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ABSTRACT

This survey was designed to examine the proportion of vehicles fitted with bull bars in Adelaide, South Australia, at the sites where pedestrian crashes have occurred in the past. The sample was stratified to examine the prevalence in separate geographical regions of the metropolitan area of Adelaide. Survey results were combined using weights determined from the relative incidence of pedestrian crashes in the three survey strata. Overall, 8.6% of traffic was equipped with bull bars. Bull bar prevalence was much greater amongst heavy vehicles (28%), but heavy vehicles formed only a minor component of the traffic volume. The average site prevalence amongst light vehicle traffic was 7.5%. Site prevalence was lowest in the CBD (average 5.5%) and highest in the Outer Metropolitan Region (average 9.1%). Differences between the site prevalence in each region were statistically significant, and there was additional variation between sites within each region. 4WD vehicles are the most common vehicle type to have a bull bar fitted and 4WD vehicles with bull bars are twice as prevalent at the sites of crashes as the next most common type of bull bar equipped vehicle, work utilities.

KEYWORDS

Bull bar, Survey, Pedestrian, Road Accidents

Contents

1 Introduction

Casual observation will confirm that bull bars are a common addition to many passenger and other light vehicles in Australian cities. Previous research on the impact characteristics of current bull bar designs show that many bull bars pose a danger to pedestrians and vulnerable road users in a crash. In 2006 we published findings (Anderson et al., 2006) that showed that metal bull bars, and steel bull bars in particular, are likely to cause serious injury in crashes with pedestrians, and that most of the bull bars tested were more dangerous than the fronts vehicles to which the bull bars were attached.

The prevalence of bull bars in pedestrian crashes is difficult to establish from crash records. Crash reporting systems are not always suited to this task; for example, the crash reporting system in South Australia – the Traffic Accident Reporting System (TARS) – does not record whether or not a vehicle was fitted with a bull bar.

Chiam and Thomas (1980) conducted bull bar counts in Melbourne and estimated a bull bar prevalence of between 0.7 and 0.92 percent of all traffic. In 1996, the Federal Office of Road Safety estimated that bull bars were involved in 12% of fatal pedestrian collisions but may have been involved in as many as 20% (FORS, 1996), although it is not clear how the latter estimate was arrived at. More recently Attewell and Glase (2000) used Australian national fatality data to try and estimate the effect of bull bars on fatality statistics. They were not able to draw firm conclusions due to the incompleteness of the bull bar status of vehicles in their fatality database. Furthermore, there were (and are) few data on bull bar fitment rates, and that made it difficult to estimate risks associated with bull bar fitment.

Kloeden, White and McLean (2000) examined South Australian Coroner's records of pedestrian fatalities that occurred between 1991 and 1997, and found that bull bars were fitted to 8.8% of vehicles involved in fatal pedestrian crashes. In their report, they noted that in around half of the cases, while the bull bar was often implicated in the specific injuries that the pedestrian received, the outcome of the crash (fatality) was probably not affected by the presence of the bull bar.

In this study, we observed traffic at a representative sample of pedestrian crash locations, and estimated the prevalence of bull bars in the passing traffic.

This report comprises several sections.

- First the survey design is explained. The survey used a stratified sampling scheme to estimate bull bar prevalence in three geographical regions around Adelaide. The survey sites were the locations of a random selection of pedestrian crashes that occurred in metropolitan Adelaide in 2005. To combine survey results, weighting the results of each stratum is necessary to account for the relative incidence of pedestrian crashes in each stratum.
- Next, the characteristics of the survey sites and their associated crashes are reported to establish their representativeness.
- Thirdly, the survey results are presented, disaggregated and combined in different ways to draw out the main findings of the study.
- Finally the results are briefly discussed.

2 Method

2.1 Survey population and sample

The aim of the sampling procedure was to identify a random sample of locations at which pedestrian crashes have occurred. Pedestrian crash sites are unevenly distributed across the Adelaide region and it was thought that their characteristics might vary with geographical region too. Therefore, a stratified sampling procedure was employed such that an equal number of locations were sampled from three geographical regions. The three regions were the central business district, an inner metropolitan region consisting of locations within 10 km of the Adelaide GPO (which is at the geographical centre of the city), and an outer metropolitan region consisting of locations more than 10 km from Adelaide GPO, but within the Adelaide metropolitan area. These sampling strata are shown in Figure 2.1.

Figure 2.2 shows the cumulative distribution of distances from the Adelaide GPO of the locations of pedestrian crashes in South Australia in 2005. Around 65% occurred within 10 km of the centre of Adelaide, and 90% within 40 km (source: the SA Traffic Accident Reporting System – see next Section). Around 74% of pedestrian crashes occurred in the Adelaide statistical division. The population of Adelaide accounts for 73% of the population of South Australia (Australian Bureau of Statistics, 2006).

2.2 Relative numbers of crashes occurring in the sampling strata

The relative proportions of pedestrian crashes that have occurred in the three strata were determined. These proportions provide weights that allowed the combination of the results from each stratum. Weighting the results allowed us to estimate the prevalence of bull bars in pedestrian crashes in Adelaide.

The South Australian Traffic Accident Reporting System was queried to determine the numbers of pedestrian crashes occurring in the three sampling strata in 2005. Crashes were included if a pedestrian required some medical treatment. Crashes were selected that had occurred on roads with speed limits greater than 20 km/h and not in car parks. Crashes of any type were included as long as the record included at least one pedestrian casualty. (Consequently, a few crashes were included where the crash was not coded as a pedestrian crash in TARS, but where a pedestrian was struck, usually after the primary collision.) The crashes were stratified according to the location criteria described in Section 2.1. The algorithm used the following logic:

- If a crash had a known location and was coded as occurring in the local government area of the Adelaide City Council, it was categorised as having occurred in the central business district (CBD) (Stratum 1).
- If the crash had a known location, but was not within the CBD, but occurred within 10 km of the GPO, it was categorised as having occurred in the Inner Metropolitan Region (Stratum 2).
- If the crash had a known location but occurred 10 km or more from the GPO, and was coded as having occurred in a local government association within the Adelaide Statistical Division, it was coded as having occurred in the Outer Metropolitan Region (Stratum 3).

In 2005, 23.3% of pedestrian casualty crashes (with known locations) in the Adelaide Statistical Division occurred in the CBD, 48.8% in the Inner Metropolitan Region and 27.9% in the Outer Metropolitan Region. These proportions were used as weights when combining the results of the survey results of the three individual sampling strata. The period 2004-2006 was also examined, and crashes occurring in this period produced nearly identical weights.

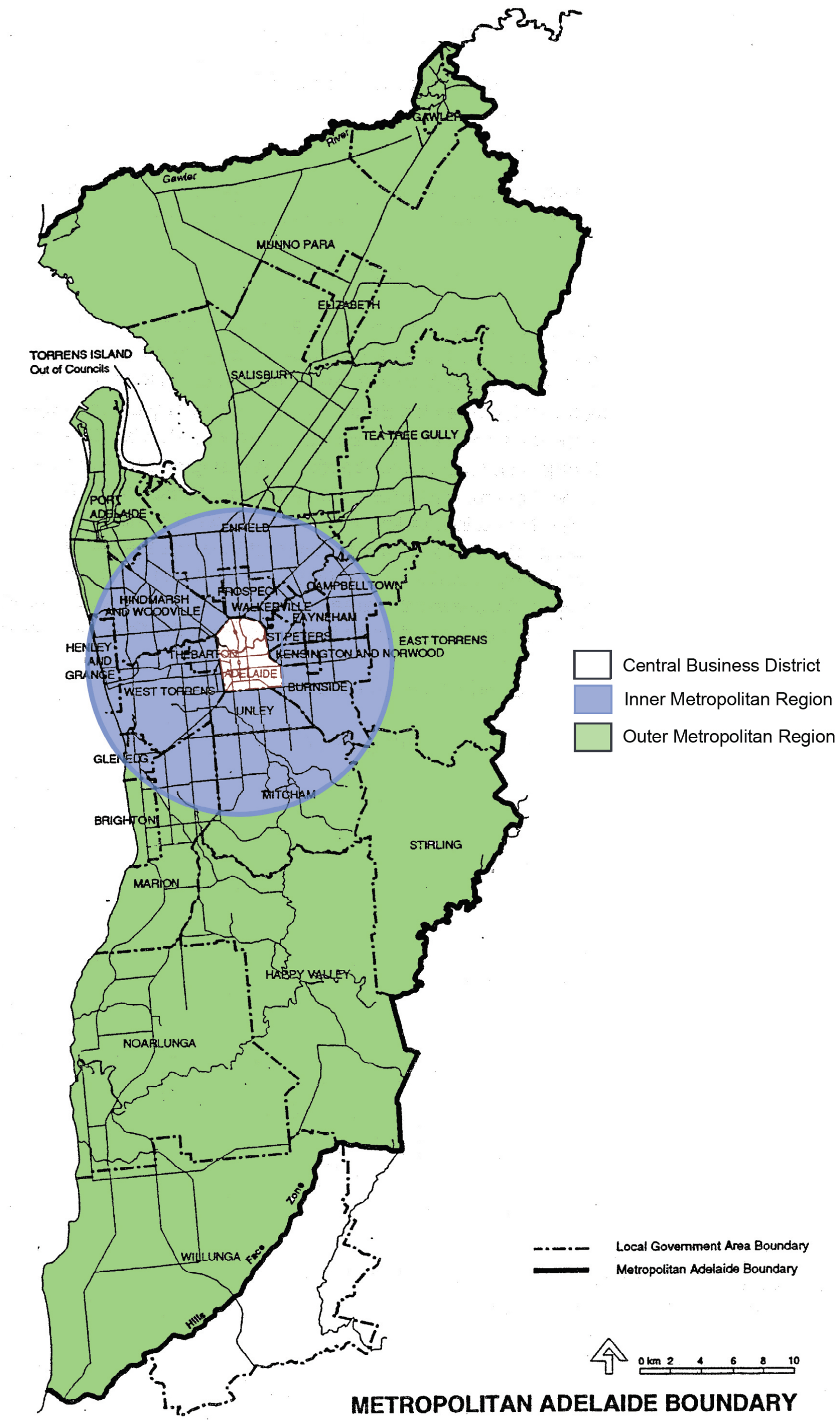

Figure 2.1
The three sampling strata chosen within the Adelaide Metropolitan Boundary
(Source: Atlas of South Australia (http://www.atlas.sa.gov.au) 2007)

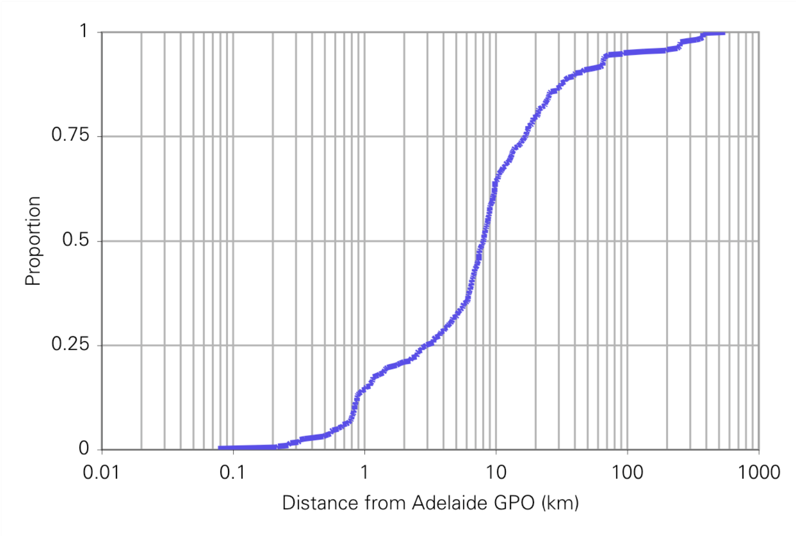

Figure 2.2
Cumulative distribution of the distance from the Adelaide GPO of the location of South Australian pedestrian crashes in 2005 (known locations only; speed limit > 20 km/h, any crash where the number of pedestrians involved was at least 1; severity at least requiring treatment by a doctor or a fatality; source South Australian Traffic Accident Reporting System)

2.3 Selection of survey sites and observation day-of-week and time-of-day

As mentioned previously, survey locations and times were a stratified random sample of the location, day-of-week and time-of-day of pedestrian crashes in Adelaide. A randomly ordered but complete list of all crashes resulting in a pedestrian casualty was extracted from TARS for the year 2005 where the severity was coded either as 'Doctor Treated', 'Hospital Treated', 'Hospital Admitted' or 'Fatality'. This yielded a list of 465 individual pedestrian crash locations across South Australia. (Note that not all crashes have a location encoded.) These individual crash locations were then categorised according to the stratum in which they fell, based on the criteria described above, and those falling outside the Adelaide statistical division were discarded.

The crashes considered for selecting survey sites were those where a passenger car, or passenger car derivative, was involved in a collision with a pedestrian. A total of 344 crashes resulting in at least one pedestrian casualty (with known locations) in 2005 fell within the three strata used in the survey (74% of all pedestrian casualty crashes in South Australia).

As the primary focus of the study was bull bar prevalence in the light vehicle fleet in the traffic stream, crashes involving buses, trucks, or motorcycles were excluded as were cases where vehicles were reversing out of car parks on main thoroughfares or where vehicles were moving from a parked position. Crashes that occurred on no-through roads or on roads that led to car parks were also excluded.

Ten survey sites within each of the three survey strata were selected from the randomised list, starting at the top of the list and working down until ten locations in each stratum had been selected. The survey locations and times are shown in Table 2.1.

Table 2.1
The location, time-of-day, day-of-week and survey date of each of the survey locations

	Survey	Location	Time	Day	Survey Date	Speed Limit
Central Business District	101	North Terrace, Adelaide	11:55	Friday	20/7/2007	50
	102	West Terrace, Adelaide	13:20	Tuesday	24/7/2007	60
	103	Frome Road, Adelaide	8:30	Monday	6/8/2007	50
	104	Grote Street, Adelaide	12:30	Friday	17/8/2007	50
	105	Pulteney Street, Adelaide	13:50	Friday	24/8/2007	50
	106	King William Road, Adelaide	15:55	Friday	24/8/2007	50
	107	King William Street, Adelaide	23:35	Saturday	25/8/2007	50
	108	Hindley Street, Adelaide	1:30	Sunday	9/9/2007	50
	109	Waymouth Street, Adelaide	19:15	Friday	14/9/2007	50
	110	Melbourne Street, North Adelaide	8:20	Monday	17/9/2007	50
Inner Metropolitan Region	201	Torrens Road, Croydon Park	15:10	Thursday	19/7/2007	60
	202	Marion Road, Plympton	13:15	Friday	23/7/2007	60
	203	South Road, Clovelly Park	16:20	Monday	30/7/2007	60
	204	O.G. Road, Klemzig	16:15	Tuesday	31/7/2007	60
	205	Hampstead Road, Clearview	9:55	Wednesday	1/8/2007	60
	206	Poole Avenue, Hampstead Gardens	15:05	Wednesday	8/8/2007	50
	207	Holbrooks Road, Underdale	19:30	Thursday	30/8/2007	60
	208	Marion Rd, Ascot Park	16:10	Friday	31/8/2007	60
	209	Greenhill Rd, Unley	20:15	Monday	3/9/2007	60
	210	Seaview Road, Henley Beach	0:01	Sunday	8/9/2007	50
Outer Metropolitan Region	301	Dyson Road, Lonsdale	16:10	Thursday	26/7/2007	80
	302	South Rd, Seacombe Gardens	13:30	Wednesday	15/8/2007	70
	303	John Rice Avenue, Elizabeth Vale	16:00	Wednesday	15/8/2007	60
	304	Andrew Smith Drive, Parafield Gardens	15:30	Friday	17/8/2007	50
	305	Noarlunga - Victor Harbor Road, McLaren Vale	6:45	Wednesday	22/8/2007	100
	306	Flaxmill Road, Christie Downs	21:30	Saturday	25/8/2007	60
	307	Panalatinga Road, Morphett Vale	8:50	Tuesday	28/8/2007	80
	308	Shepherdson Road, Parafield Gardens	15:25	Friday	14/9/2007	50
	309	Park Terrace, Salisbury	18:15	Friday	14/9/2007	50
	310	Esplanade, Port Willunga	1:20	Saturday	29/9/2007	50

2.4 Characteristics of survey sites and associated crashes

The resulting sample of locations and crashes was checked against general characteristics of all pedestrian crashes in 2005. Figure 2.3 shows the proportion of observation periods by hour-of-day, and the proportion of pedestrian crashes that occurred in 2005 in Adelaide according to the hour of the day of the crash.

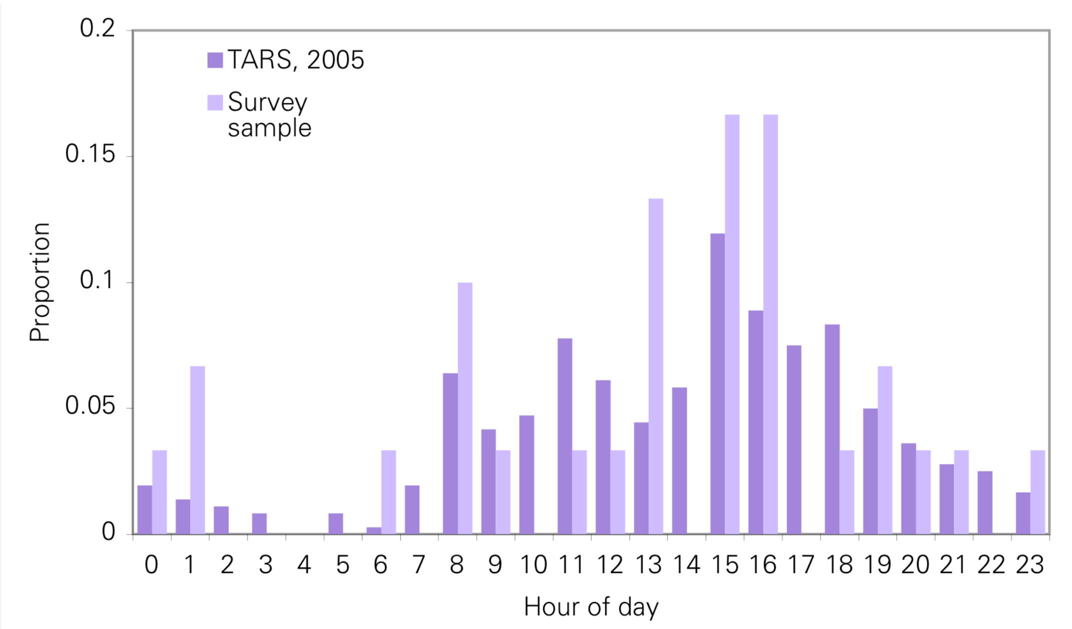

Figure 2.3
Hour-of-day of all pedestrian crashes in Adelaide during 2005, and the hour -of-day of the observations (known locations only; speed limit > 20 km/h, any crash where the number of pedestrians involved was at least 1; severity at least requiring treatment by a doctor or a fatality; source South Australian Traffic Accident Reporting System)

Figure 2.4 shows the proportions of survey locations with speed limits of 25 km/h, 40 km/h, 50 km/h, 60 km/h 70 km/h, 80 km/h, 90 km/h and 100 km/h. Also shown are the proportions of pedestrian crashes that occurred or roads with these speed limits in 2005 in Adelaide.

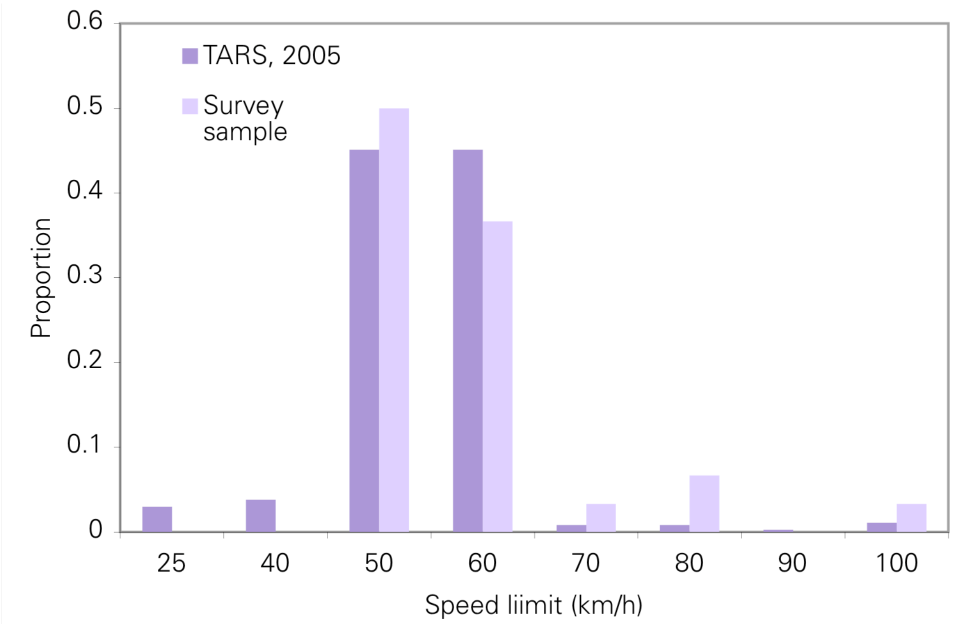

Figure 2.4
Proportion of survey locations with speed limit at the location of all pedestrian crashes in Adelaide during 2005, and that of the sample used to define observation locations (known locations only; speed limit > 20 km/h, any crash where the number of pedestrians involved was at least 1; severity at least requiring treatment by a doctor or a fatality; source South Australian Traffic Accident Reporting System)

The distribution of survey locations by road type is shown in Table 2.2. A current version of the Adelaide UBD Street Directory was used to classify the road at each location (UBD, 2007).

Table 2.2
Number of survey locations BY specific road types

Road Type (UBD definition)	Number of Survey Locations
Main Route	25
Alternate Route	3
Trafficable Road	2
Total	30

3 Data collection

Observations of the traffic at each location were made for 40 minutes; 20 minutes each side of the time of the associated pedestrian crash. The survey included all vehicles in all traffic lanes in the same direction as the vehicle involved in the crash. Traffic at survey locations during daylight hours (and some night hours) was also recorded on video: recordings of twenty five of the thirty surveys were made and have been archived.

Two research officers collected all of the survey data. One person used two 'click' type counters with a range from 0 to 9999: one counter for recording the total number of passenger vehicles and other light vehicles, and the other counter for recording the total number of heavy vehicles. Light vehicles included all vehicles that can be driven with a car licence but whose mass is no greater than that of a South Australian Ambulance (Mader Mercedes Benz, Type 2MB Ambulance) – 2680 kg. Small mini-busses such as the Toyota Hiace are included in the light vehicle category, but larger commercial mini-busses were included in the heavy vehicle category. Any vehicle requiring a Rigid vehicle licence or Combination vehicle licence was designated a heavy vehicle.

The second person used a survey sheet, and recorded information on vehicles that had any sort of commercially produced 'frontal protection device' (typical bull bar, nudge bar or grille protection bar). The survey sheet is included in Appendix A.

Other frontal attachments that were fitted to a vehicle (including *ad hoc* steel modifications that enabled supporting stanchions to be used as part of a extended roof rack) were also noted, but were not included in the count of bull bars.

The observer recorded the predominant material that the bar had been manufactured from: steel, alloy or plastic. This task was difficult in some instances but a best assessment was made for each bull bar, based on prior physical examination of several bull bar types and the study of bull bar product brochures.

There were two main attributes that were used to characterise the type of metal bull bar. The first of these was colour. Generally if a bull bar had a metallic finish it was judged to be an alloy bar. If it was painted a colour other than silver (usually black), it was judged to be a steel bull bar. If the colour of the bull bar was not sufficient to judge the type, the bull bar's geometry was noted: if the observed bull bar had a large diameter top bar and no or only a small amount of metal plate, it was judged to be an alloy bull bar. If it had a smaller diameter top bar or significant use of plate metal it was judged as steel. Finally, manufacturing methods of bull bars could also help identify type: bumper sections of steel bar are generally pressed or folded sections compared with alloy bumper sections that tend to be extruded or stamped.

Plastic bull bars were identified from the colour, finish and geometry. Distinctively, many rotationally moulded plastic bull bars are moulded as a single part.

Vehicles were classified as being either a passenger car or derivative, four-wheel-drive vehicle (4WD)/sports utility vehicle (SUV), work-utility, van, truck (all truck type vehicles), or bus/mini bus (excluding public transport buses).

Passenger cars and derivatives included all vehicles having the frontal geometry of a typical passenger vehicle. This included taxi-cabs, as well as all-wheel-drive vehicles such as the Subaru Forester. Low-to-the-ground utility vehicles such as Holden 1-tonne utilities were also defined as a 'passenger car or derivative' for this purpose because of their frontal geometry (this classification may not apply for other purposes). Four-wheel-drive vehicles (4WD)/sports utility vehicles (SUV) included all high-off-the-ground wagon style vehicles (eg. Mitsubishi Pajero, Ford Territory). Work utilities included all commercial style cab-chassis vehicles with a tray, or tray and canopy (e.g. Toyota Hilux 4x4 cab chassis). Vans included all forward control passenger vehicles and commercial vans (ambulances were the limiting case). Trucks included all rigid and articulated truck type vehicles, including light trucks and prime movers. Buses included all large passenger transport vehicles excluding public transport buses.

4 Results

4.1 Traffic volume weighted prevalence of bull bars at pedestrian crash sites

Table 4.1 shows the number of vehicles observed, and those with bull bars, categorised by vehicle size for the three sampling strata, and the weighted total. (See Section 2.2 for details on the weights applied to the data.) Note that the percentage of vehicles in each stratum with bull bars is the traffic-volume weighted average and is therefore more strongly influenced by higher traffic-volume sites. The percentages can be thought of as the average prevalence of bull bars among vehicles passing the sites of pedestrian crashes in Adelaide.

Table 4.1
Totals for vehicle categories counted in each region and the corresponding bull bar prevalence

Vehicle Category		CBD	Inner Metro. Region	Outer Metro. Region	Weighted Average
Light vehicles	Number of vehicles	5424	4614	3886	
	Number of bull bars	309	366	373	
	Percentage of vehicles with bull bars	5.7%	7.9%	9.6%	7.9%
Heavy vehicles	Number of vehicles	118	201	136	
	Number of bull bars	24	57	47	
	Percentage of vehicles with bull bars	20.3%	28.4%	34.6%	28.2%
All vehicles	Number of vehicles	5542	4815	4022	
	Number of bull bars	333	423	420	
	Percentage of vehicles with bull bars	6.0%	8.8%	10.4%	8.6%

The proportion of all vehicles observed in the Outer Metropolitan Region with bull bars was 10.4%. This region also had the lowest total traffic volume (28.0% of the total traffic volume in the survey). The central business district had the highest traffic volume recorded (38.5% of total traffic volume in the survey) and had the lowest prevalence of bull bars: 6.0%. The Inner Metropolitan Region had a bull bar prevalence of 8.8% and 33.5% of the total traffic volume.

The higher rates of fitment on heavy vehicles observed at the survey sites are notable. However, it is also notable that they are a relatively minor component of the traffic volume and the high fitment rates have a relatively small effect on the overall traffic-volume weighted prevalence of bull bars.

4.2 Prevalence of bull bars on light vehicles at pedestrian crash sites

This section examines the results of the survey relating to light vehicles only. The relatively low number of heavy vehicles at each site precludes analysis beyond the main findings mentioned in the previous section.

The proportions of light vehicles with bull bars at the individual sites are given in Table 4.2. At one site, no vehicles were observed, and thus that site is omitted from further consideration. There are statistically significant differences between sites in the proportions, and the differences are partly, but not wholly, associated with the geographical classification into CBD / Inner Metropolitan Region / Outer Metropolitan Region. The small differences between the average proportions of the sites in Table 4.2

and the traffic-volume weighted proportions in Table 4.1 occur because there was a slight tendency for sites with more traffic to have a greater proportion of bull bars.

Regarding the differences between the three geographical groups, a one-way analysis of variance of the percentage with bull bars (3 groups, with respectively 10, 10, and 9 observations) rejected the hypothesis of the three geographical areas having equal mean proportions of light vehicles with bull bars.

Now consider differences between sites within each geographical region. We conducted a chi-squared test on the counts of vehicles with and without bull bars by region. This test would show whether the sites within each region were statistically different from one another. The test was statistically significant for the CBD and the Outer Metropolitan Region, and nearly so for the Inner Metropolitan Region, indicating that it was unlikely that the variation in the proportion of bull bars among survey sites within each region was due to chance. We checked whether using distance from the centre of Adelaide as a predictor might eliminate the statistically significant differences between sites, and found this was not the case. Notwithstanding this, there was a correlation between the distance from the GPO and the proportion of light vehicles fitted with bull bars. This correlation was statistically significant, but can only explain a minority of the variation in the results between sites.

The highest proportion of vehicles with a bull bars at a single site was 21% at an Outer Metropolitan Region site. This site also had the highest speed limit (100 km/h) and no pedestrian traffic was observed during the survey period. The lowest proportion of vehicles observed with bull bars was a CBD site (1.9% of the traffic observed at the site). This site was surveyed at night and is a known popular ‘night-spot’. It appeared to have one of the highest densities of pedestrians of all sites surveyed, and the highest proportion of taxi cabs (which rarely have bull bars) of all the sites.

4.3 Vehicle type and bull bar material

The light vehicle type that accounted for the highest proportion of bull bars in the survey sample was the 4WD/SUV. Within the CBD, over half of the vehicles observed with bull bars were 4WD/SUV vehicles, and they were 40% and 41% of the vehicles observed with bull bars in each of the other survey strata (Table 4.3).

Metallic bull bars accounted for the great majority of all bull bar types. Our observations suggest that alloy bull bars were the most common type (Table 4.4). A total of 791 (67.3% of the vehicles fitted with a bull bar in the survey sample) were judged to have had an alloy bull bar. Only 4.3% of the vehicles observed were fitted with a plastic bull bar and were most common on passenger car type vehicles (17% of passenger cars with bull bars had plastic bull bars). The remaining 28.5% of light vehicles with bull bars had steel bars.

Separate observations of other frontal modifications, such as steel bars fitted to vehicles to mount lights or vertical steel bars to extend the capability of roof racks were also made. In total there were 54 ‘other’ frontal modifications noted. These were generally observed on, but not limited to, work utilities and 4WD/SUV vehicles.

Table 4.2
Bull bar prevalence among light vehicles observed at each survey site.

Site	Light vehicles with bull bars	Total number of light vehicles	Percentage with bull bars (standard deviation)
101	46	606	7.6%
102	70	1149	6.1%
103	30	787	3.8%
104	45	647	7.0%
105	28	485	5.8%
106	46	533	8.6%
107	17	541	3.1%
108	5	263	1.9%
109	7	112	6.3%
110	15	301	5.0%
CBD Mean			*5.5% (2.1%)*
201	34	437	7.8%
202	59	619	9.5%
203	61	836	7.3%
204	41	508	8.1%
205	52	467	11.1%
206	12	182	6.6%
207	19	297	6.4%
208	67	820	8.2%
209	17	366	4.6%
210	4	82	4.9%
Inner Metropolitan Region mean			*7.4% (2.0%)*
301	89	775	11.5%
302	104	1098	9.5%
303	25	303	8.3%
304	9	150	6.0%
305	49	252	19.4%
306	3	73	4.1%
307	44	629	7.0%
308	17	225	7.6%
309	33	381	8.7%
310	0	0	-
Outer Metropolitan Region mean			*9.1% (4.4%)*
Weighted mean (weighted standard deviation)			*7.5% (3.0%)*

Table 4.3
Number of vehicles with bull bars by vehicle type in each sampling stratum

Vehicle type	Number and column percentages					
	CBD		Inner Metro. Region		Outer Metro. Region	
4WD/SUV	172	(51.7%)	169	(40.0%)	172	(41.0%)
Bus	3	(0.9%)	1	(0.2%)	4	(1.0%)
Passenger car	42	(12.6%)	62	(14.7%)	50	(11.9%)
Truck	21	(6.3%)	56	(13.2%)	43	(10.2%)
Van	27	(8.1%)	54	(12.8%)	44	(10.5%)
Work Utility	68	(20.4%)	81	(19.1%)	107	(25.5%)
Total	333	(100.0%)	423	(100.0%)	420	(100.0%)

Table 4.4
Numbers and proportions of vehicles by type of bull bar in all strata

Vehicle type	Number and row percentages							
	Alloy		Steel		Plastic		Total	
4WD/SUV	385	(75.0%)	121	(23.6%)	7	(1.4%)	513	(100.0%)
Bus	7	(87.5%)	1	(12.5%)	0	(0.0%)	8	(100.0%)
Passenger car	91	(59.1%)	37	(24.0%)	26	(16.9%)	154	(100.0%)
Truck	105	(87.5%)	9	(7.5%)	6	(5.0%)	120	(100.0%)
Van	57	(45.6%)	67	(53.6%)	1	(0.8%)	125	(100.0%)
Work Utility	146	(57.0%)	100	(39.1%)	10	(3.9%)	256	(100.0%)
Total	791	(67.3%)	335	(28.5%)	50	(4.3%)	1176	(100.0%)

5 Discussion

Currently, the South Australian Traffic Accident Reporting System does not contain the information needed for a direct estimate of the prevalence of bull bars in pedestrian crashes. The presence of a bull bar is not coded and appears to be is inconsistently recorded in the free text description of the crash.

This survey has estimated the prevalence of bull bars in the vehicle fleet at the locations and time-of-day and day-of-week of pedestrian crashes in Adelaide, South Australia and the average prevalence at those sites. Having done so, we estimate that around 7.5% of crashes involving a light vehicle involve a vehicle equipped with a bull bar. This assumes that the risk of receiving an injury requiring *some* medical treatment is not affected by the presence of a bull bar. The great majority of pedestrian crashes reported to police (around 99%) are casualty crashes (South Australian Traffic Accident Reporting System), and so we should consider that our sites might have been biased toward sites with high bull bar prevalence. However, because the measured prevalence of bull bars is low, even a considerable increase in risk of injury is unlikely to have distorted our results in any significant way.

In many pedestrian crashes, the presence of a bull bar is likely to make the severity of any injuries to the pedestrian worse. Previous testing has shown that a bull bar is generally more likely to cause severe injuries to a pedestrian in a crash than the front of a vehicle (Anderson et al., 2006; Lawrence, Rodmell and Osborne, 2000). While this is not always the case for plastic bull bars, they appear to constitute only a small proportion of the bull bars fitted to vehicles in Adelaide – around 4% of all bull bars.

Fitment rates to heavy vehicles (excluding public transport buses) were high – 28% overall. However, their relatively small contribution to the overall traffic volume at pedestrian crash sites meant that the high prevalence of bull bars on heavy vehicles did not greatly affect the overall prevalence of bull bars at these sites. We cannot quantify how much difference bull bars make on the outcome of pedestrian crashes with heavy vehicles.

At the outset of the survey, we had no reason to expect that there would be differences between sites in the proportion of the light vehicle fleet fitted with bull bars. One aspect of the results is that there were notable statistical differences between sites. Stratification of the sites was performed to take account of any broad differences across regions of the survey area, and having found a difference between strata, we can explain some of the variation between sites, but much of the difference remains unexplained by our results. Despite this, the overall proportion of vehicles fitted with bull bars is a useful figure, but it should be recognised that it may be unsuitable as an estimate of bull bar prevalence at any particular place in Adelaide at any particular time and day.

The variation in the proportions of vehicles fitted with bull bars across different sites suggests that any future study on the characteristics some aspect of vehicle design amongst the traffic should take care to choose observation points in some defensible way as was done for this survey.

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The views expressed in this report are those of the authors and do not necessarily represent those of the University of Adelaide or the sponsoring organisations.

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Appendix A – Survey sheet

Location					
Start Time		Finish Time		Date	
total traffic <3.5T		total traffic >3.5T		recorded by	
Bull Bar Information Recorded By		Total Traffic			

	Bull Bar Type			Vehicle Type					
No	Steel	Alloy	Plastic	4WD/SUV	Work Ute	Van	Truck	Sedan	Bus
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
ST1									