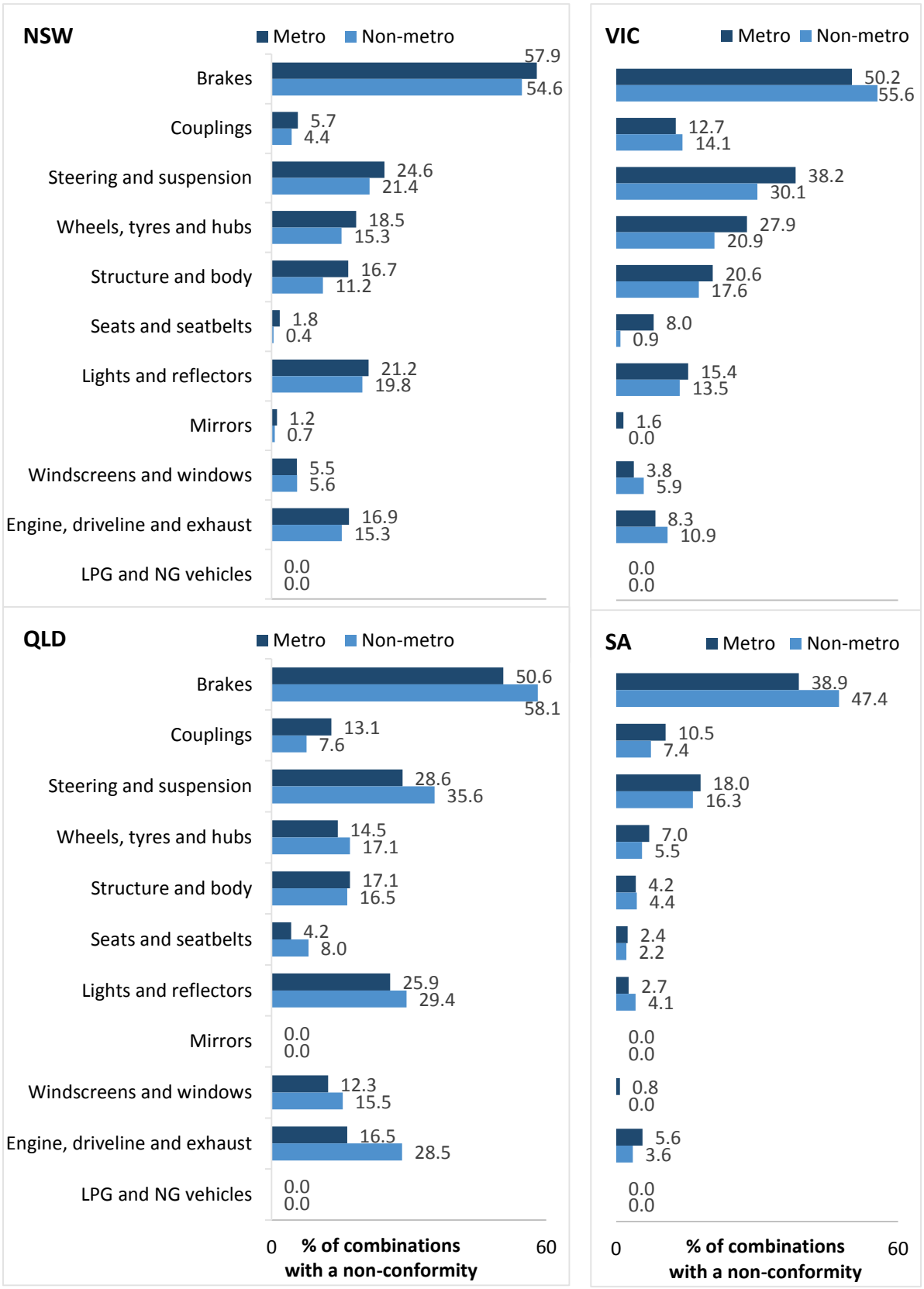
QLD

- **brakes** (58.1 % in non-metropolitan vs. 50.6% in metropolitan);
- **steering and suspension** (35.6% vs. 28.6%); and
- **engine, driveline and exhaust** (28.5% vs. 16.5%).

SA

- **brakes** (47.4 % in non-metropolitan vs. 38.9% in metropolitan).

Figure 4-42.
Incidence of categories of non-conformity in freight vehicle combinations, by region within state (weighted %s)



SAMPLE SIZE: All combinations: NSW (metro n=674, non-metro n=685), VIC (metro n=740, non-metro n=706), QLD (metro n=569, non-metro n=720), SA (metro n=312, non-metro n=458)

4.13 Mode of inspection

Selection of vehicles

Three main modes of selection of vehicles for inspection were implemented in the survey:

- **roadside intercept,** principally for rigid trucks, truck and trailer combinations and articulated vehicle combinations, as well as plant vehicles, where relevant;
- **present-for inspection (PFI) – by invitation**, principally for buses, coaches and plant vehicles, including visiting the operator depot or having the vehicle come to an inspection station; and
- **present-for inspection (PFI) – by periodic inspection**, for all types of vehicles, but again particularly for buses, coaches and plant vehicles.

Comparing non-conformity rates

For the purpose of comparison of non-conformity rates by mode of inspection, only the vehicle groups inspected in sufficient numbers in both modes were selected: rigid trucks, semi-trailers and B-doubles.

The sample sizes for vehicles for each of three modes of inspection are shown below by state of inspection (Table 4-20). There were no PFIs among these units in TAS and only three in VIC.

Table 4-20.
Number of rigid truck, semi-trailer and B-double vehicles, by mode of inspection and state of inspection

STATE OF INSPECTION	INTERCEPT	PRESENT-FOR INSPECTION			TOTAL
		By invitation or depot visit	By periodic or annual inspection	Total	
	Sample	*Sample*	*Sample*	*Sample*	*Sample*
NSW	1198	17	84	101	1299
VIC	1435	2	1	3	1438
QLD	1065	49	116	165	1230
SA	647	56	16	72	719
TAS	269	0	0	0	269
NT	113	5	26	31	144
ACT	99	2	50	52	151
Total	*4826*	*131*	*293*	*424*	*5250*

Sample: Rigid trucks, semi-trailers and B-doubles (n=5,250)

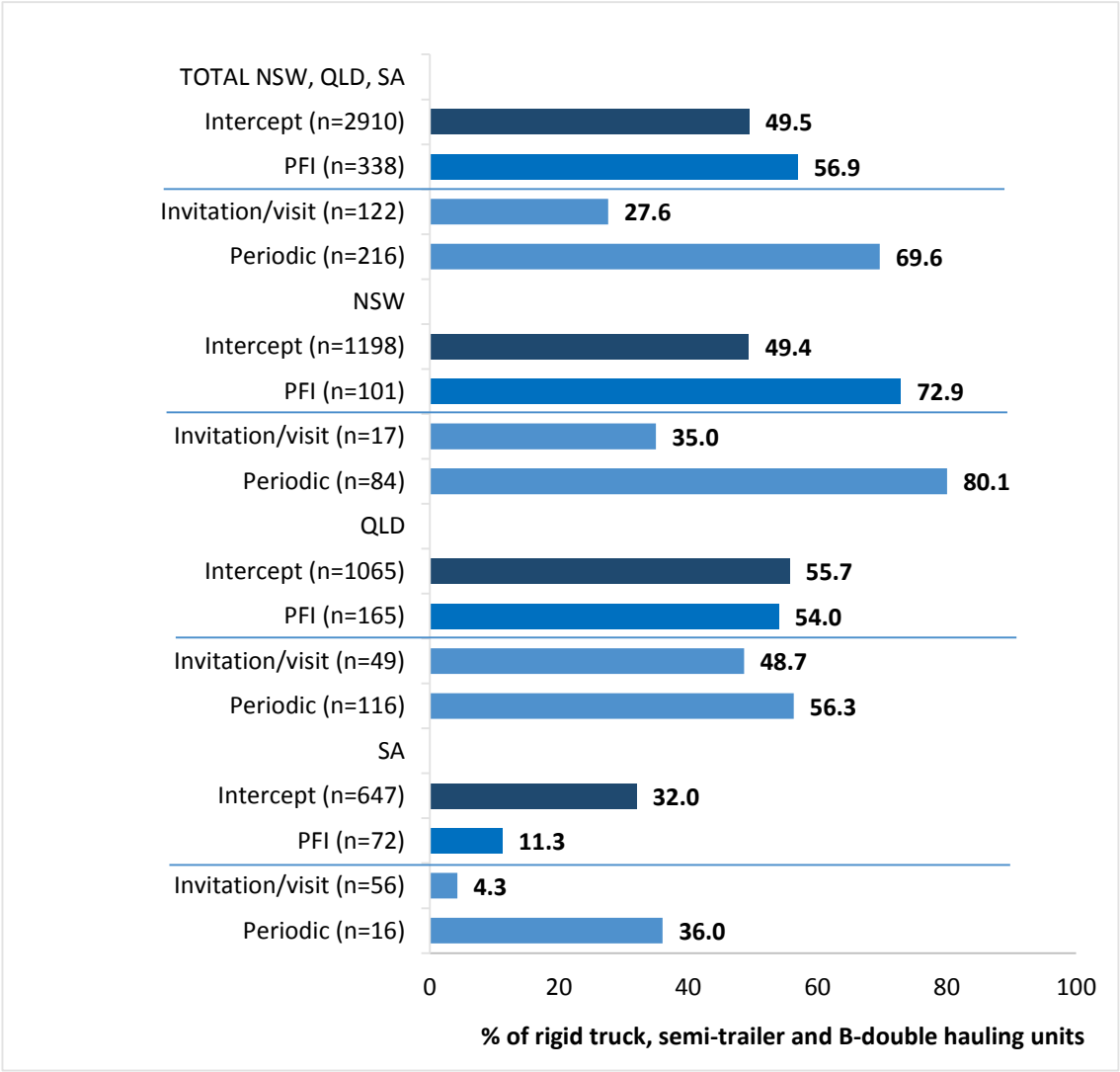
The majority (69.1%) of PFIs were periodic/annual compared with by invitation/visit. This overall distribution was observed in NSW, QLD, NT and the ACT. The opposite distribution was observed in SA, with the majority (77.8%) being by invitation/visit.

Figure 1 shows the incidence of non-conformity for the three largest relevant states—NSW, QLD and SA—for:

- intercept inspections;
- total PFI, combining the two sub-modes;
- PFI by invitation/visit; and
- periodic PFI.

An initial assessment of the incidence of non-conformity showed the lowest incidence among PFI by invitation/visit (27.6%) and highest for periodic PFI (69.6%) (Figure 4-43). The incidence for intercept surveys (49.5%) was about half-way between the two PFI modes. This overall pattern was seen in NSW and SA, with less variation between the modes in QLD (a range of 48.7% to 56.3%).

Figure 4-43.
Incidence of non-conformity among rigid truck, semi-trailer and B-double hauling units, by state and mode of inspection (weighted %s)



Sample: Rigid truck, semi-trailer and B-double hauling units in NSW, QLD, and SA (n=3,248)

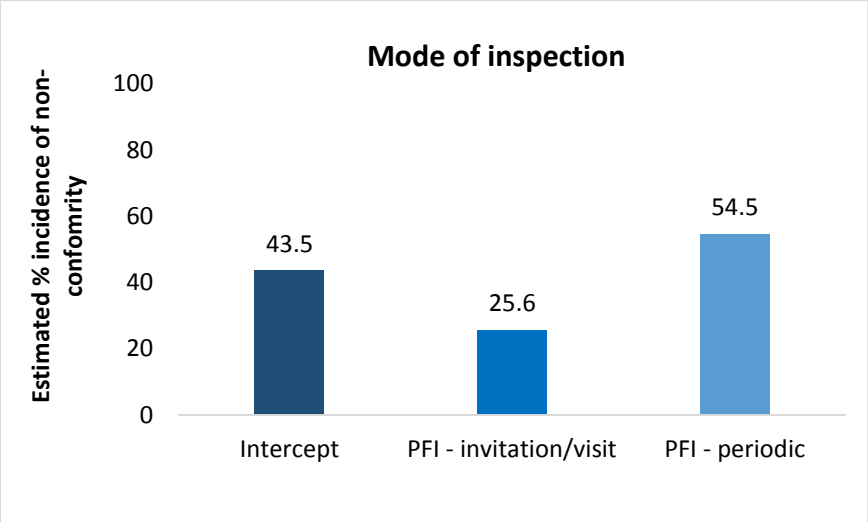
A more detailed analysis was conducted focusing again on the three larger states, and taking into account additional factors:[10]

- mode of inspection (intercept, PFI by invitation/visit, periodic PFI);
- state of inspection;
- age of vehicle (0<4 years, 4<10 years, 10+ years); and
- vehicle group (rigid truck, semi-trailer/B-double hauling unit).

The analysis confirmed that state of inspection and age of the unit were statistically significant related to the incidence of non-conformity, consistent with findings reported earlier. Other statistically significant findings are presented below.

- Confirmation of an overall relationship with **mode of inspection** (Figure 4-44), being lowest for PFI by invitation and highest for periodic PFI (as indicated previously in Figure 4-43).

Figure 4-44.
Estimated incidence of units with a non-conformity by mode of inspection (unweighted)

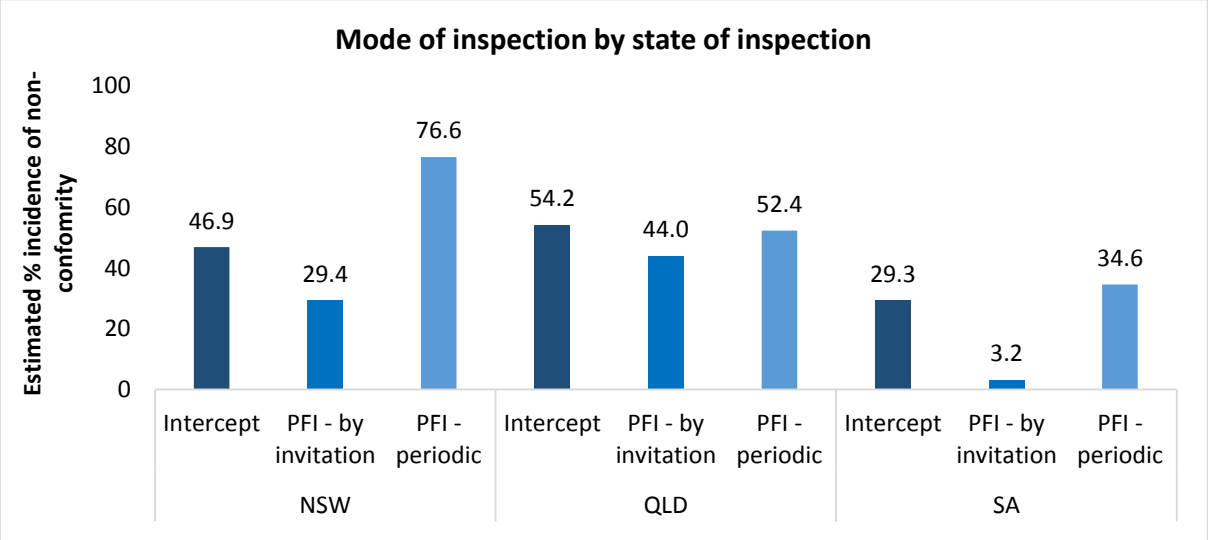


Sample: Rigid truck, semi-trailer and B-double hauling units in NSW, QLD and SA, where age was known (n=3,185)

[10] General Linear Modelling was utilised, using the unweighted data. The estimated incidences reported are the incidence of non-conformity for each factor adjusted for other factors in the model. These are not the same as the observed incidences, but help identify factors associated with non-conformity.

- A relationship between **state of inspection and mode of inspection** (as indicated in Figure 4-43): There was a pattern in NSW and SA for the incidence of non-conformity to be highest for periodic PFI and lowest for PFI by invitation, particularly in SA. In contrast, the incidences for the three modes were relatively similar in QLD (Figure 4-45).

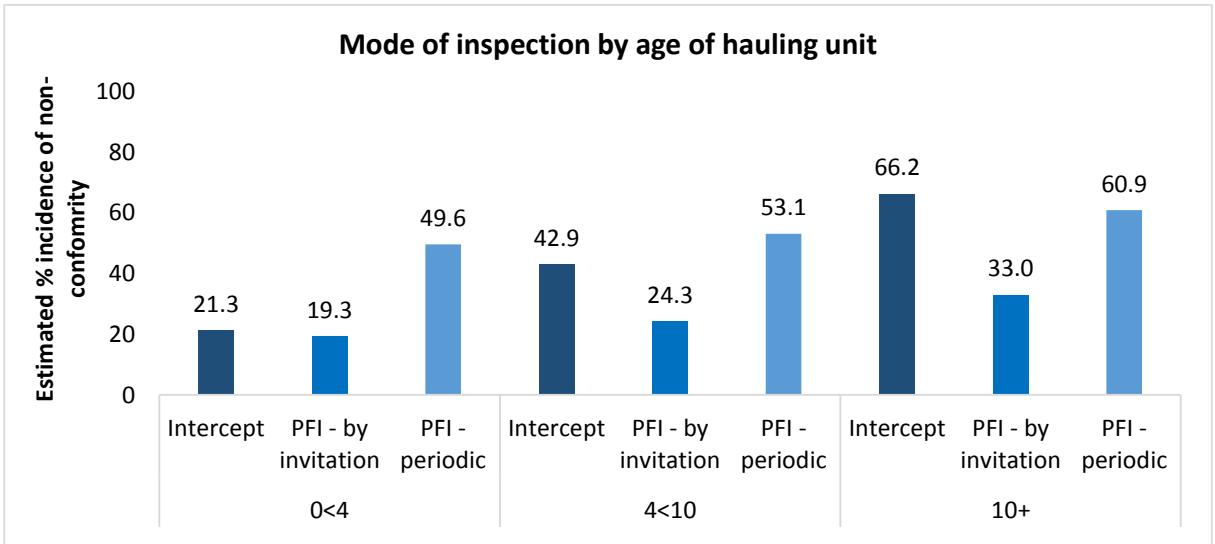
Figure 4-45.
Estimated incidence of units with a non-conformity by mode of inspection and state of inspection (unweighted)



Sample: Rigid truck, semi-trailer and B-double hauling units in NSW, QLD and SA, where age was known (n=3,185)

- A relationship between **age and mode of inspection**: The incidence of a non-conformity increased substantially with age for intercept inspections, and was highest in the 10+ years age group (Figure 4-46). The incidence for PFI by invitation was at a similar level to intercept inspections for newer vehicles but lowest in the older two age groups.

Figure 4-46.
Estimated incidence of units with a non-conformity by mode of inspection and age group (unweighted)



Sample: Rigid truck, semi-trailer and B-double hauling units in NSW, QLD and SA, where age was known (n=3,185)

4.14 Vehicle ownership

Vehicle ownership

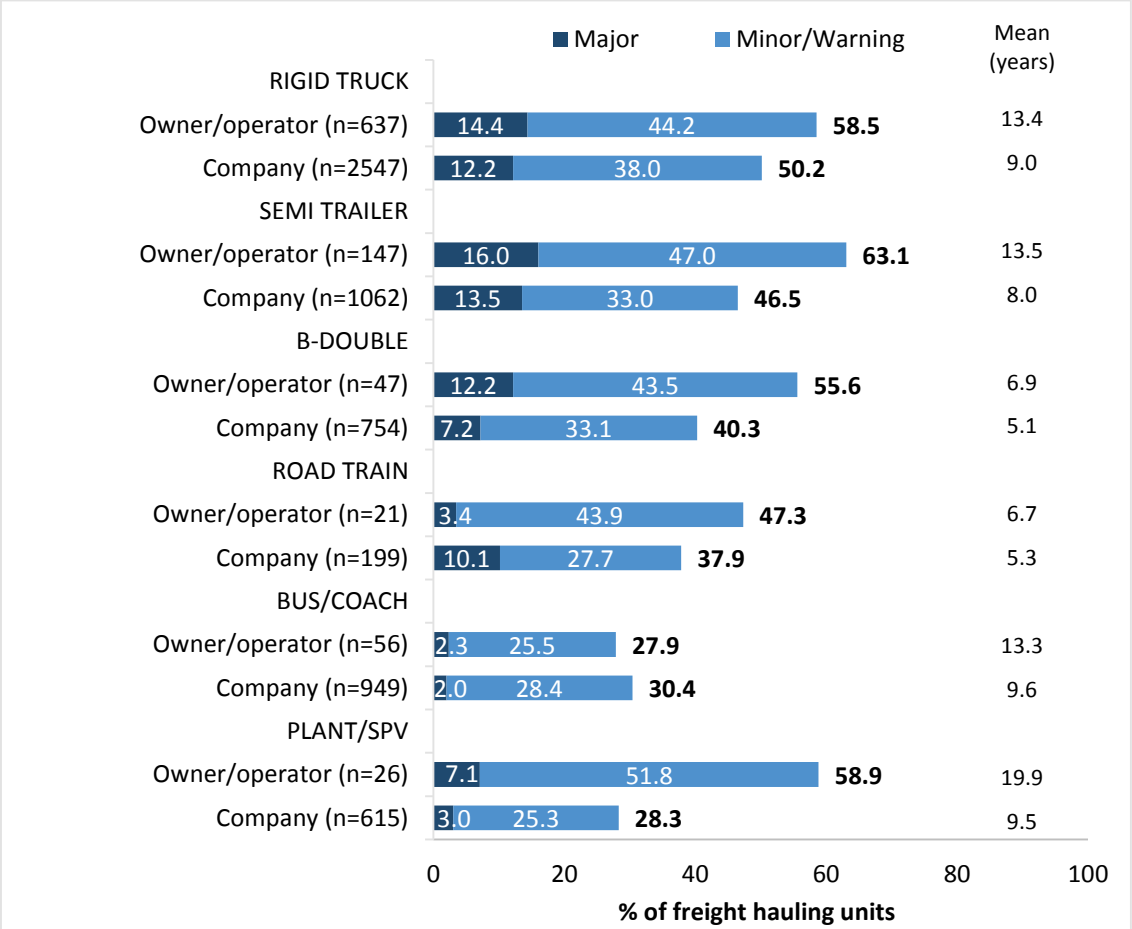
The impact of different types of vehicle ownership was assessed for:[11]

- owner/operator vs. company ownership of hauling units on incidence of non-conformities in hauling units;
- comparative ownership of trailers and hauling units on incidence of non-conformities in trailers; and
- comparative ownership of freight hauling units and trailers in freight combinations on incidence of non-conformities in hauling units and combinations.

Overall relationship between type of ownership and non-conformity

The initial assessment of ownership showed that the incidence of non-conformities tended to be higher for owner/operator hauling units for all vehicle categories other than bus/coach (Figure 4-47). The difference was confirmed as statistically significant for rigid trucks, semi-trailers, and plant/SPV.

Figure 4-47.
Incidence of highest level of non-conformity by category of hauling unit and type of ownership (weighted %s)



Sample size: Hauling units where ownership was known (n=7,060)
Note: Adding percentage results may give a rounding error of ±0.1% on the total

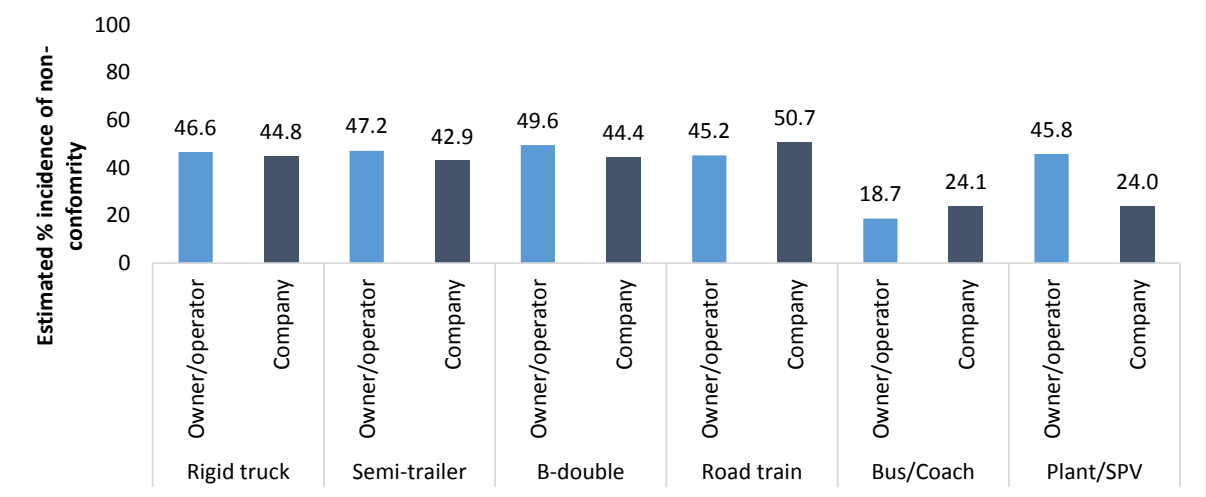
[11] For the purposes of the analysis, owner/operator was defined as vehicle ownership where an individual, or two individuals, or a family trust were identified as the owner.

Owner/operator units also tended to be older than company owned units, and this was confirmed as statistically significant for rigid trucks, semi-trailers, bus/coach and plant/SPV. The trends for higher incidences of non-conformity were consistent with the vehicles being older.

Further analysis taking into account state of inspection, age of vehicle and type of inspection, confirmed that the higher incidence of non-conformity was related to the owner/operator vehicles being older.[12] Once age was taken into account the estimated incidences were more similar (Figure 4-48). The higher incidence for owner/operator plant/SPV was not confirmed based on the very small sample size for owner/operator units.

The analysis supported the conclusion that the higher incidence of non-conformity among owner/operator units was associated with the units being older.

Figure 4-48.
Estimated incidence of non-conformity for hauling units, by category and type of ownership, adjusting for other factors*



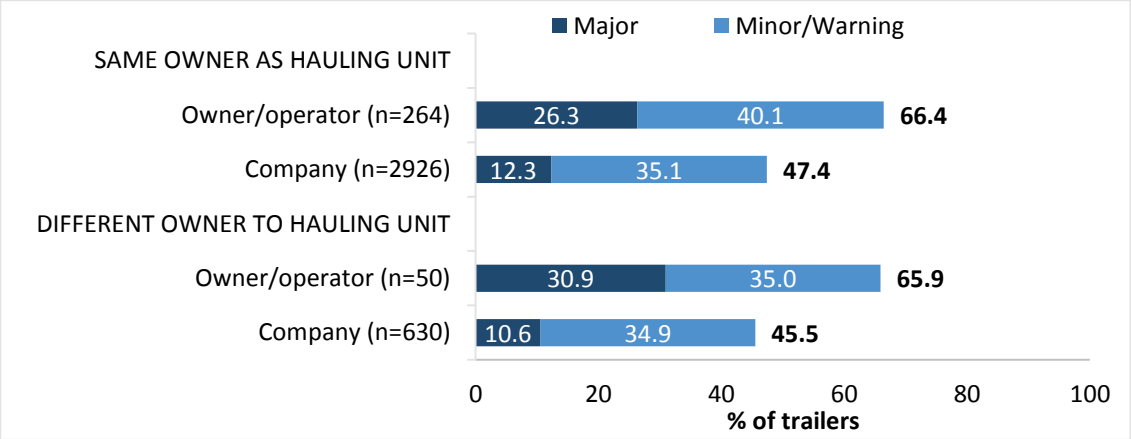
Sample size: Hauling units inspected in NSW, VIC, QLD, SA and TAS where age and ownership were known (n=6,520)
**Estimated incidences adjusting for ownership, hauling unit category, state, type of inspection, and age group*

[12] The analysis produces estimated of the incidence, adjusting for other factors. See Section 5.4.3 in Appendix B.

Type of ownership of hauling unit and trailers

The relationship with ownership was also assessed for trailers, based on whether or not the trailer had the same ownership as the hauling unit. Owner/operator trailers had a statistically significantly higher incidence of non-conformities both where the trailer had the same owner as the hauling unit and where it was a different owner (Figure 4-49).

Figure 4-49.
Incidence of highest level of non-conformity for freight trailers, by relationship with hauling unit ownership and type of owner of hauling unit (weighted %s)

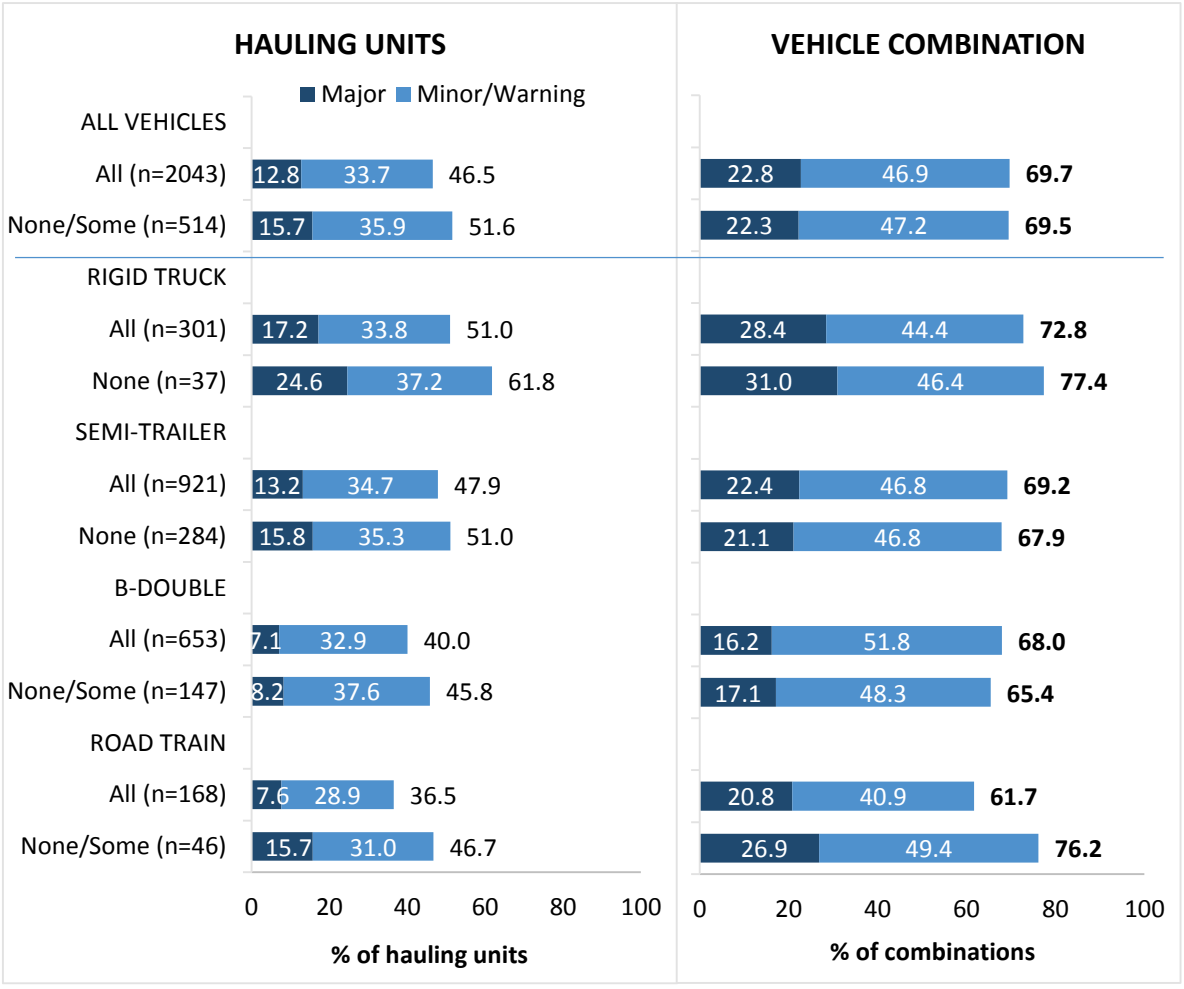


Sample size: Freight trailers where ownership was known (n=3,870)

Shared ownership of hauling unit and trailers

The relationship was assessed between incidence of non-conformities and whether all, some or no trailers were owned by the same owner as the hauling unit. As the incidence of only *some* trailers sharing ownership was small, these were combined with *none* for the analysis. The incidence of non-conformities in the hauling unit and in the combination showed little overall difference. There was an overall trend for a lower incidence for hauling units where all trailers shared ownership (46.5% vs. 51.6% for none/some) (Figure 4-50). The size of difference was not confirmed based on the sample sizes involved.

Figure 4-50.
Incidence of highest level of non-conformity for freight hauling units and combinations, by shared ownership of trailers (weighted %s)



Sample size: Hauling units and combinations where ownership of trailers/units was known (n=2,557)

5. Appendix B: Survey method

5.1 Survey approach

5.1.1 Overview

A key feature in the survey methodology was incorporating innovation, including:

- taking advantage of existing cross-jurisdiction operations;
- standardised training and conducting pilots to support delivery;
- utilisation of the NHVIM by all inspectors for a consistent identification and categorisation of non-conformities; and
- electronic data collection using tablets for efficiency of data processing and reduction in administrative time over alternative, paper-based methods.

The main development and fieldwork periods occurred from May to the first week in November 2016 (Figure 5-1). The development work involved:

- liaising with jurisdictions to promote the method and plan resourcing;
- developing the survey instrument and data collection method;
- training inspectors in the jurisdictions;
- distributing survey material;
- planning the survey implementation, including reviewing transport routes and inspection sites, and developing schedules in consultation with the jurisdictions' operations managers;
- testing and refining the survey instrument; and
- piloting the survey in each jurisdiction and making final changes.

Figure 5-1.
Summary of survey development and fieldwork periods

<table>
<tr><th colspan="8">2016</th></tr>
<tr><th>MAY</th><th>JUNE</th><th>JULY</th><th>AUGUST</th><th>SEPTEMBER</th><th>OCTOBER</th><th>NOVEMBER</th></tr>
<tr><td>• Liaison with jurisdictions
• Planning
• Drafting survey</td><td>• Training sessions
• Survey set up
• Begin site selection, scheduling</td><td>• Distributing material
• Pilot shifts
• Survey refinement
• Scheduling 50+% of the survey</td><td colspan="4">• FIELDWORK: 1 AUGUST TO 4 NOVEMBER
• Daily monitoring and feedback
• Additional pilots at new sites and finalise scheduling in ACT, NT
• Scheduling second half of fieldwork</td></tr>
<tr><td colspan="2"></td><td></td><td colspan="4">FIELDWORK</td></tr>
<tr><td colspan="2"></td><td>NSW:</td><td colspan="4">1–25 AUG</td></tr>
<tr><td colspan="2"></td><td>VIC:</td><td colspan="4">1 AUG – 8 SEP</td></tr>
<tr><td colspan="2"></td><td>QLD:</td><td colspan="4">1 AUG TO 20 OCT</td></tr>
<tr><td colspan="2"></td><td>SA:</td><td colspan="4">1 AUG – 27 OCT</td></tr>
<tr><td colspan="2"></td><td>TAS:</td><td colspan="4">1–29 AUG</td></tr>
<tr><td colspan="2"></td><td>NT:</td><td colspan="4">2 SEP – 4 NOV</td></tr>
<tr><td colspan="2"></td><td>ACT:</td><td colspan="4">1 AUG TO 14 OCT</td></tr>
</table>

The fieldwork period included:

- daily monitoring of shifts and the number of inspections completed in each jurisdiction;
- troubleshooting any issues with completing the survey;
- providing daily updates to the NHVR and each jurisdiction; and
- revisions to schedules, including further consultation with the NHVR and with jurisdictions to complete the survey.

5.1.2 Survey size and quotas

The NHVR engaged a statistical consultant, Data Analysis Australia (DAA), to recommend a sample size and sampling methodology to ensure the data collected was valid and reliable. The survey sample included quotas for six vehicle types and preferred regions where heavy vehicle inspections would be conducted. The final recommended sample size for each vehicle type by jurisdiction and region are shown in Table 5-1.[13]

Table 5-1.
Final proposed quotas by jurisdiction, area and vehicle type

Jurisdiction	Region	Rigid Truck	Semi-trailer	B-double	Road train	Bus/ Coach	Plant/ SPV	*Total*
NSW	Metro	380	130	60	0	135	70	*775*
	Non-Metro	360	150	85	60	115	90	*860*
	Total	*740*	*280*	*145*	*60*	*250*	*160*	*1635*
VIC	Metro	390	150	130	0	105	95	*870*
	Non-Metro	340	170	140	10	95	105	*860*
	Total	*730*	*320*	*270*	*10*	*200*	*200*	*1730*
QLD	Metro	330	130	80	0	135	70	*745*
	Non-Metro	370	135	105	60	100	70	*840*
	Total	*700*	*265*	*185*	*60*	*235*	*140*	*1585*
SA	Metro	205	70	50	15	85	85	*510*
	Non-Metro	185	100	80	40	50	85	*540*
	Total	*390*	*170*	*130*	*55*	*135*	*170*	*1050*
TAS	Non-Metro	160	60	30	0	30	10	*290*
	Total	*160*	*60*	*30*	*0*	*30*	*10*	*290*
NT	Non-Metro	115	30	10	40	30	30	*255*
	Total	*115*	*30*	*10*	*40*	*30*	*30*	*255*
ACT	Metro	75	20	10	0	40	25	*170*
	Total	*75*	*20*	*10*	*0*	*40*	*25*	*170*
TOTAL	Metro	1380	500	330	15	500	345	*3070*
	Non-Metro	1530	645	450	210	420	390	*3645*
	Total	*2910*	*1145*	*780*	*225*	*920*	*735*	*6715*

The design was intentionally a balance between generating suitable sample sizes for analysing and reporting results for vehicle/jurisdiction sub-groups, and effective representation of the relevant population. Smaller vehicle groups and jurisdictions were over-sampled, and corresponding larger

[13] The sample sizes originally proposed for Western Australia are not included in the table.

groups and jurisdictions were under-sampled. The intention was for the sample structure to be redressed through post-weighting of the data.

Setting quotas by metropolitan and regional areas was based on distribution of registrations by postcodes, with general assignment using the Australian Bureau of Statistics' (ABS's) categorisation of postcodes as major cities, or regional/remote. DAA proposed that the metropolitan/non-metropolitan sampling be guided by:

- location of intercept sites being in the ABS's Statistical Areas Level 4 (SA4) containing some postcodes categorised as major cities being treated as metropolitan; and
- location of a depot of a vehicle inspected in a periodic inspection or through special arrangement (referred to as present-for inspections) being a specific postcode categorised as a major city being treated as metropolitan.

This guide was followed generally, with some adjustments for practicality of survey implementation, in particular:

- in New South Wales, focusing on the Sydney/Newcastle/Wollongong conurbation for the metropolitan quotas;
- in Victoria, allowing Geelong to be categorised as non-metropolitan for sampling buses; and
- in South Australia, allowing a portion of freight vehicles in metropolitan quotas to be completed in non-metropolitan areas.

The implementation of the survey with the primary intercept method presented a compromise in sampling of vehicles, focusing on the *location* of travel. For the purposes of implementing the survey in a practical way, the sampling distribution by metropolitan/non-metropolitan areas was used for the *location* of the inspections. The sample was then weighted to the population of vehicles by state and vehicle type as representative of the heavy vehicle fleet. It was not practical to capture postcode of registration in the survey and hence a metropolitan or non-metropolitan stratification could not be implemented specifically when weighting to the population.

5.1.3 Vehicle selection

The most effective method for achieving a representative sample of vehicles would involve random selection. Fixed and mobile inspection stations along or close to main and secondary travel routes, with facility to use mobile interception on roads up to several kilometres away, provided a very good basis for achieving a representative sample, particularly of freight of vehicles. While certain freight vehicles would be less likely to be on such a route, or even active over the time period of the survey, the ability to access such vehicles was limited.

Within this sampling regime, access to plant/special purpose vehicles and buses/coaches was also limited. In the case of plant/SPV there was limited travel on the relevant routes, and in the case of buses/coaches there was a need to minimise disruption to services and passengers; in addition, it was not seen as appropriate or safe to attempt an inspection of a bus or coach loaded with passengers.

As a result of these sampling issues, it was accepted that the majority of the plant and bus/coach quotas would be inspected via special arrangement to visit a depot or attend an inspection station. Many of the plant vehicles were therefore inspected at depots, or arrangements made for the vehicles to be brought to an inspection station. In addition, the large majority of inspections of coaches and buses were also made at depots or through special arrangement.

Where jurisdictions had periodic inspections of vehicles, such vehicles were also allowed to be included in the survey, based on the full inspection required for the survey being implemented. This type of inspection was open to all six types of vehicles, with a limitation imposed that no more than 7% of freight vehicles would count directly to a jurisdiction's quota for freight vehicles. In practice, this limitation required that 93% of the freight sample needed to be sampled by intercept, and post-survey weighting was applied to correct for any over-sampling, beyond the 7% of the original quotas.

To summarise, the three modes of selection of vehicles were:

- **roadside intercept**, principally for rigid trucks, truck and trailer combinations and articulated vehicle combinations, as well as plant vehicles, where relevant;
- **present-for inspection – by invitation**, for buses, coaches and plant vehicles; and including visiting the operator depot or having the vehicle come to an inspection station
- **present-for inspection – by periodic inspection**, for all types of vehicles, but again particularly for buses, coaches and plant vehicles.

5.1.4 Measures of non-conformities

Non-conformities are reported in a number of formats, including the highest non-conformity level for:

- the **hauling unit**, in some cases divided into freight and non-freight units;
- **trailers**, which are treated as additional vehicle units for reporting; and
- the **vehicle combination**, of hauling unit and one or more trailers, covering all units (i.e., hauling and trailer) in the vehicle, and in some cases also divided into freight and non-freight vehicles.

For the purposes of reporting categories of non-conformities, components of non-conformities under *Section 14: Trailers* were aligned with the substantive systems (*Section 2 Brakes*, etc.). The incidences of non-conformities for *Section 13: Buses* have been reported typically based only on the sample of bus/coach.

Table 5-2.
Alignment of Section 14: Trailers with other non-conformity Sections

Vehicle systems		Alignment of Section 14
Section 2	Brakes	14.1 – 14.2
Section 3	Couplings	14.3 – 14.7
Section 4	Steering and Suspension	14.8 – 14.9
Section 5	Wheels, Tyres and Hubs	14.10 – 14.13
Section 6	Structure and Body	14.14 – 14.18
Section 7	Seats and Seatbelts	–
Section 8	Lights and Reflectors	14.19
Section 9	Mirrors	–
Section 10	Windscreens and Windows	–
Section 11	Engine, Driveline and Exhaust	–
Section 12	LPG and NG Vehicles	–
Section 13	Buses	–

5.2 Survey terminology

A glossary is presented at the front of this document to define technical language and common terms related to the survey used in the report. Key terms are:

- **quota**: the required number of sample items (i.e., vehicles), for the overall survey and for specific sub-groups;
- **random sampling:** selection of units where each unit has equal probability of being selected;
- **sample size**: the number of vehicles surveyed in a particular sub-group, such as the number rigid trucks in metropolitan NSW;
- **weighting**: applying a multiplier to individual sub-groups in the survey so that the resulting distribution matches that of the target population; and
- **tests of statistical significance**: to assess the probability, or likelihood, that differences in results between sub-groups are great enough that it is unlikely to be due to chance, using a pre-determined probability—the significance level. A significance level of less than .01 has been applied—meaning that there is a 99% probability that the differences are real.

5.3 Survey operations

5.3.1 Inspection method

The inspection method emphasised consistent process based on the NHVIM v2.1, with results categorised in line with NHVIM standards. Vehicles were inspected by combination, encompassing the hauling unit and any attached trailers. The inspection captured brake performance through a roller brake test on each axle of the vehicle combination, unless it was unsafe to do so.

Fifteen non-conformity categories are covered in the NHVIM (Table 5-3).

Table 5-3.
Categories of non-conformities in the NHVIM

Categories of non-conformities	
Section 2	Brakes
Section 3	Couplings
Section 4	Steering and Suspension
Section 5	Wheels, Tyres and Hubs
Section 6	Structure and Body
Section 7	Seats and Seatbelts
Section 8	Lights and Reflectors
Section 9	Mirrors
Section 10	Windscreens and Windows
Section 11	Engine, Driveline and Exhaust
Section 12	LPG and NG Vehicles
Section 13	Buses
Section 14	Trailers
Section 15	Motorhomes, Caravans and Campervans

5.3.2 Survey instrument

The survey instrument was based on that used in recent roadworthiness surveys in New South Wales. The survey had four broad categories of content:

- details of the inspection time and location;
- details about the vehicle combination, and then for each unit;
- details of non-conformities, completed separately for each unit; and
- capturing roller brake test results – printouts/recorded information photographed.

The sequencing and content are shown in Figure 5-2 and Table 5-4.

Figure 5-2.
Flow diagram of survey instrument

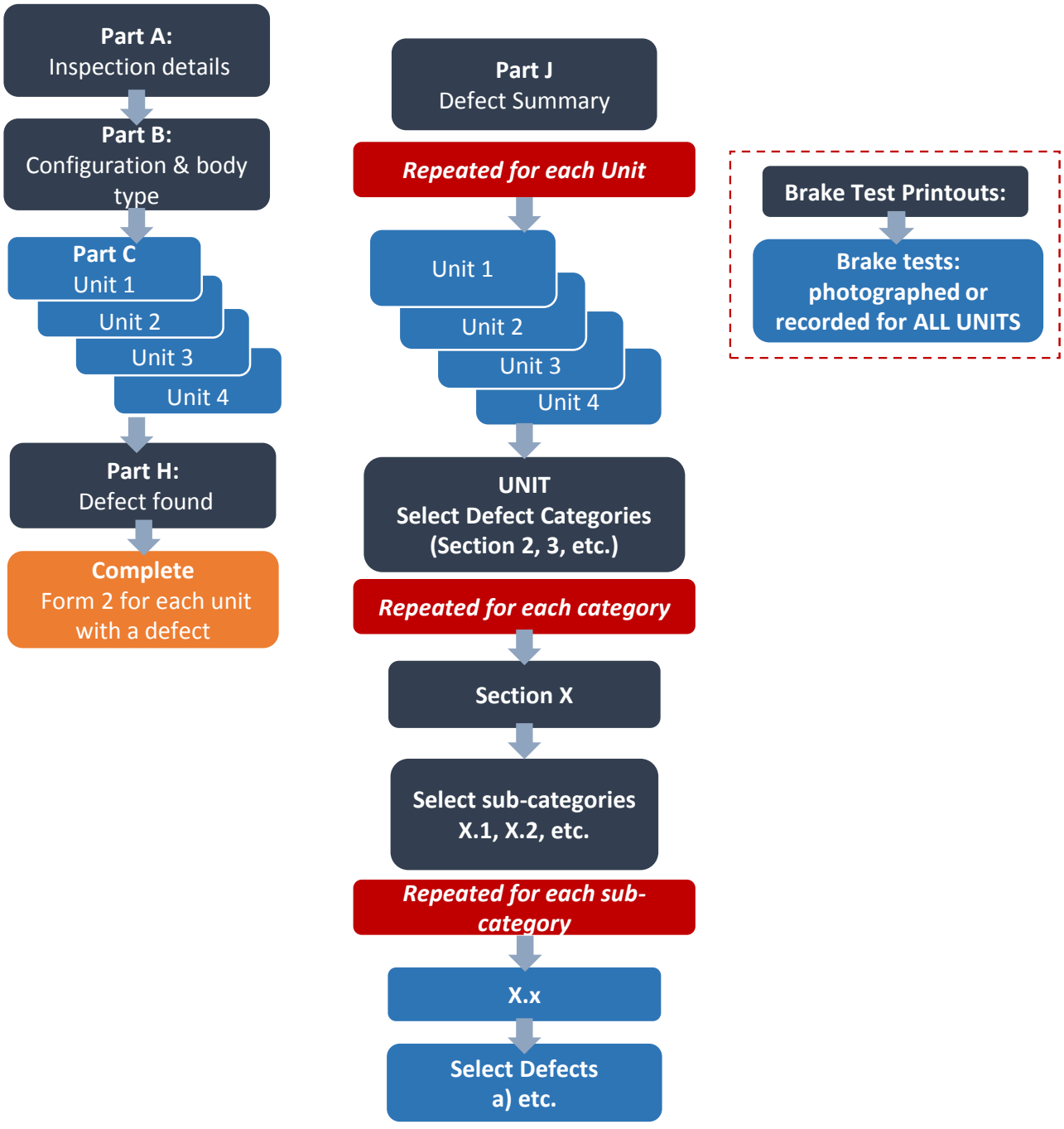


Table 5-4.
Summary of the inspection details, vehicle combination and body types, and unit details

INSPECTION DETAILS	DESCRIPTION	
Inspection Start Time	When the vehicle is brought in	
Surface Condition	Options for dry or wet, or additional description	
Authorised Officer IDs	Up to three officers	
Inspection State	The state or territory where the inspection takes place	
Site Location	List of sites to select from, or other description of the location	
Type of Inspection	Whether by intercept, or present-for inspection: invited to site or visited at a depot; inspected for a periodic or annual inspection	
Moving interception with redirection	The vehicle is intercepted by a team operating away from the site and redirected to the site	
NRBS Quota Category	One of the main six types of vehicle combinations	
Number of units	The number of registerable units	
CONFIGURATION & BODY TYPE	**DESCRIPTION**	
Vehicle type of hauling unit	Selected for the hauling unit	
Vehicle type of the other units	Selected for each trailer/dolly	
Number of axles in each axle group	Entered for each unit	
Body types	Entered for each unit	
UNIT DETAILS	**Unit 1 (Hauling unit)**	**Unit 2+**
Number plate	✓	✓
Odometer reading	✓	✓
State of Registration	✓	✓
Federal Registration	✓	✓
Vehicle/Trailer Ownership	✓	✓
Load Type (can be multiple)	Skipped if bus/coach or prime mover	Asked for each unit
Participation in a scheme	Asked for the vehicle/driver	Asked for each unit
Vehicle/Bus chassis make	✓	–
Bus body	Asked for bus/coach	–
Trailer Make	–	✓
Model of vehicle	✓	
Date of manufacture	✓	✓
VIN or Chassis	✓	✓
Brake system	✓	✓
Type of suspension	✓	✓
Type of steering	✓	–
Fuel system	✓	–
NON-CONFORMITIES IN EACH UNIT	**EACH UNIT**	
Was a non-conformity detected?	✓	
Maximum level of non-conformity	✓	
Details of non-conformities	✓	

5.3.3 Data collection

The primary data collection method was through Computer Assisted Personal Interview (CAPI), using tablets. The survey was programmed with the survey authoring software Confirmit, and implemented on the tablet with the Confirmit CAPI app. This approach allowed the survey to be conducted offline, which facilitated inspections being conducted in some rural locations. Online connectivity was required to download any revisions to the survey and upload data. Use of the tablets and data input was managed by the inspectors.

Paper forms were provided as a back-up for where use of the tablets was not possible. Paper forms had been used previously in the NSW surveys. Electronic data collection provided benefits of:

- the program managing the sequence of data entry, reducing the risk of missing information;
- storing/uploading data, reducing the need to handle paper forms; and
- taking and storing photographs, used to capture brake test outputs.

Tablets also facilitated broadcasting messages to inspectors. Some key instructions were also highlighted at the front of the survey, and updated during fieldwork.

There were some limitations with the tablet method which did need to be taken into account in implementing the survey:

- there was less flexibility in moving back and forward in the survey compared with paper forms;
- the survey followed a set sequence of questions/recording information; and
- the resolution of images captured from the camera was compressed in the survey software, potentially affecting legibility of the brake test printouts.

To address the issue of resolution of the images of the printouts, a process was put in place for the brake test printouts to be mailed to AMR progressively through the survey period.

5.3.4 Training and pilots

Training sessions were conducted in each jurisdiction. Sessions took place in each jurisdiction:

- NSW: Botany (2 sessions);
- VIC: Melbourne (2 sessions);
- QLD: Brisbane, Rockhampton;
- SA: Adelaide, Port Augusta;
- TAS: Launceston;
- ACT: Canberra;
- NT: Katherine; and
- WA: Perth.

Training sessions were conducted over a 6-hour period and included comprehensive coverage of:

- the background to the survey and the rationale and objectives;
- implementation of inspections;

- completing the survey, including use of the tablets and survey software; and
- practice surveys using set scenarios.

Pilot shifts were conducted in each jurisdiction during 18–23 July 2016. This included formal pilot days in the first week as a well as some additional 'practice' shifts. These took place at the following sites:

- NSW: Wetherill Park;
- VIC: Millers Rd Bay, Altona North;
- QLD: Yamanto, Burpengary, Port of Brisbane;
- SA: Churchill Road, Regency Park;
- TAS: Midland Highway;
- ACT: DMVR; and
- NT: Berrimah.

A representative from AMR or the NHVR attended each pilot. Some revisions were made to survey sequencing, question wording and instructions as a result of feedback from the pilots.

Results from the pilot inspections were included in the final survey numbers.

5.3.5 Scheduling shifts

DAA had recommended surveying at a number of different sites in each jurisdiction to help with the effective coverage and representation of the vehicle fleet.

AMR reviewed information provided by the NHVR on primary and secondary freight routes and the location of inspection sites, and consulted with each jurisdiction to assist in the development of a schedule of sites and shifts to provide representative coverage of heavy vehicles. The jurisdictions provided guidance around their knowledge of the routes and experience at different sites.

A schedule was put together prior to the survey fieldwork period and revised during the period based on the progress of shifts and coverage of vehicles, with the goal of ensuring quotas were met. The jurisdictions also arranged for present-for inspection vehicles surveys with a range of businesses to meet bus/coach and plant vehicle quotas.

5.3.6 Survey material

AMR distributed material to each jurisdiction. Each tablet pack included:

- tablet and mains charger;
- instruction manual;
- car charger adaptor;
- back-up battery pack where requested by the jurisdiction; and
- envelopes for returning hardcopies of brake test printouts and paper forms.

The survey manual covered:

- AMR contact information;
- a quick reference guide to the survey software;
- using the survey software;

- the survey structure and summary questions;
- key definitions;
- a guide to completing the survey, recording non-conformities, and processing roller brake test results;
- a daily check list; and
- a supply of back-up paper forms.

The NHVR also distributed a letter of inspection to the driver which exempted the *hauling unit* from further inspections as part of the survey.

5.3.7 Monitoring of the fieldwork

The survey was monitored daily during fieldwork, and updates on the number of inspections completed were provided to each of the jurisdiction operations managers. The summary spreadsheet included:

- total completed surveys by vehicle type for each site for each jurisdiction; and
- surveys completed on the previous day by vehicle type for each site.

The operations managers and inspectors were in contact with AMR during the survey to address any issues experienced with the use of the tablets and the survey software. AMR was also in regular contact with the operations managers about any issues with survey shifts, need for rescheduling, or balancing of coverage of different routes to help with representativeness of the sample.

5.4 Logistical issues during fieldwork

A number of issues associated with the logistics of the survey are highlighted below, which should be taken into account in conducting future surveys.

- **Maintaining planned schedules**: While there was initial planning of schedules to cover different routes and areas within each state, maintaining this coverage during the survey was influenced by a number of factors including the speed of completing surveys, availability of resources and efficiency of certain sites.
- **Resourcing of inspectors**: The progress of the survey was impacted in some instances by lack of inspector resources. It is noted that 15% of inspections were conducted by only one inspector (based on the information recorded). This incidence was relatively high in NT (52% of inspections) and lowest in the ACT (3%) and QLD (9%). The other states ranged between 14% and 21%.
- **Assessing numbers of shifts**: As a number of survey shifts could include multiple inspection teams, the final numbers of shifts were estimated from individual daily tablet usage. More detailed records of shifts/inspectors could be kept to provide a more accurate measure of the logistics involved.
- **Inconsistency in recording survey data**: There were a number of issues with accuracy and consistency of data entered, which would in part be related to difficulty in using the keyboard on the tablet screen. There was inconsistency and entry errors in entering inspector IDs, which impacted estimations of number of inspectors.

- **Interpretation of survey questions**: There were issues around interpretation of some survey questions which impacted the accuracy of the data. This included recording type of ownership, identifying plant/SPV, recording axles groups, and entering inspection start/finish times. The inaccuracy of the times impacted measuring the length of inspections. Some elements could be improved by better training of inspectors.
- **Roller brake tests**: There were a number of quality issues with the brake test data, influenced by issues with roller brake tester and operator error. While these were only judged to affect a small minority of units, it impacted the level of processing and validation of results, and the need to make interpretations of accuracy. While conducting roller brake tests was not required if there was a safety issue or the vehicle was unsuitable for testing, the actual implementation for plant/SPV was influenced by the availability and/or utilisation of mobile testing units.

5.5 Survey conduct

5.5.1 Final survey numbers and shifts

The final number of vehicles inspected was 7,130, which was 415 over the original total quota of 6,715 (Table 5-5). Some of the over-sampling, however, was from the present-for inspection mode, which was required to represent no more than 7% of freight vehicles inspected. A more detailed breakdown of the quotas and sample achieved after final cleaning of the data is shown in Appendix C.

Table 5-5.
Overall survey numbers vs. overall quotas by state of inspection

State of Inspection	Quota	Surveyed	Difference	Comment
NSW	1635	1761	+126	
VIC	1730	1917	+187	
QLD	1585	1696	+111	
SA	1050	983	-67	(under-sampling of plant)
TAS	290	316	+26	
NT	255	241	-14	(under-sampling of plant)
ACT	170	216	+46	(over-sampling of PFI)
TOTAL	**6715**	**7130**	**415**	

As more than one team could be working at a single site, the final number of shifts was estimated by counting the number of days that each tablet was used. This led potentially to under estimating shifts in NSW where some sites involved 24-hour operation. The estimated total was 1,049 shifts.

5.5.2 Weighting of the survey sample

As noted previously, the sampling distribution by state and metropolitan/non-metropolitan areas was used for the *location* of the inspections, as a practical approach to implementing the survey. This *location* distribution was then used as the reference for final weighting of the survey sample, as a practical representation of usage of the heavy vehicle fleet.

The survey sample was weighted primarily to the population of vehicles provided by DAA to the original set of location quotas based on:

- **Step 1.** Adjustment the raw inspection numbers to:
  - make PFI freight inspections 7% of the original freight quota;
  - reduce representation of Mt White (in NSW) to be closer to the intended share of inspections planned by the NSW operations; and
  - reduce representation of Burpengary (in QLD) based on the original planned number of survey days, as a proportion of the total final number of days, which had led to oversampling.
- **Step 2.** Weighting each vehicle type within state to state registrations, based on the state of registration of the hauling unit as per the original DAA set up (before quotas were adjusted to balance sample size against proportional representation) — this approach in particular brought up the share of the larger states (which were under-sampled) and brought down the share of the smaller states (which were over-sampled), to give a more accurate representation of vehicles in each state.
- **Step 3.** Making final adjustments to estimates of road train registrations as a share of B-doubles. DAA had originally applied estimates based on QLD travel counts, and subsequently adjusted these based on feedback from VIC, QLD and NT (and WA). The survey provided more detail around the actual registration profile.
- **Step 4.** Adjusting weights to state of registration distributions (as reported by DAA).

Additional issues and considerations included the following:

- inspections of 39 B-doubles in SA were switched from metropolitan areas to non-metropolitan, based on feedback from the operations manager of the low incidence of the vehicles in metropolitan areas;[14]
- weights were capped at 2.5 and, in general, adjustments were made to maintain the correct vehicle/jurisdiction population targets; the exception was inspections of plant vehicles in NT, leaving a shortfall of 22 vehicles compared with the total quota; and
- 42 vehicles registered in WA were incorporated into the final data by applying a nominal weight for each vehicle type based on the final weights applied to SA vehicles inspected in VIC and NSW.

[14] There had also been an earlier request from the SA operations manager to include a sample of 15 road trains in metropolitan areas, reducing the sample of B-doubles, in addition to 40 in non-metropolitan areas, to represent better the distribution (although only three of the 15 were surveyed).

The final unweighted sample sizes for each vehicle type within each state of inspection, along with the weighted percentage distribution based on the vehicle population, are shown in Table 5-6. The weight assigned to the hauling unit was also applied to the trailers in a combination.

Table 5-6.
Profile of types of vehicles in each state, highlighting low sample sizes (unweighted n, weighted %s)

VEHICLE	STATE OF INSPECTION													
	NSW		VIC		QLD		SA		TAS		NT		ACT	
	Sample n	*Wtd %*	*Sample n*	*Wtd %*	*Sample n*	*Wtd %*	*Sample n*	*Wtd %*	*Sample n*	*Wtd %*	*Sample n*	*Wtd %*	*Sample n*	*Wtd %*
Rigid truck	854	71.8	792	66.5	756	70.4	419	58.1	175	72.2	110	68.4	121	71.3
No trailer	*772*	*73.1*	*706*	*69.7*	*655*	*68.2*	*380*	*68.2*	*158*	*76.5*	*104*	*76.9*	*110*	*81.8*
Trailer	*82*	*7.8*	*86*	*8.3*	*101*	*10.2*	*39*	*7.0*	*17*	*8.3*	*6*	*4.3*	*11*	*10.8*
Semi-trailer	286	11.2	362	12.9	279	10.0	178	11.0	65	8.1	30	3.5	21	4.7
B-double	159	5.1	284	5.7	195	7.2	122	5.9	29	4.8	4	2.0	9	1.1
Road train	60	0.6	8	0.2	59	2.2	51	2.2	–	0.0	43	10.3	–	0.0
Bus/Coach	247	7.9	242	7.0	265	8.2	136	7.1	34	13.9	51	10.8	40	16.0
Plant/SPV	155	3.3	229	7.7	142	2.1	77	15.7	13	1.0	3	5.0	25	6.9
TOTAL	**1761**	**100**	**1917**	**100**	**1696**	**100**	**983**	**100**	**316**	**100**	**241**	**100**	**216**	**100**

Highlighting small sample sizes: <30
Wtd=weighted

5.5.3 Statistical tests and highlighting differences

The survey results are presented generally as a descriptive analysis. As the survey is only of a sample of vehicles from the population, however, the results represent an estimate of the results in the population, and there is a degree of error. Assuming random sampling of vehicles, the level of precision improves as the sample size increases.

Effective sample size

The weighting of the survey sample by vehicle category and location to the population of vehicles potentially reduces the precision of the results by introducing additional error in the survey estimates. The impact reduces the *effective sample size* (estimated to be 72.8% of the original sample size of 7,130). This impact was taken into account in statistical tests on the weighted data through a corresponding reduction in the sample size.

Chi-square test of differences between groups

Tests of statistical significance were conducted to identify key differences between survey sub-groups on the incidence of non-conformities, generally using chi-square tests of association. The tests assess the probability, or likelihood, that the differences are great enough that it is unlikely to be due to chance, using a pre-determined probability level.

A level of significance level of .01 or less has been applied—meaning that there is a 99% probability that the differences are real. Statistically significant differences are highlighted in the commentary. The tests assume random sampling of vehicles.

Analysis of Variance (ANOVA)

ANOVA was used to assess differences between groups where the measures were averages: age in years, non-conforming units.

General Linear Modelling

Additional tests was used for more detailed investigation of specific relationships with incidence of non-conformities, adjusting for multiple group variables. The tests used general linear modelling (GLM). GLM in particular allows for taking into account the influence of more than one factor on the outcome measure, including interactions between the factors, to give a simple, interpretable set of estimated outcomes (e.g., incidence of non-conformities).

The analysis provides estimated marginal means, averaged across levels of the other factors. For the purposes of the analysis, the outcome variable used was whether or not there was a non-conformity, and hence the *mean* was taken to represent the *percentage* incidence. These are not the same as the observed incidences, but help identify factors associated with non-conformity.

This analysis was conducted on unweighted data.

6. Appendix C: Final survey numbers and weighting

6.1 Final survey numbers and weighting to the population

Table 6-1.

Summary of quotas, final survey numbers and weighting by location, vehicle type and type of inspection

Inspection				SURVEYED				WEIGHTED TO POPULATION			AVERAGE WEIGHT	
State	Region	Vehicle	Quota	Intercept	PFI	Total	±#	Intercept	PFI	Total	Intercept	PFI
NSW	Metro	Rigid truck	**380**	420	49	469	89	757	81	838	1.80	1.65
		Semi-trailer	**130**	132	3	135	5	108	3	111	0.82	1.09
		B-double	**60**	62	8	70	10	38	5	43	0.62	0.60
		Road train		0	0	0	0	0	0	0		
		Bus/Coach	**135**	5	130	135	0	4	97	101	0.74	0.74
		Plant/SPV	**70**	44	18	62	-8	21	9	30	0.48	0.48
	Non-Metro	Rigid truck	**360**	348	37	385	25	666	69	735	1.91	1.86
		Semi-trailer	**150**	147	4	151	1	130	4	134	0.88	1.01
		B-double	**85**	89	0	89	4	69	0	69	0.78	
		Road train	**60**	60	0	60	0	14	0	14	0.23	
		Bus/Coach	**115**	45	67	112	-3	29	43	72	0.64	0.64
		Plant/SPV	**90**	61	32	93	3	28	15	43	0.46	0.48
		Total	**1635**	**1413**	**348**	**1761**	**126**	**936**	**131**	**1067**		
VIC	Metro	Rigid truck	**390**	410	0	410	20	547	0	547	1.33	
		Semi-trailer	**150**	181	0	181	31	80	0	80	0.44	
		B-double	**130**	144	0	144	14	39	0	39	0.27	
		Road train	**0**	5	0	5	5	2	0	2	0.32	
		Bus/Coach	**105**	0	105	105	0	0	61	61		0.58
		Plant/SPV	**95**	6	151	157	62	2	46	48	0.32	0.31
	Non-Metro	Rigid truck	**340**	379	3	382	42	414	3	417	1.09	1.08
		Semi-trailer	**170**	181	0	181	11	107	0	107	0.59	
		B-double	**140**	140	0	140	0	43	0	43	0.31	
		Road train	**10**	3	0	3	-7	1	0	1	0.32	
		Bus/Coach	**95**	1	136	137	42	0	41	41	0.30	0.30
		Plant/SPV		5	67	72	-33	4	60	64	0.84	0.89
		Total	**1730**	**1455**	**462**	**1917**	**187**	**1239**	**211**	**1449**		

Inspection State	Region	Vehicle	Quota	SURVEYED				WEIGHTED*			AVERAGE WEIGHT	
				Intercept	PFI	Total	±#	Intercept	PFI	Total	Intercept	PFI
QLD	Metro	Rigid truck	**330**	303	49	352	22	515	45	561	1.70	0.92
		Semi-trailer	**130**	126	12	138	8	80	4	85	0.64	0.37
		B-double	**80**	72	7	79	-1	55	3	58	0.77	0.42
		Road train		0	0	0	0	0	0	0		
		Bus/Coach	**135**	16	119	135	0	11	81	92	0.68	0.68
		Plant/SPV	**70**	47	23	70	0	13	7	20	0.27	0.30
	Non-Metro	Rigid truck	**370**	328	76	404	34	646	48	694	1.97	0.63
		Semi-trailer	**135**	128	13	141	6	87	6	93	0.68	0.50
		B-double	**105**	108	8	116	11	65	5	70	0.60	0.64
		Road train	**60**	57	2	59	-1	39	1	40	0.68	0.61
		Bus/Coach	**100**	18	112	130	30	7	47	54	0.42	0.42
		Plant/SPV	**70**	31	41	72	2	7	10	17	0.24	0.24
		Total	**1585**	**1234**	**462**	**1696**	**111**	**851**	**117**	**968**		
SA	Metro	Rigid truck	**205**	188	30	218	13	211	26	237	1.12	0.88
		Semi-trailer	**70**	46	22	68	-2	24	4	28	0.52	0.17
		B-double	**50**	22	1	23	-27	18	1	19	0.82	0.90
		Road train	**15**	3	0	3	-12	4	0	4	1.45	
		Bus/Coach	**85**	0	86	86	1	0	38	38		0.44
		Plant/SPV		13	27	40	-45	19	39	58	1.48	1.45
	Non-Metro	Rigid truck	**185**	184	17	201	16	176	18	194	0.96	1.05
		Semi-trailer	**100**	110	0	110	10	54	0	54	0.49	
		B-double	**80**	97	2	99	19	24	1	25	0.25	0.27
		Road train	**40**	48	0	48	8	12	0	12	0.25	
		Bus/Coach	**50**	1	49	50	0	0	14	15	0.29	0.29
		Plant/SPV		9	28	37	-48	12	46	58	1.37	1.65
		Total	**1050**	**721**	**262**	**983**	**-67**	**279**	**79**	**358**		

Inspection				SURVEYED				WEIGHTED			AVERAGE WEIGHT	
State	Region	Vehicle	Quota	Intercept	PFI	Total	±#	Intercept	PFI	Total	Intercept	PFI
TAS	Non-Metro	Rigid truck	**160**	175	0	175	15	154	0	154	0.88	
		Semi-trailer	**60**	65	0	65	5	17	0	17	0.27	
		B-double	**30**	29	0	29	-1	10	0	10	0.35	
		Road train		0	0	0	0	0	0	0		
		Bus/Coach	**30**	0	34	34	4	0	30	30		0.87
		Plant/SPV	**10**	5	8	13	3	1	1	2	0.18	0.17
		Total	**290**	**274**	**42**	**316**	**26**	**183**	**31**	**214**		
NT	Non-Metro	Rigid truck	**115**	86	24	110	-5	92	11	103	1.07	0.45
		Semi-trailer	**30**	24	6	30	0	5	0	5	0.21	0.05
		B-double	**10**	3	1	4	-6	2	1	3	0.67	0.96
		Road train	**40**	42	1	43	3	15	0	15	0.36	0.27
		Bus/Coach	**30**	2	49	51	21	1	16	16	0.29	0.32
		Plant/SPV	**30**	3	0	3	-27	8	0	8	2.50	
		Total	**255**	**160**	**81**	**241**	**-14**	**123**	**28**	**151**		
ACT	Metro	Rigid truck	**75**	71	50	121	46	38	5	44	0.54	0.11
		Semi-trailer	**20**	19	2	21	1	3	0	3	0.14	0.09
		B-double	**10**	9	0	9	-1	1	0	1	0.07	
		Road train		0	0	0	0	0	0	0		
		Bus/Coach	**40**	1	39	40	0	0	10	10	0.25	0.25
		Plant/SPV	**25**	0	25	25	0	0	4	4		0.17
		Total	**170**	**100**	**116**	**216**	**46**	**42**	**19**	**61**		

6.2 Inspection Sites, NRBS 2016

Table 6-2.
Summary of survey numbers by survey site and vehicle type

State	Area	Site	Rigid truck	Semi-trailer	B-double	Road train	Bus/ Coach	Plant/ SPV	Total
NSW	Metro	Wetherill Park	83	27	33	0	11	32	186
		Botany	35	6	0	0	50	3	94
		Appin Road	31	11	7	0	0	0	49
		Kurnell	27	3	0	0	0	0	30
		Mona Vale Road	9	1	0	0	0	0	10
		Mt. White Northbound	55	30	10	0	1	5	101
		Mt. White Southbound	78	42	15	0	4	9	148
		The Northern Road	19	2	0	0	0	7	28
		Unanderra	23	4	2	0	4	6	39
		Windsor Road	96	9	1	0	0	0	106
		Wakehurst Parkway	5	0	0	0	0	0	5
		Seven Hills	0	0	0	0	10	0	10
		OTHER METRO - NSW	8	0	2	0	55	0	65
	Non-Metro	Marulan	107	46	35	0	11	28	227
		Chinderah	60	21	12	0	6	7	106
		Mt. Boyce	44	16	0	0	17	11	88
		Princes Highway South Nowra/Nowra HVIS	50	2	1	0	26	8	87
		Wagga Wagga	37	16	5	0	20	14	92
		Daroobalgie Northbound	26	16	6	0	0	0	48
		Daroobalgie Southbound	30	12	8	0	0	0	50
		Moree Northbound	16	13	12	23	0	1	65
		Moree Southbound	13	9	10	37	1	0	70
		Lismore HVIS	0	0	0	0	5	0	5
		Moree HVIS	2	0	0	0	5	9	16
		Orange HVIS	0	0	0	0	9	9	18
		Parkes HVIS	0	0	0	0	6	6	12
		Dubbo HVIS	0	0	0	0	2	0	2
		Nyngan HVIS	0	0	0	0	4	0	4
VIC	Metro	Millers Rd Bay (Westgate Fwy on ramp) Altona Nth	58	45	5	1	0	0	109
		Turner Street Port Melbourne (weigh bridge Site)	42	17	4	0	0	0	63
		Officer (Princes Hwy) Weigh Bridge Site	39	2	15	1	0	0	57

State	Area	Site	Rigid truck	Semi-trailer	B-double	Road train	Bus/ Coach	Plant/ SPV	Total
		Deer Park (Western Hwy) Service Rd just West of WRR	19	18	2	0	0	0	39
		Melbourne Market Footscray Rd	76	29	15	2	0	0	122
		Coldstream (Maroondah Hwy) South bound	21	7	5	0	0	0	33
		Beveridge Hume Fwy (Weigh Bridge site) north and south	39	16	0	0	0	0	55
		Campbellfield Hume Hwy Service Road Northbound North of Cooper Street	30	10	7	0	0	0	47
		Broadford Hume Hwy Weigh Bridge Site	6	10	43	0	0	0	59
		Gisborne Calder Fwy Parking Bay	12	3	26	0	0	0	41
		Waurn Ponds Princes Fwy East and West Bound	22	19	22	1	0	0	64
		Dandenong	45	5	0	0	0	48	98
		OTHER METRO - VIC	1	0	0	0	105	109	215
	Non-Metro	Chiltern Hume Fwy Rest area South bound	9	8	4	0	0	0	21
		Bungaree Western Hwy Weigh Bridge Site	29	30	10	0	0	1	70
		Leigh Creek Western Hwy (weigh bridge Site)	19	12	5	0	0	0	36
		Ballarat Sale Yards La Trobe Street	30	1	3	0	0	0	34
		Ravenswood Calder Hwy North Bound Rest Area	22	13	6	0	0	0	41
		Echuca Sturt Street (Grain Corp)	39	4	1	0	0	0	44
		Seymour (GV Hwy) Weigh bridge site)	16	4	1	0	0	0	21
		Yarrawonga Murray Valley Hwy Service Rd near Woods Rd	12	3	7	1	0	1	24
		Katamatite Katamatite - Nathalia Rd	7	0	7	0	0	0	14
		Glenrowan Hume Fwy Parking Bay	8	9	13	0	0	0	30
		Portland Henty Hwy (Port Rd) Grain Corp	16	7	10	0	0	3	36
		Warnambool Caramut Rd Livestock Exchange	37	3	2	0	3	9	54
		Bairnsdale Weigh Bridge Site	38	11	10	0	1	5	65
		Yarragon Weigh Bridge Site East and West	52	42	18	2	0	2	116
		Mildura Merbein Sth Weigh Bridge Site	7	8	12	0	2	0	29
		Mildura GBC motors Benetook Ave	13	0	0	0	0	1	14
		Ouyen Mallee Hwy / Calder Int (Service Rd Bowling Club)	15	10	12	0	0	0	37
		Warraknabeal Henty Hwy Sale Yards	2	3	2	0	0	0	7
		Nhill Rest area Western Hwy	4	6	15	0	0	0	25
		Nagambie GV Hwy Rest area just prior to Nagambie Exit North Bound	6	7	2	0	0	0	15
		OTHER NON METRO - VIC	1	0	0	0	131	50	182
QLD	Metro	Yamanto	38	6	2	0	0	4	50
		Port of Brisbane Inbound	5	2	0	0	0	0	7
		Port of Brisbane Outbound	26	9	1	0	0	1	37
		Belmont	0	0	0	0	0	6	6
		Burpengary	127	65	33	0	3	7	235
		Bundall	52	20	0	0	16	0	88

State	Area	Site	Rigid truck	Semi-trailer	B-double	Road train	Bus/ Coach	Plant/ SPV	Total
		Darra	45	13	39	0	10	2	109
		Federal N/B	0	2	2	0	0	2	6
		Logan	7	6	0	0	0	0	13
		Toogoolawah	20	11	0	0	0	1	32
		PVI - Maroochydore	8	2	0	0	10	6	26
		Bus - Hornibrook	0	0	0	0	12	0	12
		Bus - Eagle farm BCC	2	0	0	0	43	14	59
		OTHER METRO - QLD	22	2	2	0	41	27	94
	Non-Metro	Bundaberg	24	2	0	0	7	5	38
		Maryborough	43	19	23	0	9	8	102
		Toowoomba	36	11	7	1	18	12	85
		Roma	0	0	0	9	0	0	9
		Ban Ban Springs	7	10	2	0	0	0	19
		Jondaryan	18	2	6	8	0	0	34
		Cairns	75	26	9	0	32	8	150
		Townsville	40	16	20	16	1	14	107
		Emerald	50	20	26	21	9	2	128
		Etna Creek	6	4	4	0	0	0	14
		Greenacres TSV	12	0	7	0	0	1	20
		Kennedy North	0	0	1	0	0	0	1
		Rockhampton	61	14	4	0	44	15	138
		Stanwell	27	15	7	0	0	1	50
		Woodstock TSV	5	1	0	4	0	0	10
		OTHER NON METRO - QLD	0	1	0	0	10	6	17
SA	Metro	Churchill Road	51	15	7	0	0	2	75
		Regency Park	67	20	7	0	43	10	147
		Lonsdale	36	0	0	0	0	0	36
		OTHER METRO - SA	64	33	9	3	43	28	180
	Non-Metro	Bordertown	16	28	20	0	0	0	64
		Port Augusta	9	0	0	0	1	14	24
		Blanchetown	2	1	15	0	0	0	18
		Balaklava	0	0	1	0	6	0	7
		Monteith	92	45	28	0	1	3	169
		Mt Gambier	43	7	6	0	11	8	75
		Renmark	0	0	16	0	0	0	16
		Stirling North	35	22	10	40	0	3	110
		Port Wakefield	3	2	1	8	0	1	15

State	Area	Site	Rigid truck	Semi-trailer	B-double	Road train	Bus/ Coach	Plant/ SPV	Total
		Murray Bridge Link SA Bus Depot	0	0	0	0	30	0	30
		Tailem Bend	0	5	2	0	0	0	7
		Murray Bridge VIS	1	0	0	0	0	2	3
		OTHER NON METRO - SA	0	0	0	0	1	6	7
TAS	Non-Metro	Brighton Hub	39	12	4	0	0	3	58
		Cambridge	7	1	0	0	0	0	8
		East Tamar Highway	7	2	0	0	0	0	9
		Forest Farm	5	7	4	0	0	0	16
		Howth	21	15	7	0	0	0	43
		Midland Highway	19	12	3	0	0	1	35
		Southern Outlet	12	2	0	0	0	0	14
		Tasman Highway	36	2	0	0	0	1	39
		Ulverstone	16	7	6	0	0	0	29
		Wynard Eastbound	6	3	1	0	0	0	10
		Wynard Westbound	2	0	4	0	0	0	6
		OTHER NON METRO - TAS	5	2	0	0	34	8	49
NT	Non-Metro	Alice Springs	32	13	3	23	10	1	82
		Berrimah	0	1	0	0	1	0	2
		Katherine	61	16	1	20	0	2	100
		Parap	16	0	0	0	40	0	56
		OTHER NON METRO - NT	1	0	0	0	0	0	1
ACT	Metro	Barton Highway	26	3	2	0	0	0	31
		Federal Highway	44	16	7	0	1	0	68
		DMVR	51	2	0	0	8	3	64
		OTHER METRO - ACT	0	0	0	0	31	22	53