

Heavy Vehicles and Speeding: Evidence from Traffic Survey Data

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Biography

Rena Friswell has been involved in research into occupational health and safety issues for the past 10 years, first at the National Occupational Health and Safety Commission and more recently at the NSW Injury Risk Management Research Centre. Much of her work has concerned fatigue among heavy vehicle drivers.

Abstract

The aim of this project was to look at the distribution patterns and patterns of speeding of heavy vehicles on the road as measured by traffic surveys conducted at 20 fixed speed cameras sites in NSW over the period 1999-2001. At each survey site, Trafficorder data captured the number of vehicles passing at particular times across the 24 hour period. Vehicles were classified by AUSTRROADS class with light vehicles in classes 1 and 2 and heavy vehicles in classes 3 to 12. The results showed that heavy vehicles have a very different distribution to light vehicles on the road. Despite their overall much lower numbers on the road, heavy vehicles are, proportionately, most common in country areas and during the midnight to dawn period, but this is due to the concentration of light vehicles in metropolitan areas and during the daytime period. The results demonstrate that heavy vehicles were less likely to be speeding overall, but especially on metropolitan, unclassified and low speed zone roads. There was less difference in the speeding patterns of light and heavy vehicles on country non-urban roads, state highways and high-speed zones, especially 110km/h. In 110km/h limit regions heavy vehicles tended to speed at least as much as light vehicles and appeared to be responding to the upper speed limit for light vehicles rather than the lower speed requirement for heavy vehicles. Consistent with the finding of lower levels of speeding for heavy vehicles, the analysis showed that speed-related crash rates were lower for heavy vehicles, particularly on country non-urban roads, for state highways and 100km/h speed zones. Although country urban regions and speed zones of 80 and 90km/h had higher rates for heavy vehicles compared to light vehicles, the percentage of heavy vehicles that were speeding was still lower than for light vehicles.

1. INTRODUCTION

Traffic accident statistics are a sobering reminder that the road is a dangerous place. However, accident statistics only capture an endpoint of road user behaviour. Consequently, they provide a quite narrow basis for understanding road safety issues and designing effective safety interventions. One aim of the current research was to explore the usefulness of other available data sources for understanding the risks involved in heavy vehicle driving. In particular, traffic surveys provide information about road usage patterns and speeding behaviour under non-accident conditions. This information can be used as a context against which accident statistics can be interpreted, or can be used directly, to better target road safety interventions.

The current study comprised an analysis of a subset of the traffic survey data routinely collected by the NSW RTA. The specific objectives of the study were to identify patterns in light and heavy vehicle road usage across the day and on different types of roadway, to describe the patterns of speeding behaviour among light and heavy vehicles across the day and on different types of roadway, and to relate these traffic volumes and speeding data to local crash outcomes.

2. METHOD

Data from temporary Trafficorders situated near 20 fixed speed camera sites around NSW during the period 1999-2001 were available for analysis. These data represent only a fraction of the traffic survey data collected by the RTA but were available in analysis-ready form from ARRB. Standard RTA filters had been applied to the data.

The Trafficorder data captured the number of vehicles passing each survey site on a continuous basis. Counts of vehicles and estimates of vehicle speed and vehicle class were made of the lead vehicles passing but where vehicles travelled at less than six seconds apart, the system could count but not classify the following vehicles. Total vehicle numbers and travel speeds for heavy and light vehicles were estimated by assuming that they were represented amongst the following vehicles in the same proportions as they were found amongst the lead vehicles. Vehicles were judged as light and heavy on the basis of AUSTRROADS class where classes 1 and 2 were classified as light and 3 to 12 were classified as heavy. The AUSTRROADS classification system does not allow some types of heavy vehicles to be separated. Consequently, both heavy trucks and heavy buses are included among the heavy vehicles.

The speed surveys at the various sites were conducted over varying lengths of time, had no consistent start and finish times within the 24 hour day, and may have been composed of broken recording periods where equipment failure occurred in mid-survey. In addition, the basic unit of time varied across surveys. To account for these differences, the number of hours with any recorded data during each survey were tallied and were used to compute traffic counts per hour.

In order to allow comparison of counts at sites varying in their urbanization and road type, and to facilitate later examination of crash risk, the sites were coded consistent with the RTA's Traffic Accident Database System (TADS) classifications of urbanization (Sydney metropolitan areas, Newcastle metropolitan areas, Wollongong metropolitan areas, Country urban areas and Country non-urban areas) and road type (State highways, Other classified roads, and Unclassified roads).

To examine crash risk, accidents occurring in the same suburb or town and in the same street, and where the speed limit was the same as at traffic survey sites were extracted from TADS for the years 1999 and 2000. Accidents were identified as involving heavy vehicles where TADS classified the participating traffic units as Heavy Rigid Trucks, Heavy Articulated Trucks, or Buses (but only where the bus tare weight exceeded 4.5 tonnes). All other types of traffic units in the accident database were incorporated into the class of 'Light' road users. An attempt was then made to link crashes to the road usage of heavy and light vehicles at the speed survey sites.

3. RESULTS

The analyses reported here are descriptive and designed to build a 24 hour picture of light and heavy traffic volumes at sites varying in urbanisation, road class and speed limit.

3.1 Overview of traffic survey data

Table 1.1 summarises the traffic survey dataset. Overall, the data comprised 199 individual traffic surveys and captured almost 29 million vehicle movements during 46,753 hours of recording. When AustRoads vehicle classifications were applied to the lead vehicles, heavy vehicles accounted for 10% of the measured traffic.

Table 1.1: Summary of traffic survey data

	All vehicles	Heavy vehicles ¹	Light vehicles ¹
Total lead vehicles (million)	11.96	1.22	10.74
Percent of lead vehicles	100.0%	10.2%	89.8%
Total lead vehicles/hour	256	26	230
Total vehicles (million)	28.96	2.95	26.01
Total vehicles/hour	619	63	556

¹ Total vehicles and Total vehicles/hour were estimated using the percent of light and heavy vehicles among the lead vehicles

Most of the surveys (38.7%), vehicles counted (47.4%) and vehicles fully surveyed (41.6%) were in the Sydney metropolitan area. Table 2.1 shows that the sites in metropolitan areas, particularly Newcastle, had the heaviest density traffic compared to country sites, as reflected in their lower percentages of lead vehicles, higher total vehicles per hour and higher total lead vehicles per hour. The high density at Newcastle sites is probably due to the characteristics of the particular sites chosen compared to those chosen in the Sydney and Wollongong metropolitan areas.

Table 1.2: Traffic density at survey sites differing in urbanisation

Urbanisation class	Sydney Metro	Newc. Metro ¹	Woll. Metro ²	Country urban	Country non-urban
Total lead vehicles/hour	282	401	350	189	180
% lead vehicles	36.3	32.7	46.1	46.2	64.1
Total vehicles/hour	778	1224	758	409	281

¹ Newcastle Metro ² Wollongong Metro

Just under half of the surveys were conducted on each of State highways (42.7%) and Other classified roads (44.2%). The largest volumes of traffic (55.8%) and the highest numbers of vehicles per hour (786) were on Other classified roads. Unclassified roads in turn carried more traffic per hour (552 vehicles) than State highways (479 vehicles).

Most surveys were in 60km/h zones (51.8%), which is consistent with the predominance of urban areas amongst the surveys. As expected, slower speed zones (60-90km/h) were associated with higher vehicle densities. Despite the fact that nearly half of the surveys (42.7%) were conducted on State highways, only about one-quarter of the surveys were in high speed limit locations (100 and 110km/h). This, coupled with the lower density of traffic in higher speed zones, means that high speed limit roads (and certain classes of heavy vehicles) will be relatively under-represented in the following analyses.

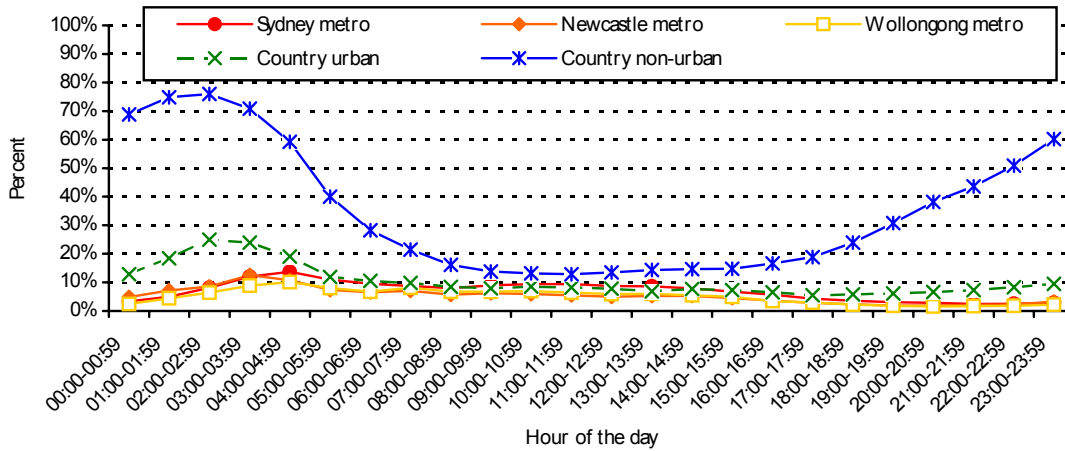
3.2 Comparison of heavy and light vehicle road use patterns

Figure 2.1 shows that although the majority of vehicles on all road types at most times of day were light vehicles, heavy vehicles made up more than 50% of the vehicles travelling through country non-urban survey sites between 10pm and 5am. Similarly, although heavy vehicles were a small, but consistent proportion of the vehicles on Other classified and Unclassified roads across the 24 hour period, on State highways heavy vehicles accounted for between 40 and 60 percent of the lead vehicles between 00:00 and 05:00 and comprised the clear majority of the lead vehicles on roads with speed limits of 100km/h or 110km/h over the period 21:00 to around 05:00.

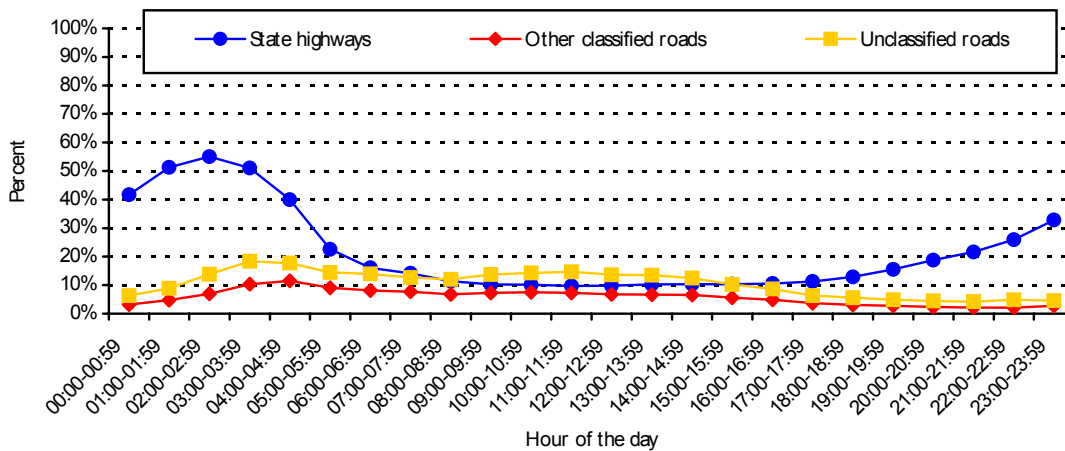
The overwhelming majority of traffic occurred during daytime hours and dropped sharply between midnight and 5:00am. However, the highest percentage of heavy vehicles were observed between midnight and 5:00 at country non-urban sites, on state highways and on high speed limit roads (100 and 110km/h), and in each of these cases, the distribution of heavy vehicles across the 24 hour day was much flatter than for other vehicles and other sites.

Figure 2.1: Heavy vehicles as a percentage of all lead vehicles at each hour of the day by type of road at survey site

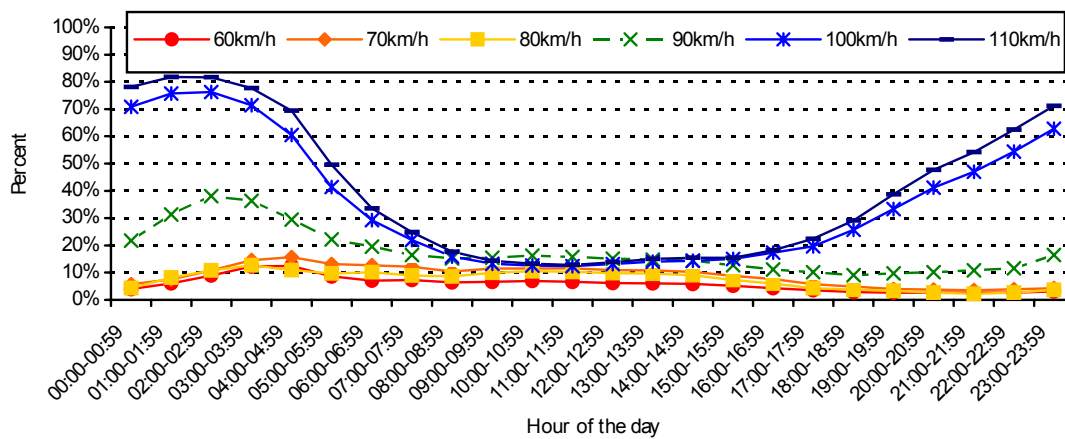
a) Urbanisation of road



b) Road classification



c) Speed limit of road

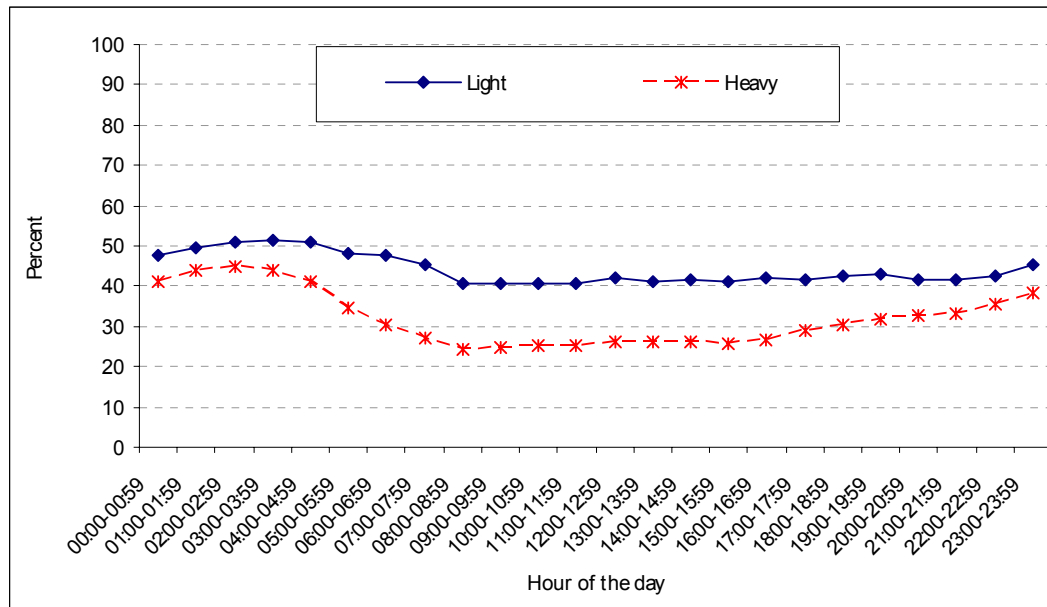


4. COMPARISON OF HEAVY AND LIGHT VEHICLE SPEEDING BEHAVIOUR

Speeding was defined whenever measured speeds were greater than the speed limit at the site. For heavy vehicles at 110km/h sites, however, speeding was defined as any speed in excess of 100km/h, consistent with legislated speed restrictions on heavy vehicles. Overall, approximately 58.5% of lead vehicles travelled within the speed limit, but almost 1 in 3 lead vehicles (29.2%) travelled up to 10km/h over the limit and more than 1 in 10 travelled at least 10km/h over the limit (12.4%). When these lead vehicle percentages were used to estimate the total number of vehicles speeding, over 11 million vehicles were recorded exceeding the speed limit at the survey sites. When the total estimated number of vehicles was converted to an average per hour of data, 67 vehicles per hour travelled at least 10km/h over the speed limit every hour, and 173 per hour travelled up to 10km/h over the speed limit.

Figure 3.1 shows the percentage of light and heavy lead vehicles at each hour of the day who were exceeding the speed limit. Both types of vehicle were more likely to be speeding in the night hours, especially between midnight and around 05:00 hours. Clearly, however, a greater percentage of light than heavy vehicles exceed the speed limit whatever the time of day.

Figure 3.1: Percentage of light and heavy lead vehicles at each hour of the day that were exceeding the speed limit



The speeding patterns for light and heavy lead vehicles were different depending on the urbanisation of the road at the survey site. Between 8% and 19% more light vehicles than heavy vehicles travelled above the speed limit at metropolitan and country urban sites. However the difference between light and heavy vehicle speeding rates decreased as the size of the urban centre decreased so that the speeding profiles of light and heavy vehicles were almost identical at country non-urban sites with 34.2% and 32.6%, respectively, exceeding the speed limit. Both light and heavy vehicles were most likely to speed in country urban areas.

Regardless of road class, heavy vehicles were more likely to adhere to speed limits than light vehicles, but the differences were most pronounced on unclassified roads and least pronounced on State highways where approximately 1 in 3 light and heavy vehicles travelled up to 10km/h over the speed limit.

Overall, speeding was most apparent on 60km/h roads, where half (49.8%) of light vehicles adhered to the speed limit, and on 110km/h roads, where almost half of the light and heavy lead vehicles exceeded their speed limits. Indeed, a slightly greater percentage of heavy (47.2%) than light (43.7%) vehicles were recorded to be speeding on 110km/h roads, but light vehicles were more likely to speed in all other speed zones. It should be remembered, however, that the speed limit is lower than 110km/h for heavy vehicles.

When the speeding profile of lead heavy vehicles was broken down by time of day for survey sites differing urbanisation, road class and speed limit and compared to the percentage of heavy vehicles on the road, heavy vehicles were under-represented in the highest speeding classes of 10km/h or more over the limit and over-represented in those doing legal speeds. This was especially so for the period 02:00 to 15:00 hours. For Country non-urban areas, the percentage of heavy vehicles in the 20km/h and over class was lower than would be expected based on the percentage of heavy vehicles on the road, especially for the night period between 17:00 and 06:00. For the Wollongong metropolitan areas and country urban areas, lead heavy vehicles were represented in the speeding classes in about the same proportions as they were on the road

On Unclassified roads, heavy vehicles were over-represented amongst the vehicles doing the legal speed and under-represented amongst those travelling over the speed limit, with the highest speeds showing the greatest under-representation. The same pattern was seen for Other classified roads and State highways although the extent of under-representation by heavy vehicles was lower and did not span the entire 24 hour period. For Other classified roads, the under-representation of speeding by heavy vehicles occurred mainly in the period 02:00 to 08:00 and for State highways, it occurred mainly between 18:00 and 08:00 and only for speeding of 10km/h or higher. On State highways, heavy vehicles did speeds of up to 10 km/h over the limit in the same proportion as would be expected based on the number of heavy vehicles on the road.

There was an increasing tendency for heavy vehicles to be under-represented amongst the fastest speeding classes as the legal speed increased up to 100km/h. This change was most pronounced for the night period. At sites with speed limits of 110km/h, heavy vehicles tended to be speeding in about the expected proportions based on the percentage of heavy vehicles on the road across the 24 hour period. As the speed limit for heavy vehicles is 100km/h in 110km/h speed zones, the speeding patterns for heavy vehicles in these zones raise the question of whether heavy vehicles are classified as speeding because they are responding to the 110km/h speed limit rather than a 100km/h limit. When speeding for heavy vehicles was redefined as being above 110km/h rather than 100km/h, the vast majority of heavy vehicles were travelling at or below this limit and heavy vehicles were considerably under-represented in each of the speeding categories, especially over the night period.

5. CRASH RISK

Using the available TADS data, the crash risk of speeding light and heavy vehicles in the vicinity of the survey sites was calculated as the number of speeding-related crashes per million speeding vehicles (Table 4.1).

Across the different urban and rural locations heavy vehicles were less likely to be involved in speeding-related crashes than light vehicles for all types of location, except Country urban areas. For Country urban areas, heavy vehicles had slightly higher speeding-related crash rates than light vehicles. Country non-urban areas showed the largest difference in speeding crash rates for heavy and light vehicles, with speeding heavy vehicles having around half the crash rates of speeding light vehicles.

Analysis of speeding-related crashes for heavy and light vehicles on different types of roads shows that the highest rates of speeding crashes were on State highways for both types of vehicles, but the speeding crash rates for heavy vehicles were about half that for light vehicles. Speeding crash rates were much lower for the other two types of roads and there was little difference in speeding crash rates between heavy and light vehicles.

Different patterns of speeding crashes occurred in different speed limit zones and for heavy and light vehicles. For light vehicles, the highest speeding crash rates occurred in 100km/h zones followed by 60km/h zones where the speeding crash rates were about one third that seen at the higher speed limit. In contrast, for heavy vehicles the highest speeding crash rates occurred in the 80 and 90km/h zones and were about half the highest speeding crash rates shown by light vehicles.

Table 4.1: Site characteristics of speeding-related accidents involving light and heavy vehicles per 1,000,000 speeding light and heavy vehicles

	Speeding accidents per million speeding vehicles	
	Light vehicles	Heavy vehicles
Urbanisation		
Sydney Metro	6.06	3.52
Newcastle Metro	1.95	0.00
Wollongong Metro	2.11	0.00
Country urban	5.60	8.71
Country non-urban	36.32	16.11
Road type		
State highways	29.85	14.33
Other classified roads	5.21	4.07
Unclassified roads	8.56	8.56
Speed limit		
60kph	11.17	6.53
70kph	1.30	0.00
80kph	5.79	15.08
90kph	4.87	13.54
100kph	32.09	7.27
110kph	2.01	1.42

6. CONCLUSION

Overall, these analyses confirm that heavy vehicles have a very different distribution to light vehicles on the road. Proportionately, heavy vehicles were most common in country areas and during the midnight to dawn period, reflecting the extent of long distance night work among heavy vehicles drivers. Heavy vehicles were less likely to be speeding than light vehicles, but especially on metropolitan, unclassified and low speed zone roads. Speeding patterns of light and heavy vehicles on country non-urban roads, state highways and high speed zones, especially 110km/h, were more similar although, in the 110km/h limit regions heavy vehicles behaved as if their speed limit were 110km/h and not 100km/h. This phenomenon deserves further investigation. Speed-related crash risk was generally lower for heavy vehicles, particularly on country non-urban roads, for state highways and 100km/h speed zones, suggesting either that lower traffic volumes in these situations diminish the risk of crashing or that heavy vehicle drivers may be more skilled at driving at higher speeds. In country urban regions and speed zones of 80 and 90km/h where heavy vehicles had higher crash risk than light vehicles, the percentage of heavy vehicles that were speeding was still lower than for light vehicles.

Because the data used in the current analysis were not strategically sampled to reflect the distribution of road types across the state, the results should be viewed as providing a preliminary picture of road use and speeding patterns. Nonetheless, this analysis has demonstrated the potential usefulness of the speed survey data for understanding road use patterns and highlighting differences in road safety risks for different road users and different road conditions and situations. Further systematic use of traffic survey data is recommended.

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Keywords

Heavy vehicles, speeding