The contributions of speeding and fatigue to work-related road crashes

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Abstract

Speeding and fatigue are both recognised as factors that increase the likelihood of being involved in a crash, and a number of road safety initiatives are targeted at reducing the incidence of these behaviours. However, not much is known about the contribution of these factors to work-related road crashes in the Australian context. Such knowledge may be useful for specifically targeting road safety programmes, particularly since work-related travel accounts for about one-third of all travel (more than half if commuting is included). In addition to being a road safety issue, this is also an occupational health and safety concern as road crashes are the most common form of work-related death in Australia. A unique dataset developed by the New South Wales Roads and Traffic Authority allows fleet-registered vehicles in crashes to be identified and compared with crashes of non-fleet-registered vehicles.

The analyses presented here compare the incidence and severity of excessive speed or fatigue in crashes involving fleet-registered and non-fleet-registered vehicles. To obtain a more complete picture of the problem, where relevant these factors are examined in relation to a number of other variables, such as the prevailing speed limit at the crash site and driver characteristics.

Introduction

Work-related driving accounts for a large proportion of travel on Australian roads. About 30% of the registered vehicles in Australia are used in business and 60% of all new vehicles are purchased initially for commercial purposes (Wheatley, 1997). About a third of all travel is undertaken for business purposes – more than half if commuting is included (Wheatley, 1997). Harrison, Fitzgerald, Pronk and Fildes (1998) conducted roadside interviews of car drivers between 12 noon and 8 pm and found that 36%-47% were on a business trip.

Road crashes are the most common form of work-related death in Australia. Recent data are not available, but in 1989-92 541 persons were killed in road crashes while they were working and 628 persons were killed in road crashes while they were commuting to and from work (National Occupational Health and Safety Commission, 1998). This represents 23% and 26%, respectively, of work-related deaths, or 6% and 7%, respectively, of road fatalities during that period (Federal Office of Road Safety, 1999). These figures do not include others who were killed or injured as a result of these work-related road crashes. Work-related on-road crashes cost Australia around $425 million each year, and the average time lost from traffic crashes is greater than for any other workplace injury claim (Stewart-Boggle, 1999).

Compared to drivers of non-fleet vehicles, fleet drivers may speed more and be at an increased risk due to fatigue (Symmons & Haworth, 2004). Such an outcome could be due to increased exposure – fleet drivers are likely to spend more time driving and travel longer distances in a given period. For example, individuals in the United Kingdom who drive for work-related reasons (not including commuting) drive more than two and a half times the annual distance of drivers of private cars (Broughton, Baughan, Pearce, Smith & Buckle, 2003).

Fell and Black (1996) reported that in the Northern Region of NSW, over a third of driver fatigue crashes or near crashes occurred on trips related to work. When drivers in the Sydney Region were interviewed, 43% of respondents who had a fatigue incident (a crash, near miss or moved out of their lane because of fatigue) stated that their trip was work-related. Among the respondents who said that they had had insufficient sleep, 55% attributed this to long working hours or overtime.

An increased amount of time spent driving is also likely to result in more speeding – for a given driver their propensity to speed is multiplied by the time spent driving. Fleet drivers may also be more likely to speed because they usually do not own the vehicle they are driving and may therefore be inclined to treat it with less care – driving faster and more recklessly than they might in their own vehicles (Broughton, et al., 2003).

A fleet vehicle will often become a workplace. To maximise productivity, drivers are liable to try to minimise the time spent travelling between destinations. Additionally, the use of devices such as mobile phones, coupled with the distractions of thinking about work-related issues may reduce the driver's attention to travel speed.

Speeding and fatigue appear to contribute to the crash involvement of company drivers. For example, the driving culture within an organisation can stress business needs, such as delivery quotas, before safety (Downs, Keigan, Maycock & Grayson, 1999). A survey of British car drivers found that speeding was common for over half of the sample, and excessive speeding was common for 13% of the drivers (Adams-Guppy & Guppy, 1995). The most influential reason for speeding was a desire to arrive at meetings on time. This was combined with a reduced perception of excess speeding as an important accident risk factor. In addition, the overall deterrent of a crash may not be as high among this group, as the company will pay for costs such as repairs and lost time. A MUARC study found that higher driving speeds were associated with business or work car use, driving a large, relatively new car owned by someone other than the driver, a relatively high level of driving exposure, being on a long trip and driving relatively little in built-up areas (Harrison, et al., 1998).

Data

Studies of work-related crashes often rely on data sources such as insurance claims (e.g., Haworth, Senserrick, Watson, & Symmons, 2003) or surveys (e.g., Broughton et al., 2003). The former can suffer from difficulties in separating injury crashes from property damage only crashes (such as low-speed incidents within car parks). Surveys are usually based on relatively small sample sizes (often involving only one or two large organisations) and time frames long enough to capture a useful number of crashes, where problems can arise due to a reliance on the drivers' memory and

their honesty in reporting crashes (particularly if they are concerned that their employer might find out).

Crash data collected by most Australian states does not include variables such as whether the crashed vehicle was a commercial or work vehicle, or whether the purpose of the trip was work-related. In some States data are unreliable. For example, Queensland's Police crash report form asks whether a commercial vehicle was involved, but this data is likely to be incomplete if the vehicle is a car that does not have obvious signage (Murray, Newnam, Watson, Davey, & Schonfeld, 2002).

In an attempt to learn more about the extent and nature of work-related crashes, the New South Wales Roads and Traffic Authority (RTA) created a dataset linking the NSW crash data covering the period 1996 to 2000 (inclusive) and NSW registration data for the period 31 December 1995 to 30 June 2000. The linkage was made using the vehicle's registration number, which was present in both the registration and crash databases. The registered keeper was the organisation or individual on record within the six months immediately preceding the crash (a particular vehicle could therefore appear more than once in the crash database and be registered to different keepers). The data was supplied to MUARC post-matched and de-identified. According to the RTA, the matching process was successful for more than 94% of all crashed NSW-registered vehicles.

The registration database was also used to determine the total number of vehicles registered to the keeper of the crashed vehicle (i.e. fleet size). Fleet vehicles were defined as those registered to "fleet owners", which included organisations or individuals with one or more business registrations, and organisations with more than two private registrations. Vehicles registered to car dealers and rental companies were classed as non-fleet vehicles.

Two variables included in the file relate to whether the vehicle was thought to be speeding at the time of the crash and whether the driver of a crashed vehicle was considered to be fatigued, where the factor contributed to the crash. According to the RTA guidelines, speeding is judged to have contributed to the crash if

- The controller (driver or rider) was charged with a speeding offence, or
- The vehicle was described by police as travelling at an excessive speed, or
- The stated speed of the vehicle was in excess of the speed limit.

Additionally, if the vehicle jack-knifed, skidded, slid, went out of control or ran off the road on a bend then speed was considered to be a factor. Thus, speeding refers to an excessive speed for the prevailing conditions, not necessarily exceeding the posted speed limit.

According to the RTA guidelines, fatigue is judged to have contributed to the crash if the vehicle's controller was described by police as being asleep, drowsy or fatigued. Fatigue was also a factor if the vehicle was involved in a head-on crash while travelling on the wrong side of the road (but was not overtaking and there were no other relevant mitigating circumstances), or the vehicle ran off the road (a straight section or the outside of a curve) but the vehicle was not considered to be travelling at an excessive speed.

Results

Overall, 23.7% of vehicles (or 867,096 vehicles) registered in NSW at 30 June 2000 were classified as fleet vehicles using the definition above. Fleet registrations accounted for around 16% of all NSW-registered cars, 14% of motorcycles, 52% of the light trucks, and 66% of "non-public" buses. Almost all heavy trucks, articulated vehicles, public buses, emergency vehicles and taxis in NSW were registered as fleet vehicles (in excess of 97% for each of these categories). Cars accounted for 52% of the fleet-registered vehicles and 87% of the non-fleet-registered vehicles. Twenty-nine percent of the fleet-registered vehicles belonged to a fleet size of one vehicle, while 25% belonged to a fleet of two registered vehicles. More than three-quarters of all fleet vehicles were registered to fleets of ten vehicles or less.

During the period 1996 to 2000 (inclusive), a total of 396,899 NSW-registered vehicles were involved in crashes (fatal, injury or towaway) where the vehicle could be classified as either a fleet or non-fleet vehicle. Overall, one-quarter of these crashed vehicles were fleet vehicles. The level of severity of crashes of fleet and non-fleet vehicles was statistically significantly different ($\chi^2(2)=51.8$; $p<0.001$), but the differences were small in percentage terms. Fleet vehicle crashes were slightly more likely to be fatal (0.9% versus 0.7%), but were less likely to involve an injury (34.2% versus 35.0%).

The RTA crash data includes variables that code, for each crashed vehicle, whether speeding or fatigue on the part of the controller of that vehicle was judged to have contributed to the crash. For both speeding and fatigue, "no" and "unknown" were grouped together in the data, although it is expected that "unknown" is likely to be the biggest component of this category.

Table 1. Numbers of drivers of fleet and non-fleet vehicles in crashes where speeding or fatigue was involved.

Involvement of crash factor	Fleet		Non-fleet		Total	
	No.	%	No.	%	No.	%
Speeding						
Yes	6,281	6.4	25,289	8.5	31,570	8.0
No or Unknown	92,570	93.6	272,759	91.5	365,329	92.0
Total	98,851	100.0	298,048	100.0	396,899	100.0
Fatigue						
Yes	3,193	3.2	12,910	4.3	16,103	4.1
No or Unknown	95,658	96.8	285,138	95.7	380,796	95.9
Total	98,851	100.0	298,048	100.0	396,899	100.0

Table 1 demonstrates the incidence of speeding and fatigue in fleet and non-fleet crashes. Overall, 8.0% of vehicles were coded as traveling at excessive speed (this may be inappropriate speed rather than exceeding the posted speed limit). As a percentage, fewer fleet vehicles were involved in speed-related crashes compared with non-fleet vehicles (6.4% versus 8.5% respectively), a statistically significant difference ($\chi^2(1)=460.4$; $p<0.001$). Fatigue was deemed to be a factor in 4.1% of

vehicle crashes, and was less likely to be noted for fleet vehicles than non-fleet vehicles (3.2% compared with 4.3% respectively), a statistically significant difference ($\chi^2(1)=231.3$; $p<0.001$). From another viewpoint, of those crashed vehicles where excessive speed was noted as a crash factor, 20% were fleet-registered vehicles and 80% were non-fleet vehicles. Fleet-registered vehicles also accounted for 20% of crashed vehicles where fatigue was a crash factor (and 80% were non-fleet vehicles).

The involvement of speeding in crashes of fleet and non-fleet vehicles varied significantly as a function of crash severity ($\chi^2(2)=6.1$; $p<0.05$). The percentage of speeding crashes that involved fleet vehicles decreased as severity increased, from 20.1% of towaway crashes to 19.7% of injury crashes to 16.7% of fatal crashes. The involvement of fatigue in fleet and non-fleet vehicles in crashes did not differ significantly as a function of crash severity ($\chi^2(2)=1.6$; $p>0.05$).

The incidence of speeding and fatigue as a function of speed limit at the site of the crash is shown in Figure 1. The percentages of both fleet and non-fleet vehicles judged to have been speeding were higher in 100-110km/h speed zones than at lower speed zones (see Figure 1a). Fleet vehicles were less likely to be judged as speeding than non-fleet vehicles at each speed zone group (60 & below: ($\chi^2(1)=442$; $p<0.001$), 70-90: ($\chi^2(1)=120$; $p<0.001$), 100-110: ($\chi^2(1)=73$; $p<0.01$)). The percentages of both fleet and non-fleet vehicles where the drivers were judged to have been fatigued were higher at 100-110km/h speed zones than at lower speed zones (see Figure 1b). Fleet vehicle drivers were less likely to be judged to be fatigued than non-fleet vehicle drivers at each speed zone group (60 & below: ($\chi^2(1)=254$; $p<0.001$), 70-90: ($\chi^2(1)=53$; $p<0.001$), 100-110: ($\chi^2(1)=9$; $p<0.005$)).

Figure 2 shows the relative involvement of excessive speed and fatigue in crashes involving different types of vehicles. Emergency vehicles were most likely to be involved in crashes where excessive speed was noted as a crash factor, with taxis least likely (see Figure 2a). Fleet cars and fleet commercial vehicles were relatively less likely to be speeding than their non-fleet counterparts. A similar pattern was evident for fatigue, where fleet vehicle crashes are less likely to involve fatigue than fleet vehicles (see Figure 2b). One point of difference, though, was the substantially lower involvement of fatigue in emergency vehicle crashes compared to the involvement of speeding in these crashes.

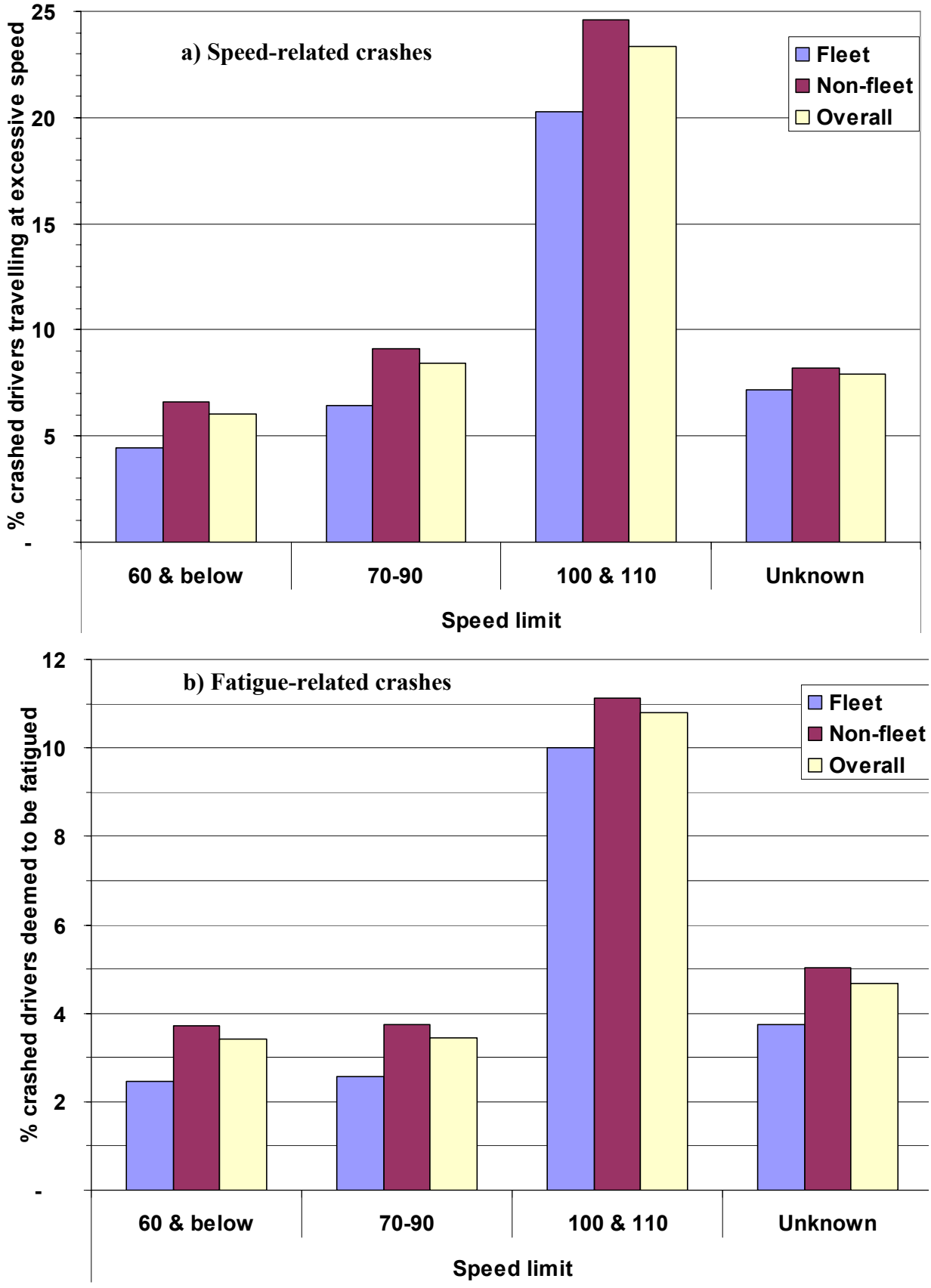

Figure 1. Percent of fleet and non-fleet vehicles in crashes where (a) speed and (b) fatigue were involved as a function of crash location speed limit.

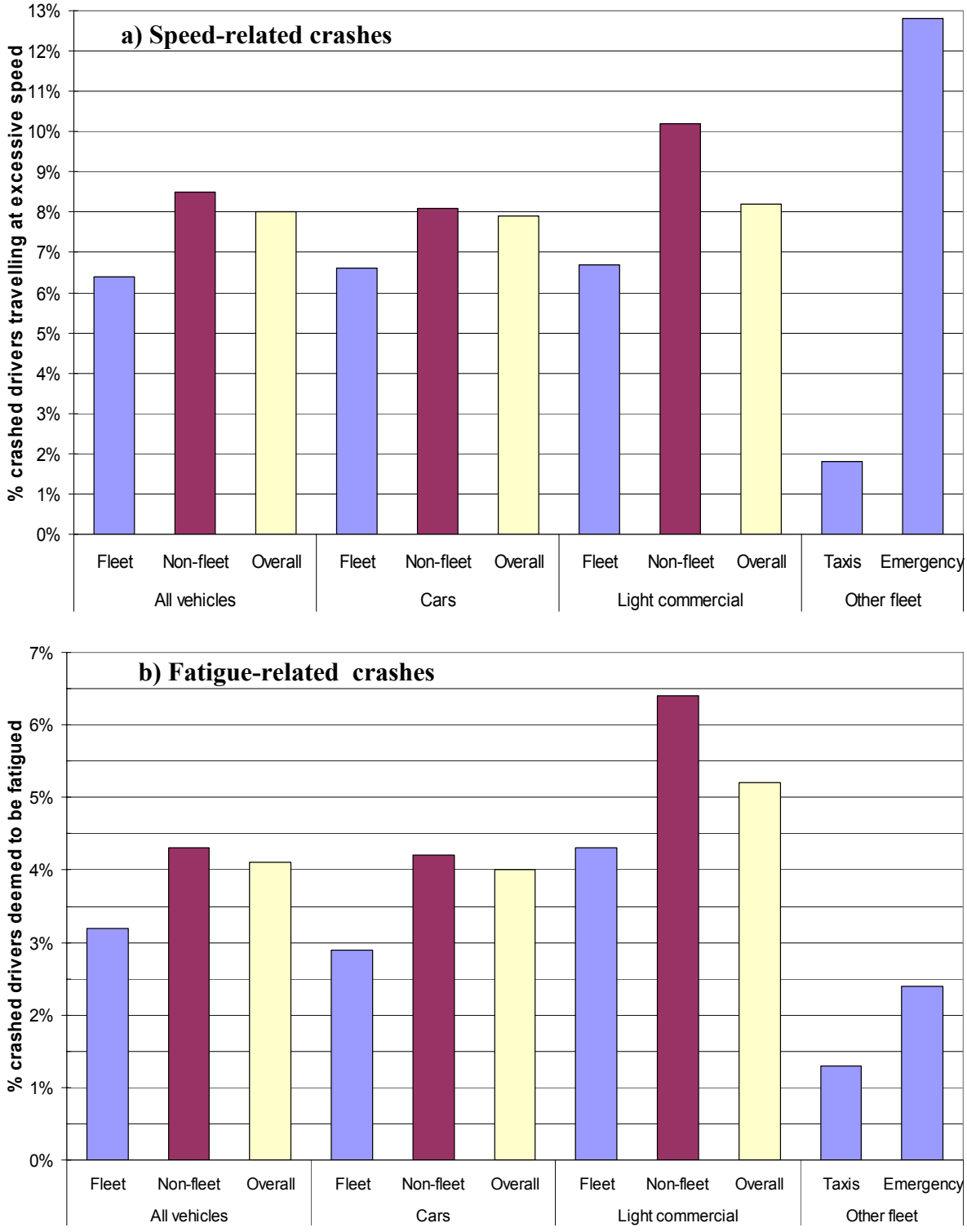

Figure 2. Percentages of crashed drivers in various fleet and non-fleet groups where (a) speed or (b) fatigue were involved as a crash factor.

Both gender and age are generally considered to be factors in relation to risky driving practices such as speeding. Of the crashes where excessive speed was noted as a factor, 77% of the crashed fleet drivers were male, compared with 68% for the non-fleet group (overall 70% of crashed speeding drivers were male); a statistically significance ($\chi^2(2)=190.9$; $p<0.001$). A similar pattern was evident for fatigue-related crashes, with males accounting for 77% of the crashed fleet drivers and 65% of

crashed non-fleet drivers (67% overall); again a significant difference ($\chi^2(2)=176$; $p<0.001$). Table 2 contains the percentage of drivers of various age groups involved in speed- and fatigue-related crashes.

Table 2. Age groups of crashed drivers of fleet and non-fleet vehicles in crashes where speeding or fatigue was involved.

Age group	Fleet		Non-fleet		Total	
	No.	%	No.	%	No.	%
			Speeding			
25 & under	2,079	33.1	12,388	49.0	14,467	45.8
26-39	1,927	30.7	6,158	24.4	8,085	25.6
40-59	1,550	24.7	3,395	13.4	4,945	15.7
60+	243	3.9	1,330	5.3	1,573	5.0
unknown	482	7.7	2,018	8.0	2,500	7.9
Total	6,281	100	25,289	100	31,570	100
			Fatigue			
25 & under	885	27.7	4,836	37.5	5,721	35.5
26-39	971	30.4	3,091	23.9	4,062	25.2
40-59	768	24.1	1,903	14.7	2,671	16.6
60+	168	5.3	1,053	8.2	1,221	7.6
unknown	401	12.6	2,027	15.7	2,428	15.1
Total	3,193	100	12,910	100	16,103	100

As demonstrated in Table 2, for both speed- and fatigue-related crashes, the age group 25 and under was most represented in crashes, with involvement decreasing with increasing age. However, there are differences between the fleet and non-fleet groups. For speed-related crashes the differences in involvement across the three younger age groups was less marked than that for non-fleet crashes – one-third of crashed fleet drivers was aged 25 or less, compared with almost half of the non-fleet crashed drivers. In relation to fatigue, the age group represented most in the fleet fatigue-related crashes are the 26-39 year-olds (30% of the crashed fleet drivers), whereas for non-fleet crashes it was the 25 and under age group. For both speed- and fatigue-related crashes the fleet versus non-fleet differences were statistically significant across age groups ($\chi^2(4)=783$;$p<0.001$ & $\chi^2(4)=290$;$p<0.001$ respectively).

The data does not indicate whether a vehicle was being used for work purposes at the time of the crash, only whether it was registered as a fleet or private vehicle. Accordingly, the crash patterns were examined as a function of the time of the day and day of the week at which the crash occurred. This "time category" was classified into commuting hours (7-9am and 4-6pm Monday to Friday), work hours (9am-4pm Monday to Friday), and non-work hours (all other hours – including weekends). Table 3 demonstrates the distribution of crashes as a function of this time category.

Table 3. Time category of fleet and non-fleet crashes where speeding or fatigue was involved.

Time category	Fleet		Non-fleet		Total	
	No.	%	No.	%	No.	%
			Speeding			
Commuting	987	15.7	3,467	13.7	4,454	14.1
Work	1,743	27.8	5,210	20.6	6,953	22.0
Non-work	3,549	56.5	16,608	65.7	20,157	63.8
Unknown	2	0	4	0	6	0
Total	6,281	100	25,289	100	31,570	100
			Fatigue			
Commuting	417	13.1	1,420	11.0	1,837	11.4
Work	708	22.2	2,139	16.6	2,847	17.7
Non-work	2,067	64.7	9,347	72.4	11,414	70.9
Unknown	1	0	4	0	5	0
Total	3,193	100	12,910	100	16,103	100

The most common time for speeding-related crashes for both fleet and fleet vehicles was during non-work hours (early mornings, evenings and weekends), although fleet speed-related crashes were relatively more likely to occur during commuting or working hours compared with non-fleet speeding-related crashes (see Table 3). The same pattern is evident for fatigue-related crashes. The prevalence of crashes during non-work hours might be expected simply because non-work time encompasses a greater number of hours. The difference between fleet and non-fleet car crashes in terms of time category for speed- and fatigue-related crashes was statistically significant ($\chi^2(3)=198$; $p<0.001$ and $\chi^2(3)=76$; $p<0.001$ respectively).

Discussion and Conclusions

Almost a quarter of vehicles registered in NSW are registered to fleets, and three-quarters of fleet registered vehicles belong to fleets that comprise ten vehicles or less. The severity profile for crashed fleet-registered vehicles was similar to that of crashed non-fleet vehicles.

Excessive speed was noted as a crash factor in less than 10% of crashes overall in NSW, and fatigue was considered a factor in less than 5% of crashes. Both factors were significantly less prevalent for fleet vehicle crashes than non-fleet crashes, a result consistent with Newnam, Watson and Murray's (2003) finding that drivers in Queensland were more likely exceed the speed limit in their personal vehicle than in a work vehicle. While it is likely that the current results are underestimations of the actual involvement of these risk factors (due to their definitions), the fleet/non-fleet comparison should be reliable.

The data did not allow the crash location to be identified as a rural or built-up area. Crash location speed zone, however, demonstrated that both excessive speed and fatigue-related crashes were most likely to occur in 100-110 km/h speed zones for fleet and non-fleet vehicles.

Not surprisingly, compared with other vehicle types, emergency vehicle crashes were most likely to involve excessive speed (but were less likely to involve fatigue). Non-fleet commercial vehicle (operationally defined as light trucks, utilities and panel vans) crashes were particularly likely to involve excessive speed and fatigue. Taxi crashes were least likely to involve either factor (although such crashes may be more likely to be low-speed and therefore less severe and less likely to be recorded in the crash database). Generally, fleet vehicle crashes were less likely than non-fleet vehicle crashes to involve excessive speed or fatigue, regardless of vehicle type.

Males are more represented in excessive speed and fatigue-related crashes for both fleet and non-fleet vehicles. Age is also a factor for both, with involvement generally decreasing with increasing age, although this is more marked for non-fleet crashes than fleet crashes, possibly suggesting that drivers provided with a vehicle as part of their occupation may be more likely to be older (and male).

Fleet drivers were slightly less likely to be involved in either speed- or fatigue-related crashes. However, as they are driving as part of their job, these drivers and their employers are subject to occupational health and safety provisions. Such considerations may be particularly pertinent for businesses who operate small fleets – a large proportion of the registered vehicle fleet in NSW. These operators may receive less attention from OH&S authorities and not have safe driving policies or guidelines in place.

Some measures that have been applied to the heavy vehicle industry could be considered for other fleet vehicles. For example, if a heavy vehicle is detected exceeding the speed limit in NSW by 15 km/h or more on three occasions within a three year period the vehicle's registration is suspended for one month. Owners and operators of heavy vehicles will be held increasingly responsible for the actions of their driving employees when Chain of Responsibility legislation is enacted across Australia in the near future.

It should be noted that the data analysed here does not directly identify crashes in work-related driving. Rather, it contains crashes involving "fleet vehicles" (as defined earlier). Many of these crashes will have occurred during work-related driving, a proposition supported by the finding that fleet crashes are more likely to occur during business hours. However, some "fleet vehicle" crashes will have occurred during commuting to and from work in fleet vehicles and some will have occurred during private use of these fleet vehicles. Additionally, some "non-fleet vehicle" crashes may have occurred during work-related use of private vehicles. Despite these limitations, the dataset is the largest and most comprehensive known source of information currently available in Australia about crashes in work-related driving.

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Acknowledgments

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