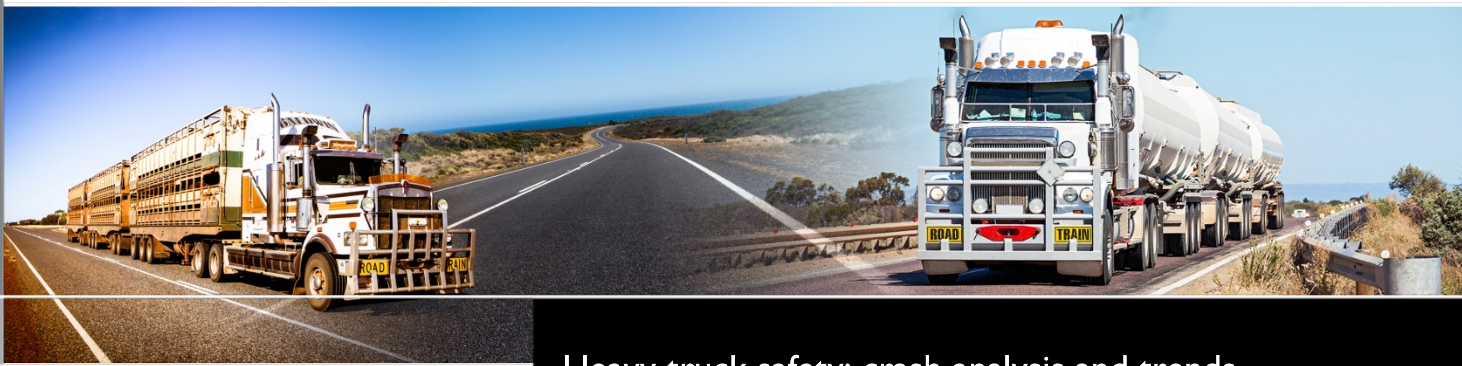
Australian Government
Department of Infrastructure and Regional Development
Bureau of Infrastructure, Transport and Regional Economics



Heavy truck safety: crash analysis and trends

At a glance

- This paper examines road crashes which involve heavy trucks and makes comparisons with crashes involving light vehicles.
- Heavy trucks are disproportionately involved in casualty crashes: approximately 16 per cent of road crash fatalities and 4 per cent of injuries involve these vehicles. In general, involvement of a heavy truck is associated with more severe injury outcomes.
- Heavy trucks account for only 2.4 per cent of registrations and approximately 7 per cent of vehicle-kilometres travelled.
- Articulated trucks do a large proportion (80 per cent) of their travel outside a capital city area. Heavy rigid truck travel is evenly split between capital city and rest of state.
- Fatalities in crashes involving articulated trucks are trending down at approximately 5 per cent per year. There is no declining trend for fatalities in heavy rigid truck-involved crashes.
- Fatalities of heavy truck *occupants* are also trending down at approximately 7 per cent per year. Recent hospitalised injury counts however have marginally increased.
- Rates of annual fatal crashes per kilometre travelled or per registered vehicle are higher for heavy truck-involved crashes than for passenger car-involved crashes.
- Approximately 60 per cent of persons killed in heavy truck crashes are light vehicle occupants. Another 20 per cent are vulnerable road users (motorcyclists, pedal cyclists or pedestrians)
- Approximately 80 per cent of fatal crashes involving heavy trucks are multi-vehicle crashes.
- Available Australian evidence suggests that in approximately 80 per cent of fatal multiple-vehicle crashes involving heavy trucks, fault is not assigned to the heavy truck. Note however that assignment of fault (or key-vehicle-status) is not necessarily feasible for all crashes.

1. Introduction

This paper analyses road traffic crashes involving heavy trucks, highlighting characteristics such as severity, location, temporality and type of crash. A brief introduction to the regulatory environment and statistical summaries of Australia's heavy vehicle fleet are also provided.

In this paper a 'heavy truck' is a motor vehicle designed for the carriage of freight, with a gross vehicle mass (GVM) of 4.5 tonnes or over. Included are rigid trucks with/without trailers, and prime movers with/without trailers ('articulated' trucks). Bus involvement is excluded. It has not been possible to disaggregate national crash data into configuration types beyond 'articulated' and 'rigid'.

The scope of the crash analysis is fatal and injury road traffic crashes. National counts of injury crashes are summations across all injury severities as provided by the states and territories. Hospitalisation data (counts of admissions) is also included where possible.

The content of the paper is structured as follows: firstly a brief description of the regulatory environment is provided outlining the roles of the National Heavy Vehicle Regulator and the State and Territory authorities. This is followed by a discussion of issues identified in recent literature on heavy truck safety. Next is the analysis of crash data including: an overview; crash characteristics; demographics and fault focussing on the last ten years or the latest data available. Lastly Australia's heavy vehicle fleet is summarised and crash rates presented.

2. Regulatory Environment

Most aspects of the transport of freight by heavy trucks are subject to the Heavy Vehicle National Law (HVNL), administered by the *National Heavy Vehicle Regulator* (NHVR). The HVNL is valid in all jurisdictions except the Northern Territory and Western Australia. Specific regulatory components of the law include fatigue management, load and mass/dimensions, road access, Chain of Responsibility, Performance Based Standards and the National Heavy Vehicle Accreditation Scheme. The NHVR also promotes industry discussion and engagement through safety alerts, fact sheets, guidelines and industry operator groups.

Other laws applicable to road freight transport include those relating to workplace health and safety, dangerous goods[1], animal welfare[2] and food handling[3]—with the Australian government as well as States and Territories having jurisdiction. Registration, licensing and broader traffic laws are administered, regulated and enforced by the States and Territories.

3. Recent literature

A detailed scan of research by Raftery et al (2011) discussed many issues around heavy vehicle safety and made some key recommendations for future research. These included research that:

- improves the management of fatigue within the road transport industry;
- improves the use of seat belts among heavy vehicle occupants;
- evaluates the effectiveness of heavy vehicle management schemes under Australian conditions (mainly in relation to lane use and speed management); and
- evaluates the effectiveness of emerging heavy vehicle safety technologies.

1 See <https://infrastructure.gov.au/transport/australia/dangerous/str_compauth.aspx>
2 <http://www.animalwelfarestandards.net.au/land-transport/>
3 <http://www.foodstandards.gov.au/>

In regards to road and vehicle design, the report pointed out:

> The design of heavy vehicles is such that they have high aggressivity, presenting a significant risk to other road users, and poor crashworthiness, presenting a risk to HV occupants. Improvement in either or both of these areas would produce safety benefits.

Issues around Australian *crash data* were explored in the Austroads 2013 report *Heavy Vehicle Safety Data* (Austroads 2013). A number of Safety Performance Indicators were proposed and recommendations made, with the report concluding that:

> Although basic reporting can currently be achieved in relation to raw crash numbers, a more intricate picture of heavy vehicle safety cannot be achieved with current road crash databases. There is an apparent lack of ability to monitor heavy vehicle safety in terms of industry sector, load type and vehicle combination type at present.

Practical issues in collecting data limit many studies to using crash data from one or a small number of Australian jurisdictions. An assumption may then be made that the study findings and recommendations are applicable to the whole of Australia. While this strong assumption may often appear reasonable, the better approach is to replicate the study in other jurisdictions to confirm the original results and increase the degree of confidence in the findings. This however is often problematic due to systematic differences in coding and definitions across Australia. Practical issues with regard to Australian crash data and vehicle classifications, and how they are resolved, are also discussed in Budd and Newstead (2014).

Many studies focus on specific components of risk and how to mitigate them. These may be grouped as *vehicle*-related, *vehicle-road* interaction, *person*-related etc. Kipling (2011) provides a good summary of the multitude of interacting factors that relate to crash risk—grouped as follows:

- enduring driver factors (eg. knowledge / skill / medical);
- temporary driver factors (eg. time–on–task / sleep / moods / drugs / local familiarity);
- vehicle (safety technologies / mechanics);
- roadway and environmental (design / intersection / traffic / weather);
- management (safety-focused practices / pay rates / training opportunities); and
- government (licensing / regulation / enforcement).

Kipling (2011) then analyses research findings on factors related to the *driver*, *roadway* and m*anagement*.

Tziotis (2011) summarises ARRB work on heavy vehicle crashes, separately analysing urban and rural areas. Some of their findings on crash risk are related to road delineation/marking, road pavement and intersection design, including sight distance.

A concise summary of key risk factors is provided as background in a case-control study by Elkington et al (2013). This paper explored risk that may be related to payment and scheduling, fatigue management, health and vehicle/load issues, and interactions between these.

Finally, analysis and recommendations related to emerging heavy vehicle crash avoidance technology is provided in Budd and Newstead (2014). These technologies are:

- Lane Departure Warning Systems (LDW);
- Autonomous Emergency Braking Systems (AEBS);
- Electronic stability (ESC) and Roll Stability (RSC) Control;
- Fatigue Warning Systems (FWS).

Budd and Newstead (2014) reports savings in annual lives lost and annual crash costs under fitment of these technologies, with all proving effective. In terms of lives saved, AEBS was estimated to save 67 lives per year, LDW 16 lives, ESC 11 lives and FWS 10 lives per year.

4. Crash / Casualty Tables

4.1 Crash data

The main source of crash data in this report is the National Crash Database (NCD). This database was developed by BITRE for the purposes of monitoring statistical targets in the the National Road Safety Strategy. It is a collation of all state and territory police-sourced road crash data, and contains information on all road traffic crashes resulting in an injury or fatality. In the NCD, injury severity is not uniformly coded across jurisdictions, and all injuries are aggregated here under the term 'Reported Injury'. In this report tables showing 'reported injuries' exclude Queensland, as the NCD does not contain a fully updated dataset for this jurisdiction.

Other injury data used here, termed 'Hospitalisation', is sourced from the National Hospital Morbidity Database, managed by the Australian Institute of Health and Welfare (AIHW). There are advantages and disadvantages with each of the NCD and AIHW data:

- the AIHW data uses a fairly consistent definition of injury[4] and can separately identify High-Threat-to-Life (HTTL)[5] injuries. However it:
- has limited information about the crash;
- cannot separately identify different configurations of truck, such as articulated and rigid; and
- lags in currency by up to three years;
- the NCD contains much more detailed crash information including some causative/contributory factors such as alcohol or drugs. However it:
- lacks uniformity on injury severity; and
- lacks detail on vehicle configuration.

Some tables in this report are also augmented by data from the *Australian Road Deaths Database (ARDD)*[6]. There are minor differences between the fatality counts in the NCD and the ARDD due to timing differences in receipt of data.

All fatal tables are at the national level and relate to the years 2008–2014 unless otherwise specified. Many tables compare involvement of heavy trucks in crashes/casualties with involvement of light 4-wheeled motor vehicles.

Heavy trucks are defined here as a freight vehicle with Gross Vehicle Mass (GVM) weight of 4.5 tonnes and over. This threshold accounts for approximately 70 per cent of registered rigid trucks and 99 per cent of registered articulated trucks. See Budd and Newstead (2014) for, amongst other topics, examples of rigid and articulated truck configurations and the NTI's *Guide to the Trucking Industry* (NTI 2011).

In interpreting the crash data it is useful to note that trucks on average travel longer distances than passenger vehicles, and account for a proportionally larger share of traffic on roads outside urban areas. Relevant exposure information is provided in Section 5.

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4 However in 2012 a change in counting hospital admissions in one jurisdiction did occur.

5 HTTL—High Threat to Life inuries are a subset of all hospitalisations. See Henley et al (2015).

6 See <http://bitre.gov.au/statistics/safety/fatal_road_crash_database.aspx >

4.2 Overview

This section presents an overview of road casualties—from crashes involving heavy trucks, and more generally. There are four analyses:

- casualties of truck occupants—with a comparison for light vehicle occupants;
- casualties in crashes involving trucks;
- an overview of the types of traffic units involved in casualty crashes; and
- single-vehicle/multiple-vehicle casualty crashes for trucks and light 4-wheeled vehicles.[7]

Table 1 summarises hospitalised injuries (including the the HTTL subset), reported injuries (excluding Queensland) and fatalities for occupants of a heavy truck.

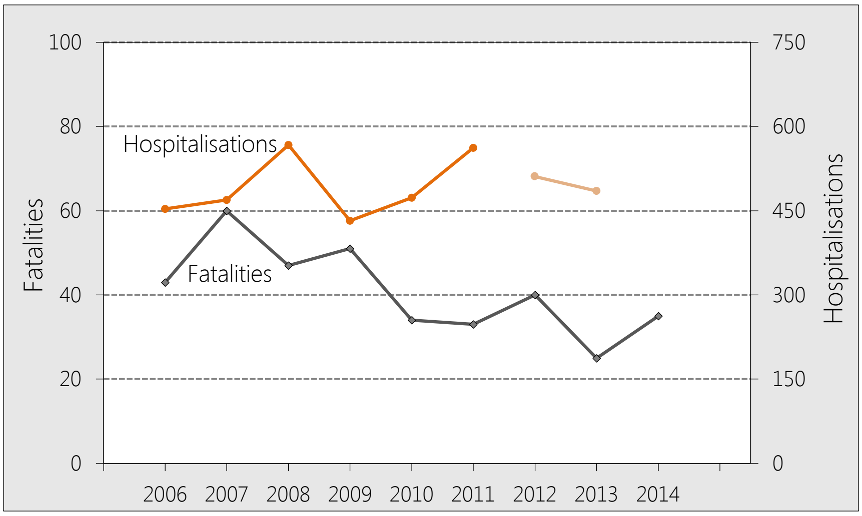
Table 1 Heavy truck occupants — counts of casualties by type/severity

	Hospitalisations	HTTL Hospitalisations	Reported Injuries	Fatalities
2006	453	147	-	43
2007	469	150	-	60
2008	567	149	840	47
2009	432	156	721	51
2010	473	145	767	34
2011	562	180	882	33
2012	511[a]	171[a]	775	40
2013	485 [a]	166[a]	661	25
2014	-	-	639	35

- Data unavailable.

a Due to a change in admission criteria in one jurisdiction, a break in the Hospitalisations series occurred in 2012. This change resulted in a lower hospitalisation count and means hospitalisation data for 2012 and 2013 cannot be compared to previous years.

Figure 1 Occupants of a heavy truck



[7] 'Light 4-wheeled vehicles' include light passenger vehicles and light commercial vehicles.

Trends[8] :

- the fatality series in Table 1 has a statistically significant annual reduction of approximately 7 per cent per year;
- noting the break in the hospitalisation series, (which was expected to lower annual counts), between 2006 and 2013 these still increased by 7%.

In Table 1, 88 per cent of the heavy truck occupant casualties are of the truck driver. Over 96 per cent are male, and the median age is approximately 45 years. More details on age are provided in Section 4.4.

By way of context, fatalities of *light* 4-wheeled vehicle occupants are trending down at approximately 6 per cent per year, while hospitalisations are trending up marginally. These trends are similar for casualties of heavy truck occupants: fatalities declining and hospitalisations marginally increasing. If we consider however the ratio of fatalities to hospitalisations, this is significantly higher for truck occupants than for light vehicle occupants. Also, the ratio of HTTL hospitalisations to all hospitalisations is higher in the former than the latter: given that a person is hospitalised, occupancy of a truck (driver/passenger) is associated with more severe injuries than occupancy of a light vehicle. Budd and Newstead (2014) found that heavy vehicles were disproportionately involved in more severe crashes, with 13 per cent of fatal crashes involving heavy vehicles compared with 3-4 per cent of lesser severity crashes.

Table 2 shows all casualties (fatalities plus reported injuries) in crashes *involving* a heavy truck. Included are not only the vehicles' occupants, but all other road users. Hospitalisations are not available for this table. The data is graphed in Figure 2. For comparison, casualties in crashes that do not involve a heavy truck are also included.

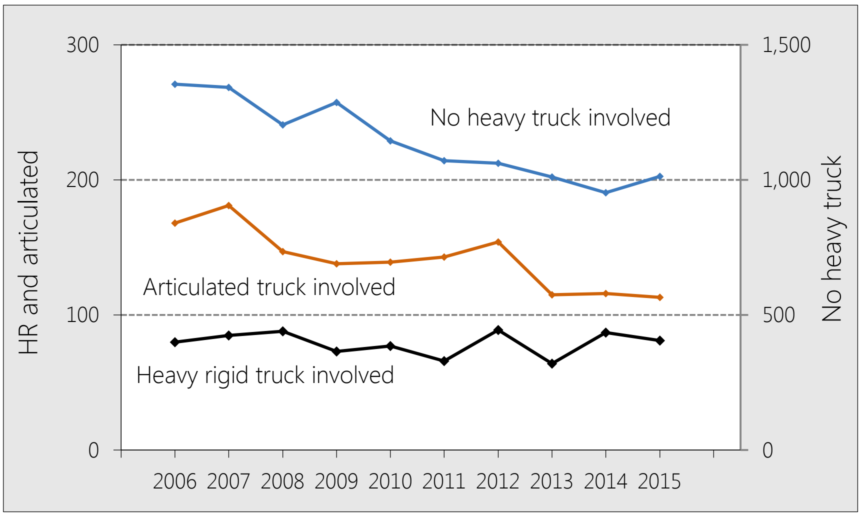
Table 2 Crashes with and without a heavy truck involved—counts of casualties of all road users by type/severity

	Heavy rigid involved		Articulated involved		No heavy truck involved	
	Reported Injuries [a]	Fatalities	Reported Injuries [a]	Fatalities	Reported Injuries [a]	Fatalities
2006	-	80	-	168	-	1,354
2007	-	85	-	181	-	1,342
2008	1,798	88	1,395	147	61,655	1,204
2009	1,526	73	1,174	138	60,773	1,286
2010	1,607	77	1,259	139	61,973	1,144
2011	1,752	66	1,408	143	63,312	1,071
2012	1,547	89	1,388	154	58,481	1,061
2013	1,421	64	1,211	115	56,716	1,010
2014	1,320	87	1,128	116	54,396	953
2015	-	81	-	113	-	1,013

a 'Reported Injuries' exclude Queensland.

8 For all trend estimation of annual counts, a linear model was fitted. If significant, the linear trend is converted to an approximate per cent change each year.

Figure 2 Counts of fatalities in crashes with and without a heavy truck involved



Trends:

- the fatalities series for articulated truck involvement has a significant annual reduction of approximately 5 per cent per year (Table 2);
- there is a flat trend in the fatality series for heavy rigid truck involvement;
- the fatalities series for crashes without heavy truck involvement has a significant annual reduction of approximately 4 per cent per year.

Beside the above trends, of note is the large reduction in articulated-involved fatalities between calendar years 2012 and 2013.

Tables 3A and 3B broaden the focus to *all* traffic units (vehicles or pedestrians) in crashes. Counts and percentages of casualties are provided, and categorised by the types of traffic units involved[9] in the crash. The ten categories are mutually exclusive and account for 90-95 per cent of all casualties. An indication of the trend over time is provided by an arrow, with a number of stars indicating the strength of the statistical significance (or confidence) in the trend estimate.

[9] 'Involved' means that in the crash reports, that vehicle/unit was recorded as being implicated in the crash sequence. It does not necessarily mean that the vehicle occupants were injured or that the vehicle operator was at fault.

Table 3A Fatalities by traffic units involved in the crash

Traffic units involved		2008	2009	2010	2011	2012	2013	2014	Trend	% of all fatalities [c]
4-wheeled motor vehicle										
	Only light vehicles[a]	772	831	723	676	645	606	584	↘ ***	52 %
	Light + Hvy truck	124	113	134	123	145	106	120	—	10 %
	Only Hvy truck	45	45	28	29	34	20	30	—	2 %
2- (or 3) wheeled motor vehicles										
	MCycle + Light vehicles	88	104	104	74	96	82	88	—	7 %
	MCycle + Hvy truck	21	10	13	13	19	10	15	—	1 %
	Only MCycle	124	105	94	110	96	118	78	—	8 %
Pedestrians										
	Ped + Light vehicles	139	148	141	117	121	128	123	—	10 %
	Ped + Hvy truck	29	27	13	33	37	26	21	—	2 %
Bicycles										
	Bicycle+ Light vehicles	13	20	14	15	20	24	24	↗ *	2 %
	Bicycle + Hvy truck	6	3	9	6	3	8	7	—	1 %
Other[b]		76	82	79	82	84	57	65	—	6 %
Total		**1,437**	**1,488**	**1,352**	**1,278**	**1,300**	**1,185**	**1,155**	↘ ***	**100 %**

a 'Light vehicles' comprises passenger cars and light commercial vehicles.

b 'Other' comprises crashes where there are multiple different types of vehicles involved, buses involved and/or unknown vehicles involved.

c Percentages are rounded.

Light 4-wheeled vehicles (predominantly passenger cars) are involved in 80-90 per cent of fatalities and injuries. Heavy trucks are involved in 16 per cent of fatalities and 4 per cent of reported injuries. Despite suggested reductions across the seven years in several rows of Table 3A, there is no statistically significant trend.

Table 3B Reported injuries by traffic units involved in the crash (excludes Queensland)

Traffic units involved		2008	2009	2010	2011	2012	2013	2014	Trend	% of all injuries [c]
4-wheeled motor vehicles										
	Only light vehicles	43,896	43,067	44,486	45,986	41,697	38,735	38,321	—	68 %
	Light + Hvy truck	2,135	1,846	1,938	2,138	1,927	1,757	1,642	—	3 %
	Only Hvy truck	608	500	543	621	552	496	469	—	1 %
2-(or 3) wheeled motor vehicles										
	MC + Light vehicles	3,048	3,009	2,970	2,951	2,938	2,939	2,989	—	5 %
	MC + Hvy truck	89	61	60	67	64	67	63	—	0.1 %
	Only MC	3,317	3,337	3,017	3,137	3,213	3,311	3,385	—	5 %
Pedestrian										
	Ped + Light vehicles	4,065	3,877	3,899	3,664	3,379	3,356	3,075	↘ ***	6 %
	Ped + Hvy truck	62	62	64	58	58	63	62	—	0.1 %
Bicycle										
	Bicycle+ Light vehicles	2,729	2,826	2,865	2,882	2,625	2,814	2,688	—	5 %
	Bicycle + Hvy truck	56	62	61	49	68	48	40	—	0.1 %
Other		4,768	4,771	4,872	4,846	4,832	5,712	4,065	—	8 %
Total		64,773	63,418	64,775	66,399	61,353	59,298	56,799	↘ *	**100 %**

The final tables in this section categorise crashes into three mutually exclusive categories: single-vehicle crash (SVC), multi-vehicle crash (MVC) and pedestrian crash (Ped). The first two categories include crashes where the person who was killed or injured may have been a vehicle occupant, a cyclist or a motorcyclist, and the latter category includes all crashes where a pedestrian has died or has been injured.[10] Tables 4A and 4B presents counts of crashes.

Table 4A Counts of fatal crashes by vehicle(s) involved

	Heavy rigid involved crash			Articulated involved crash			Any fatal crash[b]		
	SVC	MVC[a]	Ped[a]	SVC	MVC[a]	Ped[a]	SVC	MVC	Ped
2008	7	60	15	21	89	16	626	499	190
2009	7	53	10	25	73	16	646	510	188
2010	6	52	6	15	91	14	544	517	171
2011	4	39	11	19	90	18	504	464	183
2012	3	66	12	21	91	15	515	505	171
2013	3	44	12	8	75	12	512	427	160
2014	6	58	11	17	75	9	474	433	148
Trend	—	—	—	—	—	↘ *	↘ ***	↘ ***	↘ ***
Column %	**7%**	**78%**	**16%**	**14%**	**74%**	**12%**	**41%**	**45%**	**15%**

a These crashes may also involve light vehicles.
b These crashes involve any types of vehicles.

Approximately 12 per cent of fatal heavy truck crashes involve a single vehicle only (14 per cent for articulated trucks and 7 per cent for heavy rigid trucks). In most columns of Table 4A the counts are declining, but statistical tests show no significant linear trend. To compare articulated truck-involved crashes with heavy rigid-involved crashes a χ^2 test is used:[11] there is a significantly larger proportion of single vehicle crashes in the former ($\chi^2_1 = 9.7$).

Table 4B Counts of reported injury crashes (excludes Queensland)

	Heavy rigid involved crash			Articulated involved crash			Any fatal crash[b]		
	SVC	MVC[a]	Ped[a]	SVC	MVC[a]	Ped[a]	SVC	MVC	Ped
2008	203	1,171	55	277	757	14	13,635	31,797	4,486
2009	155	1,002	46	221	642	13	13,711	31,140	4,225
2010	145	1,040	50	253	710	19	12,815	32,293	4,220
2011	154	1,119	34	319	752	21	13,190	33,186	4,187
2012	151	1,003	43	243	767	16	12,715	31,578	3,942
2013	142	920	49	225	717	14	12,753	30,470	3,742
2014	154	817	50	219	623	12	12,200	29,834	3,417
Trend	—	↘ **	—	—	—	—	↘ ***	—	↘ ***
Column %	**13%**	**83%**	**4%**	**26%**	**73%**	**2%**	**26%**	**65%**	**8%**

[10] In approximately 2 per cent of crashes where a pedestrian was injured, there was also an injury to another road user. Under 0.5 per cent of crashes where a pedestrian has died also involve the death of another road user.

[11] A χ^2 test is commonly used to compare whether a 2X2 or $m \times n$ table has the same distribution (percentage pattern) in its rows—for each of its columns, or vice versa. For a *non-significant* result, *a* χ^2 value should be near its (subscripted) degrees of freedom.

Crash data in Tables 4A, 4B for casualty crashes shows that most casualty crashes involving heavy trucks also involve another vehicle.

4.3 Crash characteristics

This section analyses location and temporal characteristics of heavy truck crashes. These tables combine data for the five years to 2014 and include comparisons with light vehicle crashes.

Tables 5A and 5B analysis examines *Urban* and *Rural* characteristics of crashes. The two geographical structures used are *Remoteness Area* and *Significant Urban Area* (SUA)[12]. Remoteness Area statistics are presented for three regional groups: 'Major City', 'Regional' and 'Remote'; and SUA-based statistics are presented with two groups: (within SUAs and outside SUAs). Approximately 71 per cent of Australia's population live in a Major City, 27 per cent in a Regional area and 2 per cent in a Remote area. By SUA, 86 per cent of the population live in a Significant Urban Area, and 14 per cent outside.

Table 5A Fatal crashes — Distribution by Remoteness Area and Urban Area, 2010–2014

	Remoteness Area				Urban/Non-urban Area		
	Major cities	**Regional**	**Remote**		**SUA**	**Non-SUA**	
Involving a heavy rigid truck	43%	52%	5%	**100%**	54%	46%	**100%**
Involving an articulated truck	20%	69%	11%	**100%**	30%	70%	**100%**
Involving a light motor vehicle	36%	53%	11%	**100%**	49%	51%	**100%**
All fatal crashes	**35%**	**55%**	**10%**	**100%**	**48%**	**52%**	**100%**

Table 5B Reported injury crashes — Distribution by Remoteness Area and Urban Area, 2010–2014

	Remoteness Area				Urban/Non-urban Area		
	Major cities	**Regional**	**Remote**		**SUA**	**Non-SUA**	
Involving a heavy rigid truck	72%	26%	3%	**100%**	81%	19%	**100%**
Involving an articulated truck	47%	48%	6%	**100%**	57%	43%	**100%**
Involving a light motor vehicle	73%	25%	2%	**100%**	84%	16%	**100%**
All fatal crashes	**69%**	**28%**	**3%**	**100%**	**81%**	**19%**	**100%**

Note: Percentages may not sum to 100 due to rounding.

Table 5A shows that involvement of an articulated truck in fatal crashes is associated more strongly with non-urban locations than when a heavy rigid truck or a light vehicle is involved. These differences

[12] *Remoteness Area*: a weighted sum of road distances to Service Centres is used to classify each populated locality in Australia into one of five Remoteness areas. (Based on ARIA+). See (ABS 2013a). *Significant Urban Area:* an SA2 (or cluster of contiguous SA2s) with same labour market and combined population of over 10,000 (ABS 2013b).

are statistically significant. While only 30 per cent of Australia's population live in Regional or Remote areas, these areas account for 65 per cent of fatal crashes (and 80 per cent of those involving articulated trucks). A similar pattern is seen in the reported injury crashes. Section 5 presents crash rates standardised by distance travelled by location.

Tables 6A and 6B categorise crashes by road type[13] and SUA.

Table 6A Fatal crashes — Distribution by Road type and Urban Area, 2010–2014

	National or State Hwy		Arterial / Sub-arterial		Collector		Local		
	SUA	Non-SUA	SUA	Non-SUA	SUA	Non-SUA	SUA	Non-SUA	
Involving a heavy rigid truck	15%	25%	23%	15%	5%	1%	10%	6%	**100%**
Involving an articulated truck	17%	50%	9%	15%	2%	1%	3%	4%	**100%**
Involving a light motor vehicle	10%	18%	21%	22%	6%	2%	11%	9%	**100%**
All fatal crashes	**11%**	**20%**	**20%**	**21%**	**6%**	**2%**	**11%**	**9%**	**100%**

Table 6B Reported injury crashes, 2010–2014

	National or State Hwy		Arterial / Sub-arterial		Collector		Local		
	SUA	Non-SUA	SUA	Non-SUA	SUA	Non-SUA	SUA	Non-SUA	
Involving a heavy rigid truck	26%	8%	33%	8%	6%	0%	15%	3%	**100%**
Involving an articulated truck	27%	25%	19%	14%	3%	1%	7%	3%	**100%**
Involving a light motor vehicle	14%	5%	36%	7%	11%	1%	22%	4%	**100%**
All fatal crashes	**14%**	**6%**	**33%**	**8%**	**12%**	**1%**	**22%**	**4%**	**100%**

Fatal crashes involving an articulated truck are again distinct: 67 per cent are on a highway versus 40 per cent for heavy rigid-involved and 28 per cent for light motor vehicle-involved fatal crashes.

Table 7 presents casualty crashes by posted speed limit. Approximately 50 per cent of all fatal crashes occur in posted speed zones of 90 km/h or higher. In comparison, the distribution for injury crashes is skewed towards lower speed limits. Fatal rigid truck crashes are largely similar to fatal light vehicle crashes. Crashes with articulated truck involvement however are skewed towards higher speed limit locations.

[13] Based on PSMA road classification (PSMA 2015).

Table 7 Casualty crashes — Distribution by posted speed limit (km/h)

Table 7A Fatal crashes

	≤ 50	60	70-80	≥ 90	Total
Involving a heavy rigid truck	10%	23%	18%	48%	**100%**
Involving an articulated truck	4%	11%	15%	70%	**100%**
Involving a light motor vehicle	11%	18%	20%	51%	**100%**
All fatal crashes	**13%**	**19%**	**19%**	**49%**	**100%**

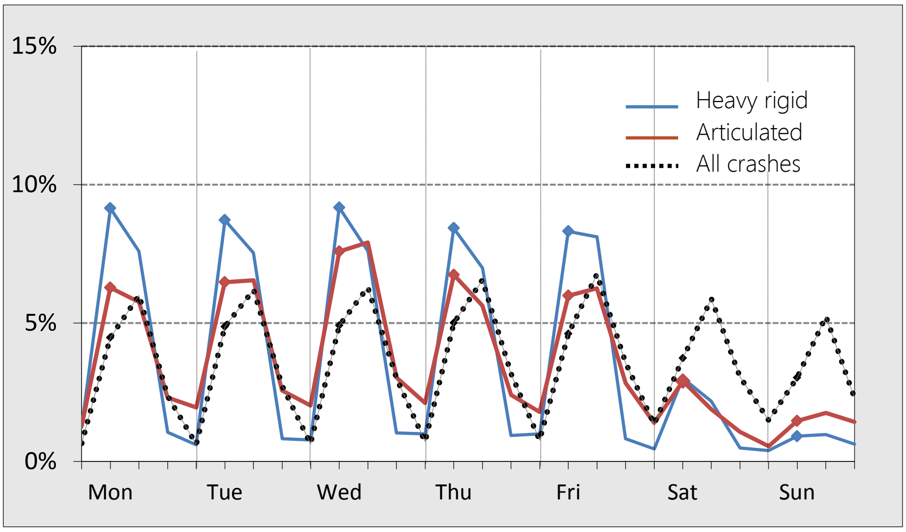
Table 7B Reported Injury crashes

	≤ 50	60	70-80	≥ 90	Total
Involving a heavy rigid truck	17%	32%	26%	24%	**100%**
Involving an articulated truck	8%	20%	24%	48%	**100%**
Involving a light motor vehicle	29%	36%	19%	16%	**100%**
All fatal crashes	**30%**	**35%**	**19%**	**16%**	**100%**

The final analysis in this section, Figure 3, categorises casualty crashes by day-of-week and time-of-day. The 24-hour day is divided into four periods: *Early* (Midnight to 5:59am), *Morning* (6am to 11:59am), *Afternoon* (noon to 5:59 pm) and *Evening* (6pm to 11:59pm) and the week is thus divided into 7x4 periods. In Figure 3 below, the Morning period is highlighted. This analysis does not account for light levels, glare or dusk.

Heavy truck crashes (blue and red) are distinct from *all* crashes (black): the former mainly peak during the morning period, and the latter peak in the afternoon period.

Figure 3 Distribution of casualty crashes by Time-of-Day and Day-of-Week heavy rigid-involved / articulated-involved / All crashes



Also, compared to heavy rigid truck crashes, the times of articulated-involved crashes are more spread out during the 12-hour 'day' period. Weekdays account for approximately 92 per cent of heavy truck crashes (and 74 per cent of non-heavy truck crashes). It was not possible to include information on the relationship between a trip starting time or whether it is in-bound or out-bound. See Driscoll (2015) for brief information on the latter.

4.4 Demographics

This section provides detail on the persons killed in crashes involving heavy trucks. Tables 8A, 8B and 8C provide counts of persons killed by road user type. Tables 9A, 9B and 9C provide counts of persons killed or injured by age. Tests for statistically significant trends over time are performed and summarised.

Table 8A Fatalities in crashes involving a heavy rigid truck

	Single vehicle crashes	Other crashes					Total fatalities
	Occupant of Heavy rigid	Occupant of Heavy rigid	Occupant of Light vehicle	Motorcyclist	Pedal cyclist	Pedestrian	
2008	8	3	46	13	2	15	**88**
2009	7	7	35	9	3	10	**73**
2010	6	6	47	7	5	6	**77**
2011	5	3	36	6	4	11	**66**
2012	3	3	53	11	3	13	**89**
2013	3	3	33	6	6	12	**64**
2014	6	5	49	12	4	11	**87**
Trend	—	—	—	—	—	—	**—**
Col. %	**7%**	**6%**	**56%**	**12%**	**5%**	**15%**	**100%**

Table 8B Fatalities in crashes involving an articulated truck

	Single vehicle crashes	Other crashes					Total fatalities
	Occupant of Articulated	Occupant of Articulated	Occupant of Light vehicle	Motorcyclist	Pedal cyclist	Pedestrian	
2008	23	15	76	11	4	16	**147**
2009	27	10	78	3	0	18	**138**
2010	15	7	87	7	6	14	**139**
2011	21	7	87	6	2	19	**143**
2012	23	12	92	8	0	15	**154**
2013	8	11	70	6	2	13	**115**
2014	18	7	69	7	3	9	**116**
Trend	—	—	—	—	—	—	**—** [a]
Col. %	**14%**	**7%**	**60%**	**5%**	**2%**	**11%**	**100%**

[a] Compare with Table 2 which has a longer series of data.

Despite indications of declining counts in Tables 8A and 8B, the fitting of a linear model to each series failed to find statistically significant reductions. Vulnerable road users (motorcyclists, pedal cyclists or pedestrians) account for a greater percentage of fatalities in heavy rigid-involved crashes than for articulated truck-involved crashes ($\chi^2_1 = 34$).

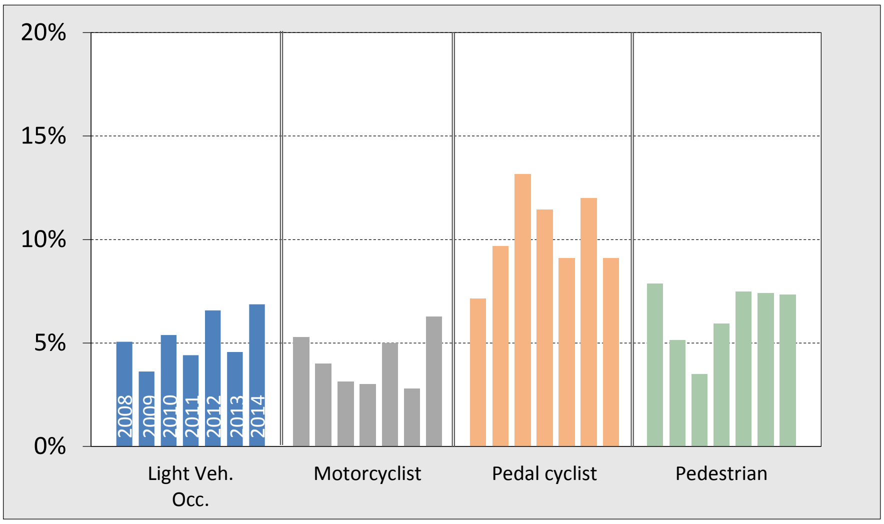
Table 8C Fatalities in crashes involving a light 4-wheeled vehicle

	Single vehicle crashes	Other crashes				Total fatalities
	Occupant of Light vehicle	Occupant of Light vehicle	Motorcyclist	Pedal cyclist	Pedestrian	
2008	526	267	87	14	138	**1,032**
2009	554	303	103	20	150	**1,130**
2010	470	272	104	13	141	**1,000**
2011	427	269	74	15	119	**904**
2012	427	240	97	19	122	**905**
2013	411	212	79	24	127	**853**
2014	387	215	89	23	117	**831**
Trend	↘ **	↘ **	—	↗ *	↘ **	↘ ***
Col. %	**48%**	**27%**	**10%**	**2%**	**14%**	**100%**

The next figure presents similar data to Tables 8A, 8B and 8C, but in reverse: it shows for each road user type, the percentage of fatalities which have a heavy truck involved. Figure 4D summarises the information about vehicles involved when a vulnerable road user is killed.

Figure 4 Proportion of fatalities involving heavy rigids /articulated /light vehicles

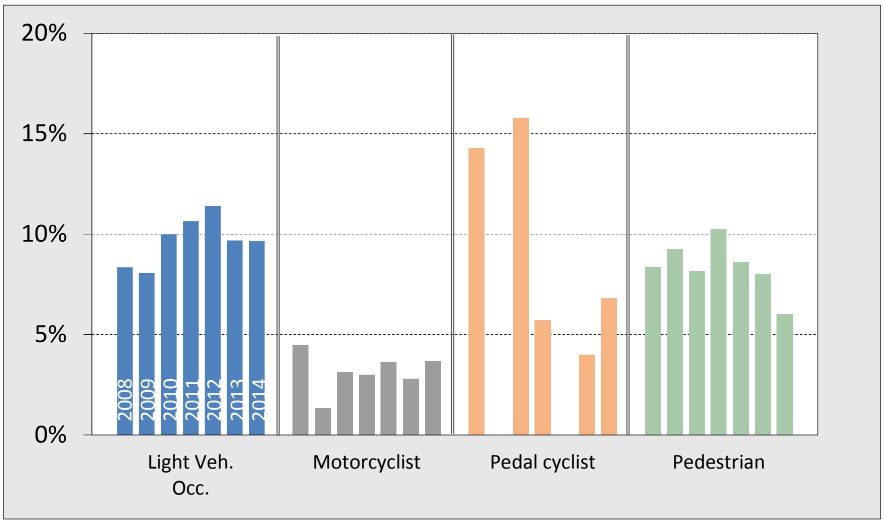
Figure 4A Involving a heavy rigid truck



There is a significant increasing trend[14] in the proportion of light vehicle occupant fatalities which occur in crashes involving heavy rigid trucks.

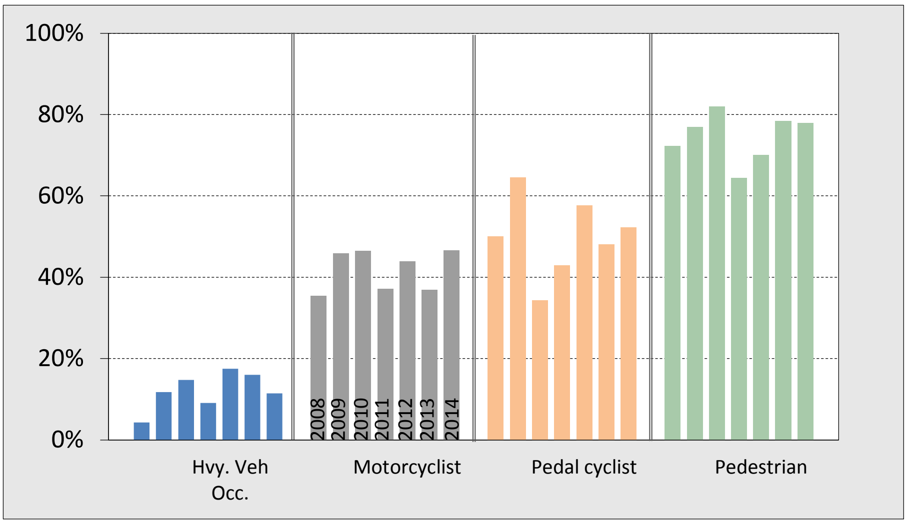
[14] Trends in *proportions* over time are that of a linear trend in the log-odds of the proportion (*prop.trend.test* in R).

Figure 4B Involving an articulated truck



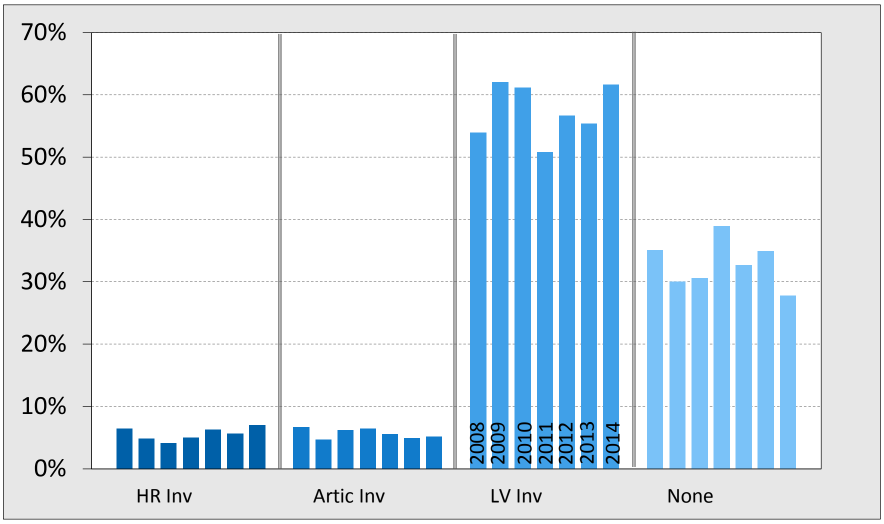
There are no significant trends over time. Approximately 10 per cent of light vehicle occupant fatalities occur in crashes in which an articulated truck is involved. Around five per cent are killed in crashes where there is a heavy rigid truck involved.

Figure 4C Involving a light vehicle



There are no significant trends over time.

Figure 4D Fatalities of vulnerable road users



Note: 'None' refers to a crash where either no other vehicle was involved or a vehicle type other than those listed.

There are no significant trends over time.

Tables 9A, 9B 9C and 9D analyse the ages of persons killed and injured. The median and two percentiles (25 percentile means the age where 25 per cent of all the persons killed or injured are younger than the reported age) of the ages are shown for each group of road user casualties. Vulnerable road users are separately shown in Table 9D.

Table 9 Age distribution of casualties 2010-2014

Table 9A Casualties in a crash involving a heavy rigid truck

Age percentile	Driver of HR truck	Occupant of light veh.	Motorcyclist	Pedestrian	Pedal cyclist	All road users
25%	32	26	29	29	33	**28**
Median	**42**	**39**	**37**	**49**	**43**	**40**
75%	53	56	50	65	56	**55**

Table 9B Casualties in a crash involving an articulated truck

Age percentile	Driver of artic. truck	Occupant of light veh.	Motorcyclist	Pedestrian	Pedal cyclist	All road users
25%	37	25	28	31	30	**29**
Median	**45**	**40**	**41**	**46**	**47**	**43**
75%	54	56	55	60	54	**55**

Table 9C Casualties in any crash

Age percentile	Driver of a heavy truck	Occupant of light veh.	Motorcyclist	Pedestrian	Pedal cyclist	All road users
25%	35	23	25	20	26	**23**
Median	**44**	**35**	**35**	**35**	**37**	**36**
75%	53	52	48	58	49	**52**

Table 9D Casualties of vulnerable road users in a collision with motor vehicles

	Heavy truck involved [a]			Light vehicle involved [b]		
Age percentile	**Motorcyclist**	**Pedestrian**	**Pedal cyclist**	**Motorcyclist**	**Pedestrian**	**Pedal cyclist**
25%	26	27	27	24	18	25
Median	**38**	**46**	**40**	**33**	**33**	**35**
75%	50	61	53	46	57	47

[a] No light vehicles involved
[b] No heavy trucks/buses involved

When a heavy truck is involved, the killed/injured person is generally older than the average for that user group. The median age for any person killed/injured in a road crash is 36 years. When a heavy truck is involved it is 42 years. It is unclear why this is the case, and whether there are any confounding factors between age of the killed/injured person and heavy truck involvement.

4.5 Crashtype

This section is based on analysing crashes using Definitions for Classifying Accidents (DCA) and Road User movement (RUM) codes—termed *crash type* here. The codes describe in broad terms the movements of traffic units at the time of—or immediately prior to—the crash. The codes are divided into ten main categories and further divided into approximately 80 sub-categories. Figure 5 shows diagrams of typical single vehicle crash types, and Figure 6 shows typical multiple vehicle crash types. The analyses in Tables 10, 11,12 and 13 are based on total casualty crashes over the five years 2010-2014, unless otherwise stated, and exclude South Australia, (whose 2010-2012 codes were not able to be standardised), and Queensland (whose non-fatal crash data was less current).

Table 10 classifies *single-vehicle*[15] crashes by main category of crash type. When there is only one vehicle involved, most crashes involve loss of control followed by run off the road and the two main crash types are *Off Path on Straight* and *Off Path on Curve.* This analysis combines both fatal and injury crashes (as preliminary exploration revealed no differences between the two). Table 11 further classifies these crashes by whether they occurred in Urban or Non-urban areas.

[15] Single vehicle crashes here exclude pedestrian involvement.

Figure 5 Predominant single-vehicle crash types

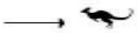
Main category	Examples	
Off Path (Straight)		
Off Path (Curve)		
Other	 On Path–animal	

Table 10 Single-vehicle casualty crashes—by crash type, 2010-2014

	Off Path – Straight	**Off Path – Curve**	**Other**	**Number of casualty crashes**
Involving a heavy rigid truck	50%	39%	11%	**693**
Involving an articulated truck	43%	51%	5%	**1,201**
Involving a light 4-wheeled motor	54%	37%	9%	**41,409**
All SVC	**53%**	**37%**	**10%**	**28,130**

A χ^2 test rejects the hypothesis that the column percentages are the same: compared to heavy rigid trucks or light vehicles, articulated truck single vehicle crashes have a higher incidence of loss of control from a *curved* segment, rather than from a *straight* segment. Table 11categorises these distributions by SUA and non-SUA.

Table 11 Single-vehicle casualty crashes—by crash type and SUA, 2010-2014

	SUA				**Non-SUA**				χ^2_2
	Off Path – Straight	**Off Path – Curve**	**Other**		**Off Path – Straight**	**Off Path – Curve**	**Other**		
Involving a heavy rigid truck	50%	28%	22%	**100%**	46%	42%	12%	**100%**	**21** ***
Involving an articulated truck	41%	48%	12%	**100%**	41%	48%	11%	**100%**	**0.2**
Involving a light motor vehicle	56%	28%	16%	**100%**	44%	41%	15%	**100%**	**960** ***
All SVC	**56%**	**27%**	**17%**	**100%**	**41%**	**43%**	**16%**	**100%**	**1,925** ***

Note: Percentages may not sum to 100 due to rounding.

The χ^2 tests compare the non-SUA and the SUA crashes. There is no difference for SVC crashes involving articulated trucks. For other crashes, an urban location is associated with an increase in loss of control from a *straight* segment. For further information see also (NSW 2014).

We now turn to two-vehicle crashes[16], categorised as follows:

- Heavy rigid —with Light
- Articulated— with Light
- Light —with Light
- Heavy truck — with Heavy truck

The predominant crash types are shown in Figure 6.[17]

Figure 6 Predominant two-vehicle crash types

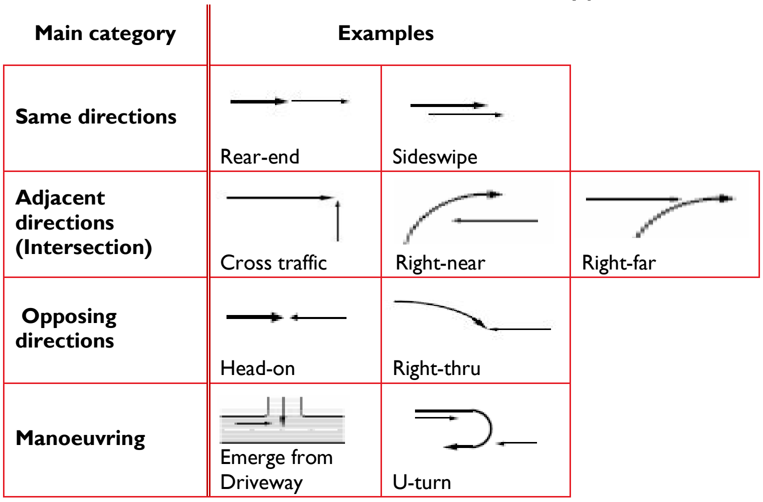


Table 12 Two-vehicle casualty crashes by crash type, 2010-2014

Vehicles involved	Severity	Same Directions	Adjacent Directions	Opposing Directions	Manoeuvring	Other	Number of casualty crashes
Heavy rigid—Light	**Fatal**	8%	24%	53%	5%	9%	**98**
	Injury	51%	19%	16%	7%	8%	**2,522**
Articulated —Light	**Fatal**	10%	19%	56%	6%	10%	**161**
	Injury	54%	15%	16%	5%	10%	**2,002**
Light—Light	**Fatal**	9%	20%	53%	4%	12%	**666**
	Injury	36%	26%	21%	9%	8%	**86,646**
Heavy—Heavy	**Fatal**	33%	12%	28%	5%	23%	**43**
	Injury	49%	12%	12%	8%	20%	**653**

For fatal crashes, a test was performed for differences in crash type: excluding the Heavy–Heavy category, there are no differences in crash type amongst the other three groups (χ^2_8 = 3). The

[16] This analysis excludes involvement of motorcycles, pedestrians and buses.

[17] From DCA/RUM data it is not possible to identify which of two moving vehicles was the truck and which was the other vehicle.

Heavy-Heavy fatal crashes have a statistically greater proportion of *Same Direction* crashes, and a lower proportion of *Opposing Directions* crashes.

Within reported injury crashes, Light—Light crashes have a different distribution than heavy truck involved crashes: there are increased proportions of *Manoeuvring* and *Adjacent Direction* crashes and a lower proportion of *Same Direction* crashes. Further discussion (on articulated truck-involved crashes) is provided in Zhang et al (2014).

Table 13 analyses crash type of multiple-vehicle (injury) crashes within Urban/non-Urban.

Table 13 Two-vehicle Injury crashes by crash type and urban/non urban, 2010-2014

Vehicles involved	Location	Same Directions	Adjacent Directions	Opposing Directions	Manoeuvring	Other	Number of crashes
Heavy rigid — Light	**Urban**	56%	18%	14%	7%	6%	**2,146**
	non Urban	28%	24%	26%	9%	14%	**376**
Articulated — Light	**Urban**	66%	13%	10%	4%	6%	**1,340**
	non Urban	30%	19%	27%	6%	17%	**662**
Light — Light	**Urban**	39%	26%	21%	7%	7%	**65,034**
	non Urban	24%	29%	29%	7%	11%	**6,644**

In Urban locations, *Same Direction* crashes dominate, although for Light-Light crashes, the proportion is smaller than for Truck-Light crashes. In non-Urban locations, *Opposing Direction* crashes increase in frequency. See Austroads (2013b) for analysis of heavy vehicle crashes in urban locations.

4.6 Crash fault

'Fault' of a vehicle operator or other road user is not recorded in all state and territory road crash databases, and is not available in the NCD. Some databases record 'critical events' or 'key vehicle status' rather than assign fault. As background, the following table categorises crashes involving heavy trucks by involvement of other traffic units. Table 3 and Table 4 also provide relevant information.

Table 14 Fatal crashes involving heavy trucks—involvement of other vehicles / traffic units, 2010-2014

	Crashes involving a heavy rigid truck	Crashes involving an articulated truck
Single vehicle	7%	14%
Also involving other heavy truck	3%	6%
Also involving light vehicle	58%	61%
Also involving a motorcycle	11%	6%
Also involving a pedal cycle	6%	2%
Pedestrian killed	15%	11%
	100%	**100%**

The hypothesis of identical distributions in the two columns is rejected with $\chi^2_5 = 32$ (in agreement with Table 4): compared to crashes involving an articulated truck, crashes involving a rigid truck are more likely to involve a vulnerable road user, and less likely to be a single vehicle.

Approximately 60 per cent of fatal crashes involving a heavy truck also involve a light vehicle. Approximately 26 per cent involve a vulnerable road user (33 per cent for fatal heavy rigid crashes, and 21 per cent for fatal articulated crashes). This remainder of this section presents brief results of a scan of published research relevant to crash fault and pre-crash events for heavy truck-involved crashes. A representative selection of published findings on critical pre-crash events follows:

- The large truck Crash Causation study (LTCCS 2005) states that in around 55 per cent of fatal crashes involving a heavy truck and a passenger vehicle, the critical factor was associated with the light vehicle. In two-vehicle crashes involving a large truck and a passenger vehicle (not necessarily fatal), the passenger vehicle was assigned the critical reason in 56 percent of the crashes and the large truck in 44 per cent.
- In the US DoT Large truck and bus Crash Facts (LTBCF 2013), the heavy truck's movements are coded as critical pre-crash events in approximately 23 per cent of fatal crashes.
- In a 2014 summary presentation on heavy truck safety produced by the NSW Centre for Road Safety (NSW 2014), key-vehicle status in fatal multi-vehicle heavy truck crashes was assigned to the truck in 18 per cent of cases.
- NTI (2015): In fatal crashes involving a truck and other vehicle, no fault was found for the truck driver in 84% of cases.
- The Australian Road Transport Suppliers Association (ARTSA 2015) presents a number of analyses of crashes involving heavy trucks ≥12t including fault and crash type.

5. Exposure Measures and Rates

Heavy trucks account for around 2.4 per cent of all vehicle registrations, down from 2.7 per cent in 2001. In terms of kilometres travelled, they account for 7.0 per cent of the total[18], up from 6.3 per cent in 2001. They are involved in approximately 16 per cent of fatal crashes and 4 per cent of injury crashes.

Table 15 shows numbers of registered vehicles: trucks (categorised by weight) and passenger cars (total)— sourced from ABS (2015). Note that this data is not numbers of *new* registrations each year, but the number of total registered vehicles at a fixed point in time each year. Relevant statistics are also provided in (ARTSA 2016).

Table 15 Vehicles on Register — Trucks (by weight[19]) / Passenger cars

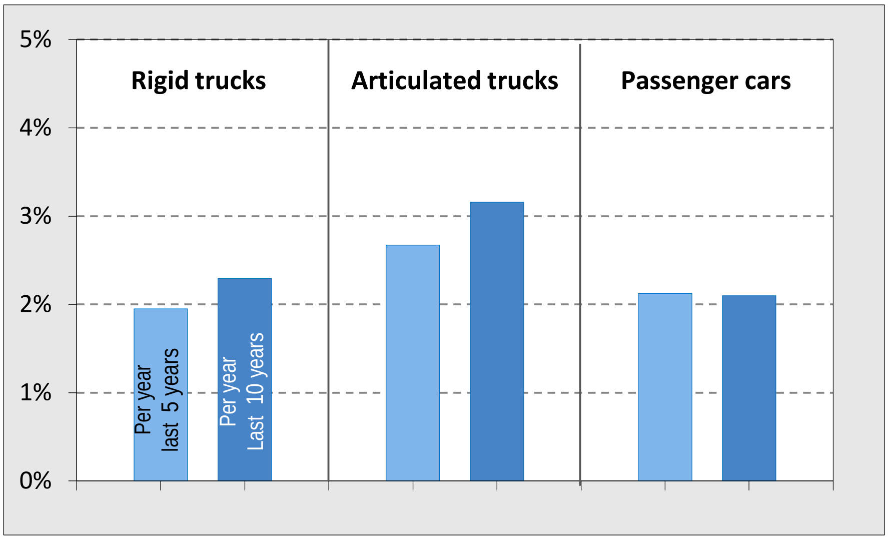
		Rigid trucks				**Articulated trucks**				**Passenger cars**
		≤ 4.5t	**4.5t – 20t**	**≥ 20t**	**Total**	**3t – 20t**	**20t – 60t**	**≥ 60t**	**Total**	
	2006	95,452	219,183	68,911	**383,546**	638	40,681	30,361	**71,680**	**11,188,880**
	2007	99,817	221,945	72,728	**394,490**	611	40,294	33,518	**74,423**	**11,466,560**
	2008	105,726	227,303	77,881	**410,910**	598	41,008	37,526	**79,132**	**11,803,536**
	2009	110,763	229,545	81,394	**421,702**	771	40,908	39,538	**81,217**	**12,023,098**
	2010	115,845	231,834	83,599	**431,278**	729	40,314	41,393	**82,436**	**12,269,305**
	2011	119,539	231,962	86,261	**437,762**	867	41,533	43,565	**85,965**	**12,474,044**
	2012	124,291	233,156	88,959	**446,406**	904	42,531	44,560	**87,995**	**12,714,235**
	2013	131,147	233,837	92,161	**457,145**	885	42,796	47,223	**90,904**	**13,000,021**
	2014	135,658	234,597	94,867	**465,122**	907	42,901	50,045	**93,853**	**13,297,260**
	2015	140,625	234,967	96,732	**472,324**	946	42,455	51,574	**94,975**	**13,549,449**
% change per year	**last 5 years**	4.2	0.3	3.0	**1.9**	1.8	0.5	4.6	**2.7**	2.1
	last 10 years	4.4	0.7	3.7	**2.3**	5.6	0.7	5.7	**3.2**	2.1

As seen in Table 15, most of the growth (around 3-4% per year) in numbers of registered rigid trucks has occurred in the largest weight category (≥ 20 t) and in the smallest category (≤ 4.5 t). A similar pattern is seen in registrations of articulated trucks.

The changes over time in numbers of registered vehicles are illustrated in Figure 7.

[18] Includes rigid trucks with a Gross Vehicle Mass of 3.5 t and over.
[19] GVM used for rigid truck weights and GCM (Gross Combination Mass) is used for articulated truck weights.

Figure 7 Growth rate (per year) in numbers of registered vehicles



There has been a marginal reduction in the growth rate of heavy truck registrations during the last five years when compared to the preceding five years.

Crash data available nationally does not contain sufficient detail on the weights of vehicles involved to calculate crash rates based on the data in Table 13. The following table therefore combines all weight categories to show fatal crash rates per registered vehicle.

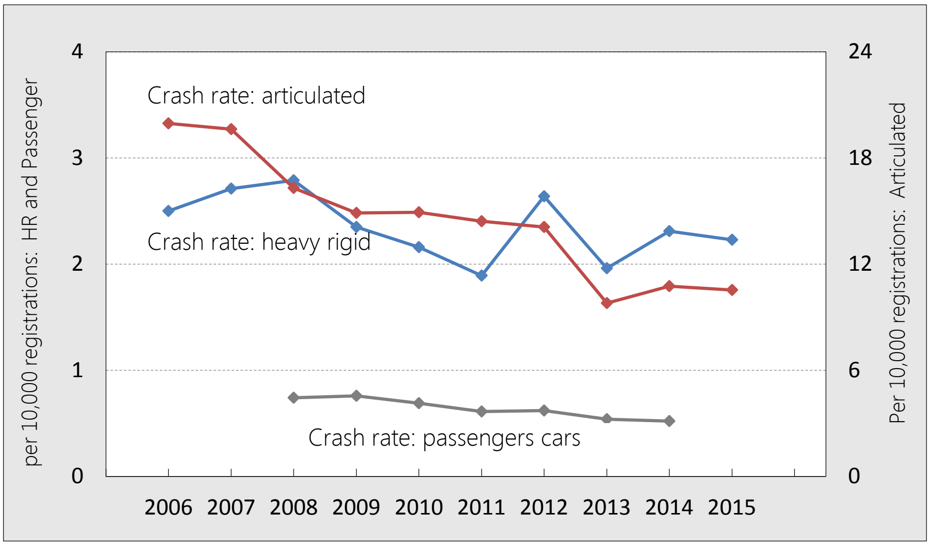
Table 16 Rates of annual fatal crashes per 10,000 registered vehicles

		Heavy rigid Involved		Articulated Involved		Passenger Car Involved	
		Single vehicle	All	Single vehicle	All	Single vehicle	All
	2006	0.24	2.50	2.93	19.95	-	-
	2007	0.20	2.71	4.17	19.62	-	-
	2008	0.36	2.79	2.91	16.30	0.33	0.74
	2009	0.23	2.35	3.57	14.90	0.32	0.76
	2010	0.22	2.16	1.82	14.92	0.28	0.69
	2011	0.19	1.89	2.09	14.42	0.25	0.61
	2012	0.16	2.64	2.05	14.09	0.24	0.62
	2013	0.12	1.96	0.88	9.79	0.22	0.54
	2014	0.21	2.31	1.70	10.76	0.20	0.52
	2015	0.18	2.23	1.90	10.53	-	-
% change per year	**last 5 years**	-2.5%	+1.4%	-3.5%	-8.2%	-8.6%	-7.2%
Trend		—	—	↘ ***	↘ ***	↘ ***	↘ ***

For fatal crashes involving articulated trucks, the rate per registered vehicle is 20 times the rate for passenger cars. The rates however for both these vehicle types are decreasing strongly.

The following figure plots the 'All' columns in the above table. The rate for articulated-involved is on a separate axis from the other two rates.

Figure 8 Rate of annual fatal crashes per 10,000 registered vehicles



Articulated trucks travel on average much further than other vehicles, and have a larger proportion of travel on rural roads. Tables 17A, 17B and 17C show total kilometres-travelled (VKT) by vehicle type and by Greater Capital City Statistical Area (GCCSA) / Rest of State[20], crash numbers and crash rates per VKT. The source of the VKT estimates is BITRE (2015).

Table 17A Fatal crashes, VKT and rates of fatal crashes per 100 million VKT —Heavy rigid truck-involved

	Greater Capital City			Rest of State			All		
	10^8 VKT	Fatal crashes	Rate per 10^8 VKT	10^8 VKT	Fatal crashes	Rate per 10^8 VKT	10^8 VKT	Fatal crashes	Rate per 10^8 VKT
2008	4.5	46	1.0	4.4	35	0.8	8.9	81	0.9
2009	4.4	36	0.8	4.3	34	0.8	8.8	70	0.8
2010	4.5	35	0.8	4.5	29	0.6	9.0	64	0.7
2011	4.7	24	0.5	4.6	30	0.7	9.2	54	0.6
2012	4.8	32	0.7	4.7	47	1.0	9.4	79	0.8
2013	4.9	30	0.6	4.8	29	0.6	9.6	59	0.6
2014	5.0	40	0.8	4.9	35	0.7	9.8	75	0.8
Trend	↗ ***	—	—	↗ ***	—	—	↗ ***	—	—

[20] For an explanation of Greater Capital City Statistical Area See (ABS 2013c).

Table 17B Fatal crashes, VKT and rates of fatal crashes per 100 million VKT —Articulated truck-involved

	Greater Capital City			Rest of State			All		
	10^8 VKT	Fatal crashes	Rate per 10^8 VKT	10^8 VKT	Fatal crashes	Rate per 10^8 VKT	10^8 VKT	Fatal crashes	Rate per 10^8 VKT
2008	1.3	32	2.5	5.6	93	1.7	6.9	125	1.8
2009	1.3	28	2.2	5.6	86	1.6	6.8	114	1.7
2010	1.3	31	2.4	5.7	89	1.6	6.9	120	1.7
2011	1.3	31	2.3	5.9	96	1.6	7.2	127	1.8
2012	1.4	25	1.8	6.0	102	1.7	7.5	127	1.7
2013	1.4	22	1.5	6.2	73	1.2	7.7	95	1.2
2014	1.5	23	1.6	6.4	78	1.2	7.8	101	1.3
Trend	↗ ***	↘ ***	↘ ***	↗ ***	—	—	↗ ***	—	↘ **

Table 17C Fatal crashes, VKT and rates of fatal crashes per 100 million VKT —Passenger car-involved

	Greater Capital City			Rest of State			All		
	10^8 VKT	Fatal crashes	Rate per 10^8 VKT	10^8 VKT	Fatal crashes	Rate per 10^8 VKT	10^8 VKT	Fatal crashes	Rate per 10^8 VKT
2008	99.7	379	0.4	66.0	490	0.7	165.7	869	0.5
2009	99.4	376	0.4	65.7	524	0.8	165.1	900	0.6
2010	100.1	326	0.3	66.0	515	0.8	166.1	841	0.5
2011	101.5	294	0.3	66.5	465	0.7	168.0	759	0.5
2012	102.5	323	0.3	67.1	455	0.7	169.6	778	0.5
2013	103.7	296	0.3	67.5	408	0.6	171.2	704	0.4
2014	104.6	274	0.3	67.9	408	0.6	172.5	682	0.4
Trend	↗ ***	↘ ***	↘ **	↗ ***	↘ **	↘ **	↗ ***	↘ ***	↘ **

Heavy rigid truck travel is evenly split between GCCSA and Rest of State. In comparison, over 80 per cent of articulated truck travel is outside the GCCSA areas. Comparing the crash rates per VKT for GCCSA with Rest of State shows that they are higher in the Rest of State areas for Passenger car-involved crashes, are similar for heavy rigid truck-involved crashes, and *lower* for articulated truck crashes. Over the last five years, the rates for articulated truck-involved crashes are trending down, as are passenger car rates.

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Prepared by Peter Johnston. For further information on this publication please contact roadsafety@infrastructure.gov.au.

Use of the Coat of Arms

Contact us

Department of Infrastructure and Regional Development
Bureau of Infrastructure, Transport and Regional Economics (BITRE)
GPO Box 501, Canberra ACT 2601, Australia

Phone: (international) +61 2 6274 7210
Fax: (international) +61 2 6274 6855
Email: bitre@infrastructure.gov.au
Website: www.bitre.gov.au