

**INQUIRY INTO PEDESTRIAN SAFETY
(MINISTERIAL REFERENCE)**

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TABLE OF CONTENTS

	Page
Part 1: Introduction	3
Part 2: Analysis of Pedestrian Casualty Trends	5
Part 3: Pedestrians & Speed	55
Part 4 : Pedestrian Safety Countermeasures	57
4.1 Safer Roads – Engineering and traffic measures	57
4.2 Safer People – Behavioural measures	72
4.3 Safer Vehicles – Motor Vehicle measures	76
Part 5: Additional Strategies to increase pedestrian safety	87
5.1 New Technologies and Pedestrian Safety	87
5.2 Pedestrian Countdown Timers	97
5.3 Observation of Pedestrian Behaviour	98
Part 6: Impact of Urban Planning and Urban Design on Pedestrian Safety	99
Part 7: Emerging Risks and Exposures	101
Part 8: References:	102
<i>Appendix 1 :</i>	Characteristics of pedestrian fatalities and injuries for the most recent five year period (2004 to 2008) <i>2009 Pedestrian Crash data</i>
<i>Appendix 2 :</i>	Summary for each pedestrian fatality that has occurred in NSW during the first five months of 2009
<i>Appendix 3 :</i>	Sample of RTA Technical Directions relating to pedestrian facilities or issues.
Appendix 4 :	Growth Centres Report

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TERMS OF REFERENCE

STAYSAFE INQUIRY INTO PEDESTRIAN SAFETY

In May 2009, the Minister for Roads requested the Staysafe Committee to undertake an investigation into pedestrian safety.

The table below provides a reference point for each of the Staysafe Inquiry terms of reference within the RTA submission.

Terms of Reference	Location/Reference in RTA Submission
Short and long terms trends in pedestrian injuries and fatalities in metropolitan and non- metropolitan areas	Part 2
Underlying causes of pedestrian injuries and fatalities	Part 2
The incidence of drivers leaving the scene of the accident after hitting pedestrians	Part 2; and Refer to NSW Police
Effectiveness of recent measures to address pedestrian safety	Parts 2, 3 & 4
Additional strategies to increase pedestrian safety	Part 5
The current emphasis placed on pedestrian road users as part of land use policies and in the planning and management of the road system	Part 6
Pedestrian safety issues and strategies in other jurisdictions	Part 2
Any other related matters	Part 7

PART I – INTRODUCTION

On 4 May 2009, the Minister for Roads requested the Staysafe Committee to undertake an investigation into this year's rise in pedestrian fatalities. The Minister noted the rise this year in the number of fatalities and that a significant proportion of this increase relates to pedestrians.

On 13 May 2009, Staysafe requested a submission from RTA addressing the specific terms of reference. This submission focuses on casualty crash trends in 2004-2008 and the trends in 2009 (noting the small sample and very preliminary nature of the data).

The NSW Government is strongly committed to improving road safety amongst all road users. The 2008 road toll of 395 fatalities was the lowest loss of life on the roads since 1944 and a 9 per cent reduction on the previous year. 2008 was the sixth year in a row the road toll has gone down in NSW which hasn't happened since records began 100 years ago. This is despite there being 15 times as many vehicles, 11 times as many licensed drivers and double the population on our roads since 1944.

NSW is the only state to have achieved consecutive reductions in the toll for the past six years. The 2008 fatality rate of 5.7 deaths per 100,000 population is the lowest since records began in 1908 and the NSW fatality rate is now the lowest amongst all the Australian States.

The 2008 road toll represents a saving of nearly a thousand lives compared with 1978 which saw 1,384 people killed on NSW roads. The important partnership between the RTA and NSW Police has been essential in that reduction through targeting key issues such as speeding, drink driving and pedestrian safety.

However the RTA is very concerned about the recent increase in the NSW road toll. During the first five months of 2009, there were 195 deaths on NSW roads, 52 (36%) more than for the same period in 2008. This rising trend requires close monitoring and analysis of the factors involved in crashes as well as further road safety initiatives and Police enforcement.

The RTA places a very strong focus on pedestrian safety and implements a wide range of programs (and projects) that deliver pedestrian safety benefits. RTA Programs providing safety benefits include:

- NSW Centre for Road Safety Programs
- NSW Road Environment Safety Program
- Local Area Traffic Management Program
- Traffic Control Facilities Program
- Network Upgrading and Maintenance Programs
- Major projects

This submission outlines the wide range of initiatives being undertaken by RTA to facilitate improved pedestrian safety.

The RTA places a very strong emphasis on road safety. The NSW Centre for Road Safety (CRS) was formed in 2007 and formally established in 2008. The CRS structure is based on the four pillars of the safe system approach including:

- Safer People
- Safer Roads;
- Safer Vehicles; and
- Road Safety Technology

The RTA is actively implementing the '*Safe System Partnership*' approach to road safety. This approach is being adopted at a national level and used by the world's best performing road safety performers.

The Centre's role is underpinned by the RTA's *Safe System Partnership* approach to road safety; a logical framework which examines road safety elements and their interactions. It encourages a new perspective on responsibility for road safety; requiring those who design and manage the road system to be specifically accountable for the safety performance of the network, and that the design of vehicles and road environments must be undertaken on the basis of human limitations.

The RTA policy *Mainstreaming road safety across the RTA* acknowledges the RTA's *Safe System Partnership* approach by requiring RTA business areas to contribute to, and be accountable for, improved road safety outcomes and engage in active partnerships with the Centre.

Another key element of the RTA's *Safe System Partnership* approach is the emphasis that is placed on partnerships with road user and partner organisations. The Centre must provide strategic leadership to external partner organisations, the NSW community and internal RTA business areas to influence road safety outcomes."

PART 2 – ANALYSIS OF PEDESTRIAN CASUALTY TRENDS

Background

After six years of reductions in the NSW road toll, the RTA crash data indicated that there was a reversal in this trend during the early months for 2009. Amongst a number of road toll characteristics to increase, it was noted that pedestrian fatalities were increasing proportionately higher than the rest of the road toll. The following analysis provides an overview of trends for pedestrian casualties in metropolitan and non-metropolitan areas of NSW.

Scope of the Analysis

This analysis of pedestrian fatality and injury data covers

- an extended historical overview of the NSW road toll and other interstate jurisdictions, especially with regard to the levels of pedestrian trauma,
- recent and historic trends for pedestrian trauma in the metropolitan and non metropolitan areas
- characteristics and factors involved in pedestrian trauma for the most recent five year period 2004 to 2008p
- features of pedestrian fatalities during the first five months of 2009 compared with the same period in 2008

At the time of this analysis the 2008 pedestrian casualty data are preliminary and incomplete. The data are therefore subject to change. The 2009 fatality data, limited to the January to May period, are also preliminary and are also subject to change. Injury data for 2009 is not yet available.

Definitions

For the purposes of this analysis the metropolitan area is defined as the Sydney, Newcastle and Wollongong Conurbation and the non-metropolitan area as the rest of NSW. The Sydney, Newcastle and Wollongong Conurbation is the area which includes the Newcastle metropolitan area, Wyong, Gosford, Hawkesbury, Blue Mountains, Wollondilly local government areas, Sydney metropolitan area and Wollongong metropolitan area.

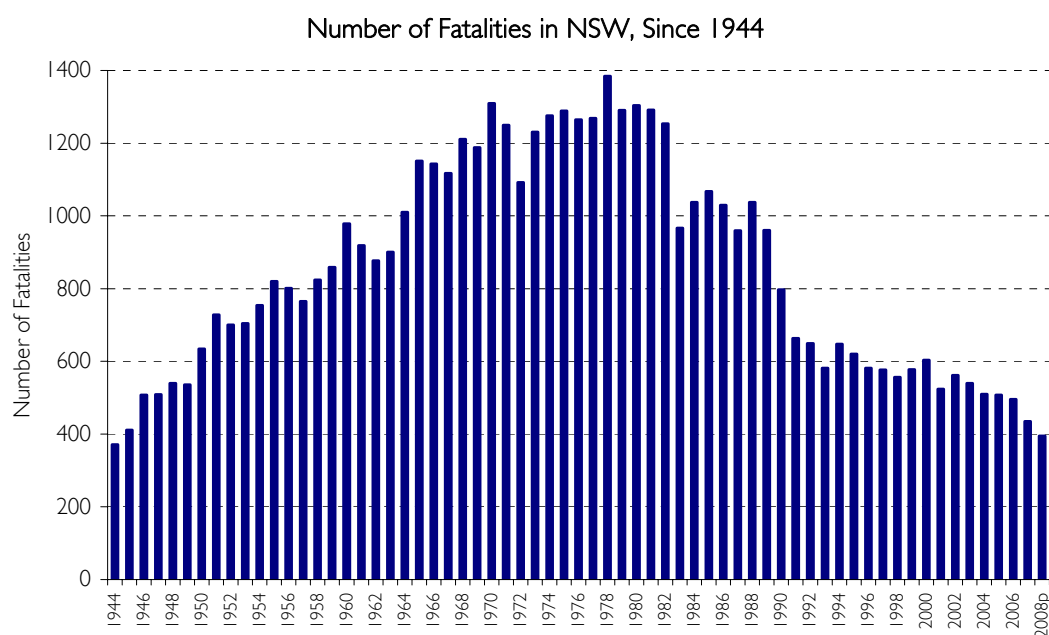
Only crashes which are reported to the Police and in which at least one person has been killed or injured, or at least one vehicle has been towed away are recorded in the RTA crash database. A fatality is a person who dies within 30 days of a crash from injuries received in the crash.

Historical Road Trauma Trends

General Overview

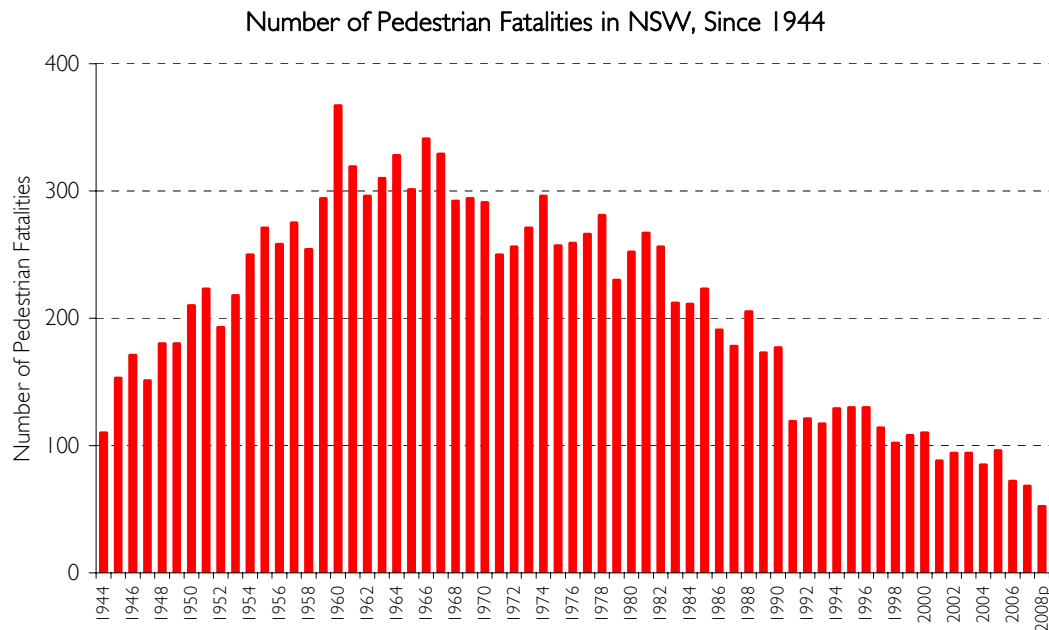
There was a total of 395 persons killed in NSW in 2008 (provisional figure as at 1 January 2009), 40 (9%) fewer fatalities than 2007 and the lowest annual road toll since 1944. The 2008 result represented the sixth consecutive annual road toll decrease, the first time this has been achieved since records began in 1908.

From a peak of 1,384 fatalities in 1978, the road toll had fallen by 71% by 2008.

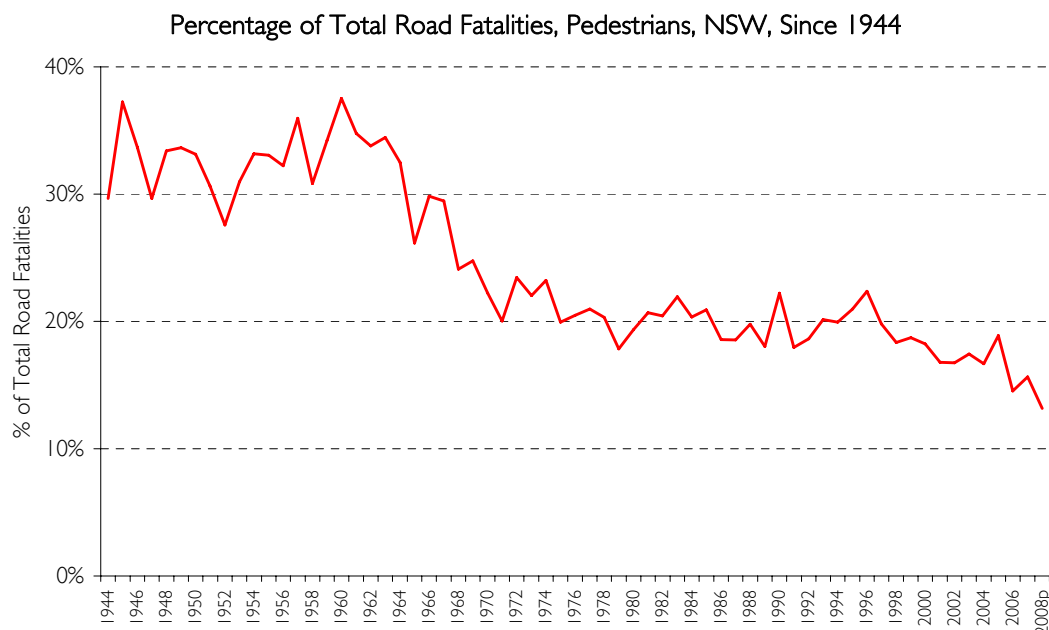


The reduction in pedestrian trauma has been a major contributor to this overall reduction of the NSW road toll. In 2008 there were 52 pedestrians killed in NSW, 16 (24%) fewer fatalities than 2007 and the lowest annual pedestrian fatality total since these records were first collated in 1928.

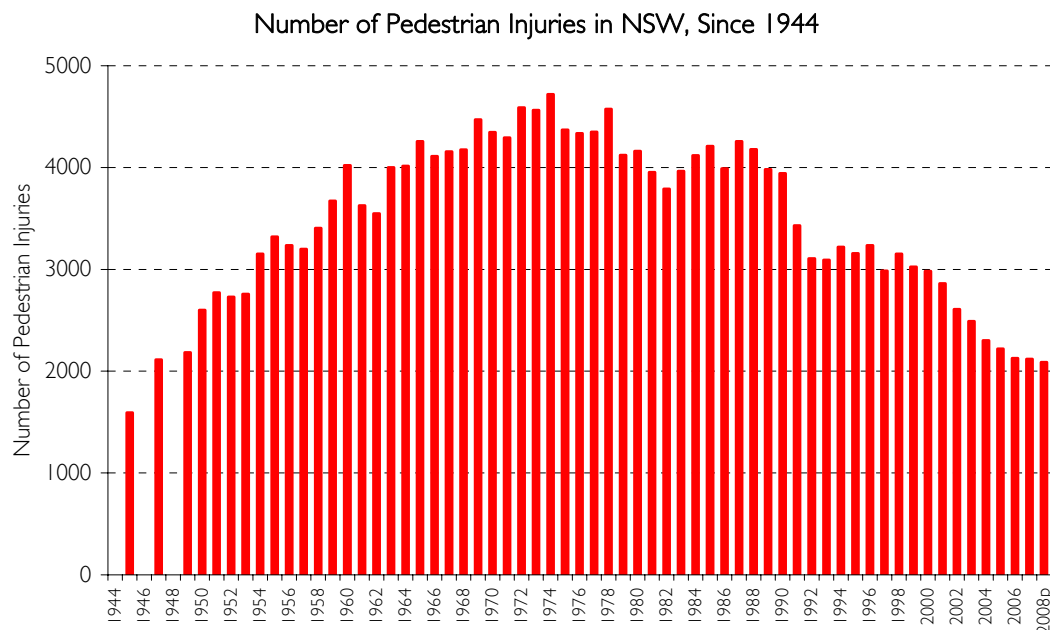
From a peak of 367 pedestrian fatalities in 1960, pedestrian fatalities had fallen by 86% by 2008.



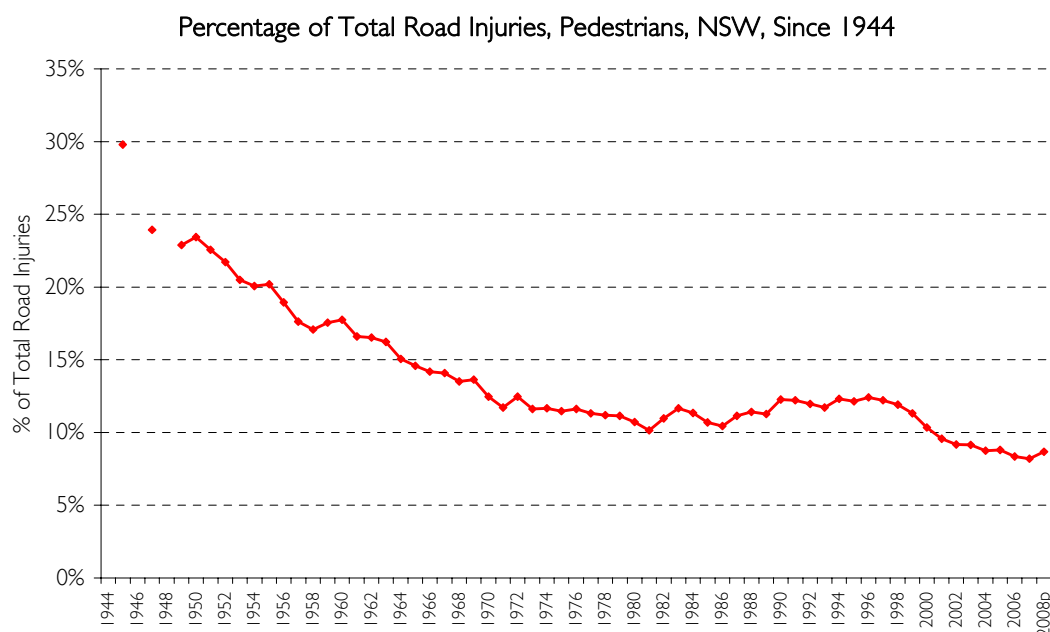
Consequently, the proportion of the road toll comprising pedestrians has declined over the same period, accounting for around one in three road fatalities up to the mid 1960's, declining to around one in five road fatalities between 1970 and the mid 1990s and then further decreasing to only 13% of all road fatalities in 2008.



The trends for pedestrian injuries have been similar, but not as extreme. There were 2,087 pedestrian injuries in 2008, 32 (1.5%) fewer injuries than 2007 and the lowest injury total since 1945. From a peak of 4,719 pedestrian injuries in 1974, pedestrian injuries had fallen by 56% by 2008.



Over the same period there has been a smaller, but still impressive reduction in all injuries, falling by 37% since 1974. Consequently, the proportion of total injuries comprising pedestrians has declined over the same period, accounting for around one in three road injuries in 1945, declining to around one in twelve road injuries in 2008.

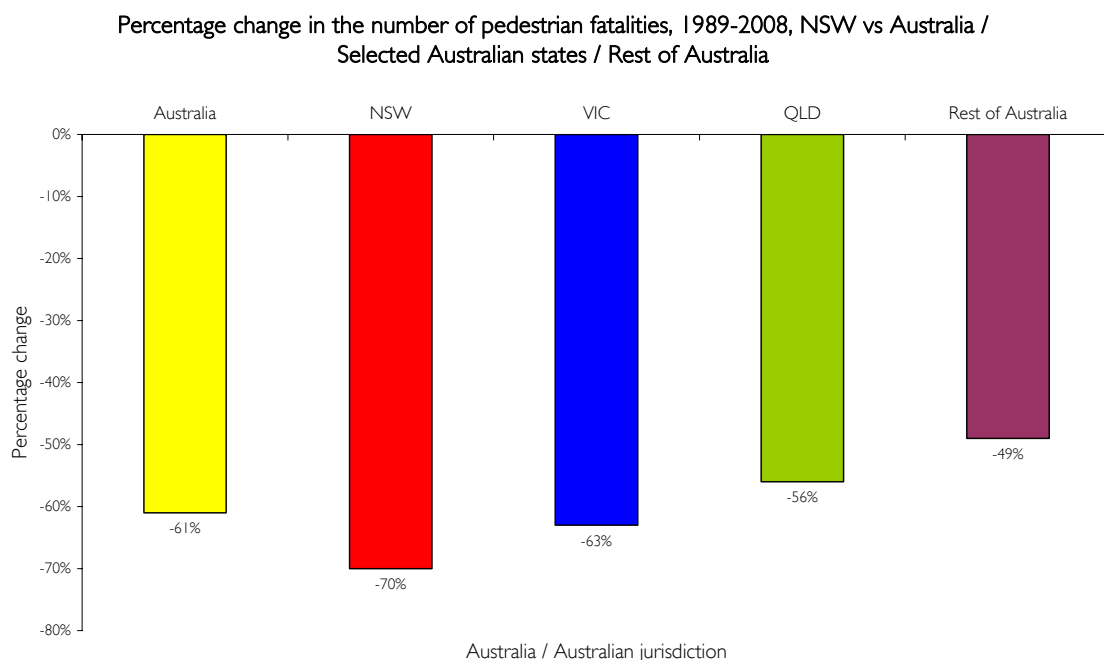
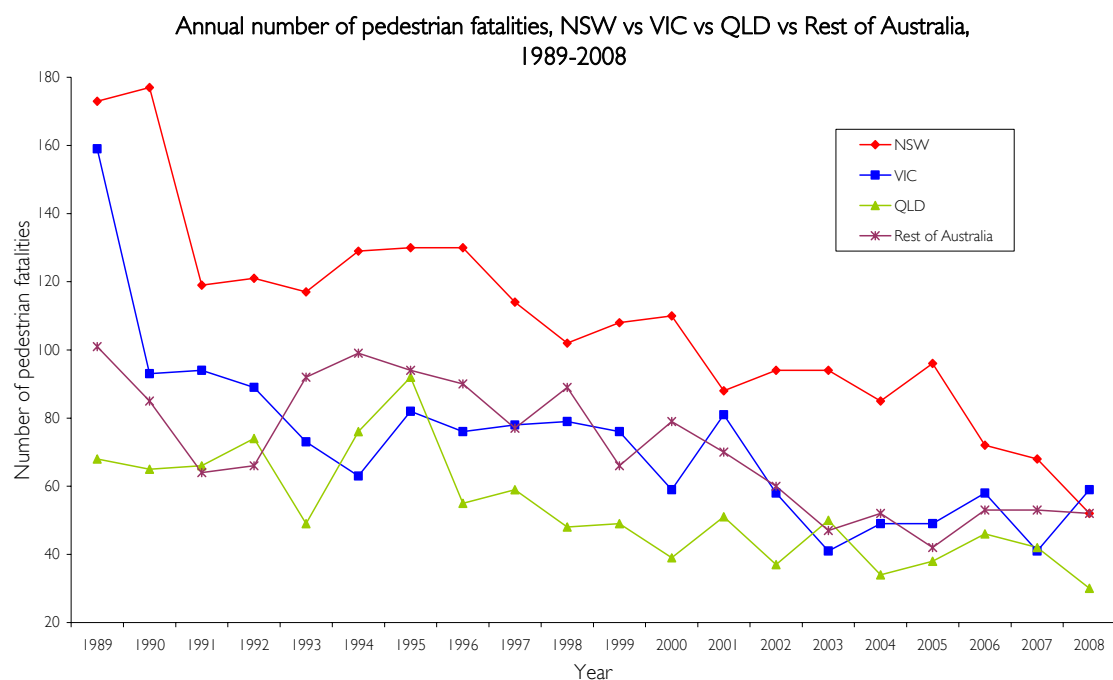


Whilst the road toll has been improving, the early figures for 2009 suggest a possible turnaround in the fatality trends. During the first five months of 2009, there were 195 deaths on NSW roads, 52 (36%) more than for the same period in 2008. Pedestrian fatalities also increased during this five month period, up by 53%, from 19 in 2008 to 29 in 2009.

Trends in Pedestrian Fatalities for Australian Jurisdictions

Over the past twenty years there have been significant improvements in the Australian road toll, particularly with regard to pedestrian fatalities. Since 1989 the total number of road fatalities throughout Australia has dropped by 52%, whilst the number of pedestrian fatalities has decreased by 61% over the same period.

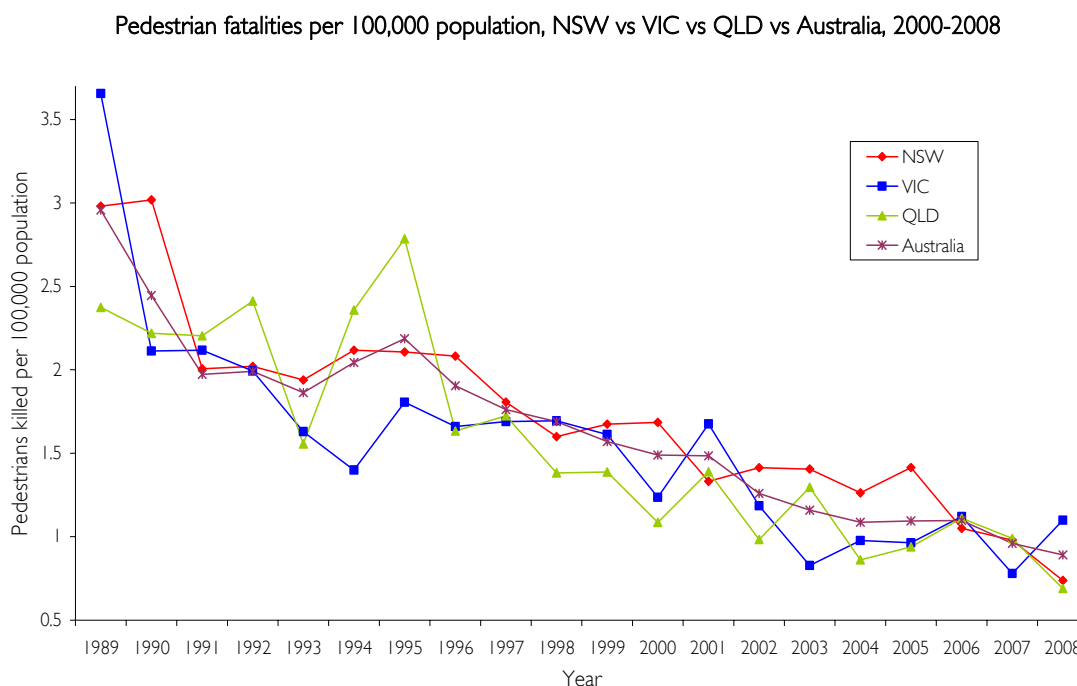
The graphs below show the annual number of pedestrian fatalities for NSW, Victoria, Queensland and the rest of Australia, as well as the percentage change in the number of pedestrian fatalities between 1989 and 2008 for Australia overall, and for NSW, Victoria, Queensland and the rest of Australia. Given that 2009 fatality data are limited to the January to May period, these data have not been included in comparisons between Australian jurisdictions.



The reduction in pedestrian fatalities over the past twenty years has not been consistent. NSW leads with the largest reduction (70%), ahead of Victoria (63%), Queensland (56%) and the combined rest of Australia (49%).

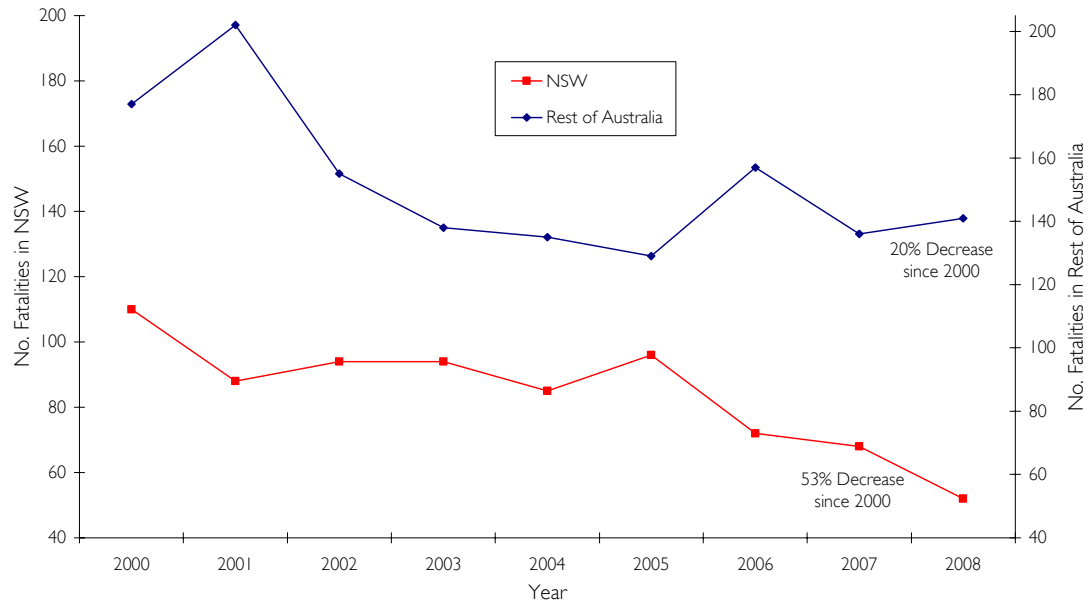
The largest annual pedestrian fatality reductions were observed for NSW and Victoria between 1989 and 1991, which is likely to reflect the impact of the national economic recession during this time. Historically, at low levels of economic growth there have been sizeable reductions in the road toll. Other larger annual pedestrian fatality reductions were observed for Queensland between 1995 and 1996, and Victoria between 2001 and 2003. Following the introduction of covert speed enforcement operations and reduced tolerances from 2001 onwards, there was a marked reduction in pedestrian fatalities in Victoria in 2002 and 2003, particularly in metropolitan Melbourne.

In terms of pedestrian fatality rates per 100,000 population for 2008, there is a clear downward trend across Australia. The graph below shows the pedestrian fatality rate for NSW, Victoria, Queensland and for Australia overall. The pedestrian fatality rate in NSW has dropped steadily and is now at its lowest level since 1989 (0.74), which is lower than South Australia (0.75) and Victoria (1.09), and is also substantially lower than the rate for the whole of Australia (0.89).



More recently, NSW has bucked the trend for road fatalities for the rest of Australia since the year 2000. Compared with 2000, the number of pedestrian fatalities in NSW decreased by 53% for the twelve months ending 2008, compared to only 20% for the rest of Australia over the same period.

Trends in pedestrian fatalities, NSW versus Rest of Australia, 2000-2008

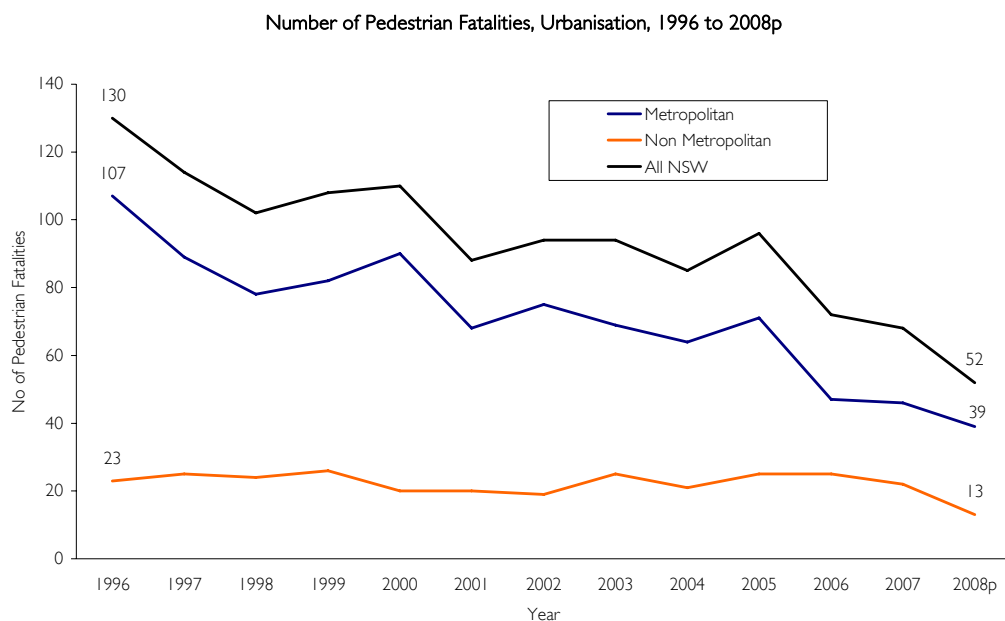


Trends in NSW Pedestrian Casualties by Urbanisation Since 1996

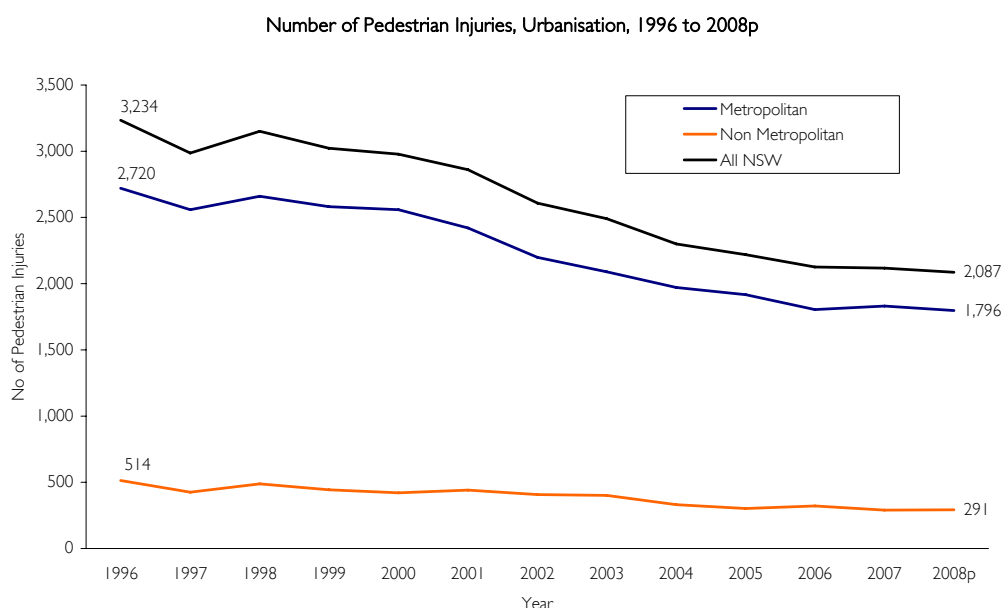
Since 1996, the majority of pedestrian fatalities and pedestrian injuries have occurred in the defined metropolitan area, with this area also contributing the largest reductions in NSW pedestrian trauma over this period.

In 2008, three-quarters of all pedestrian fatalities in NSW occurred in the metropolitan area whilst around 85% of all injuries occurred in the same area.

Pedestrian fatalities in the metropolitan areas have decreased from 107 in 1996 to 39 in 2008, whilst fatalities in the non metropolitan areas averaged around 20 per annum until 2008 when there were only 13 fatalities.



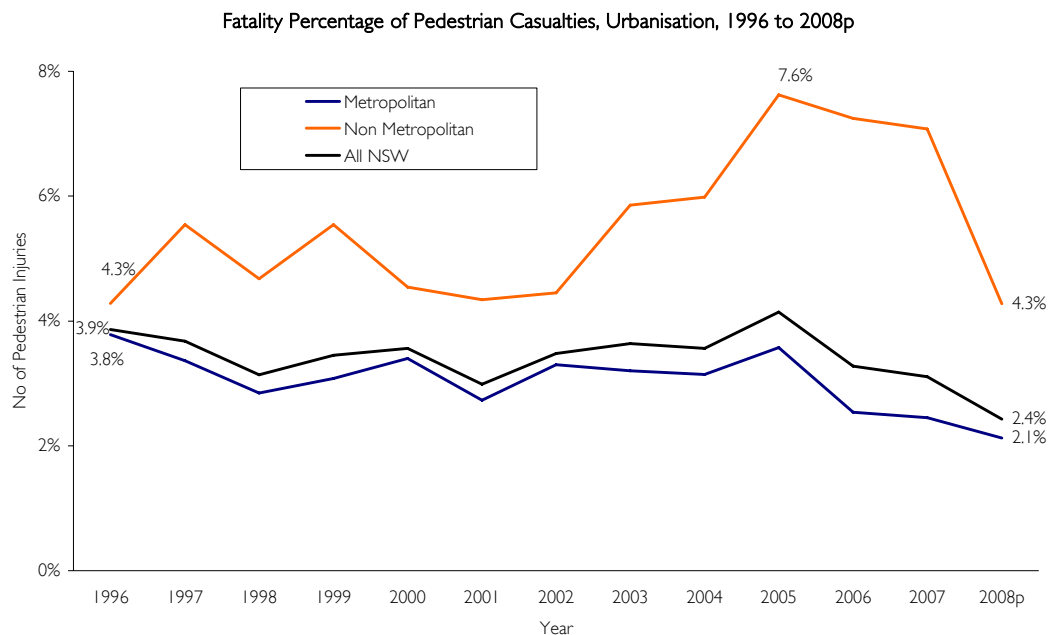
For pedestrian injuries there was a more consistent downward trend across urbanisation-injuries in the metropolitan areas decreasing by 34% between 1996 and 2008, whilst non metropolitan injuries decreasing by 43% over the same period.



The severity of pedestrian trauma differs across the urbanisations, with around 1 in 50 metropolitan casualties in 2008 resulting in a fatality, compared with 1 in 23 non metropolitan

casualties resulting in a fatality. With the non metropolitan areas tending to have higher posted speed limits, as well as these areas perhaps having longer emergency service response times, a higher risk of a fatality outcome is not unexpected. There were increases in the fatality risk for non metropolitan pedestrian casualties during the three year period 2005 to 2007 – 7.6% in 2005 and above 7.0% for the other years. This has arisen because fatalities were relatively stable at around 24 per annum whilst injuries had decreased by around 70 on previous years.

The downward trend for fatality risk for the metropolitan suggests that lower impact speeds (from lower posted speed limits), safer vehicle design and possibly improved emergency response times may have contributed to the decreased fatality risk.



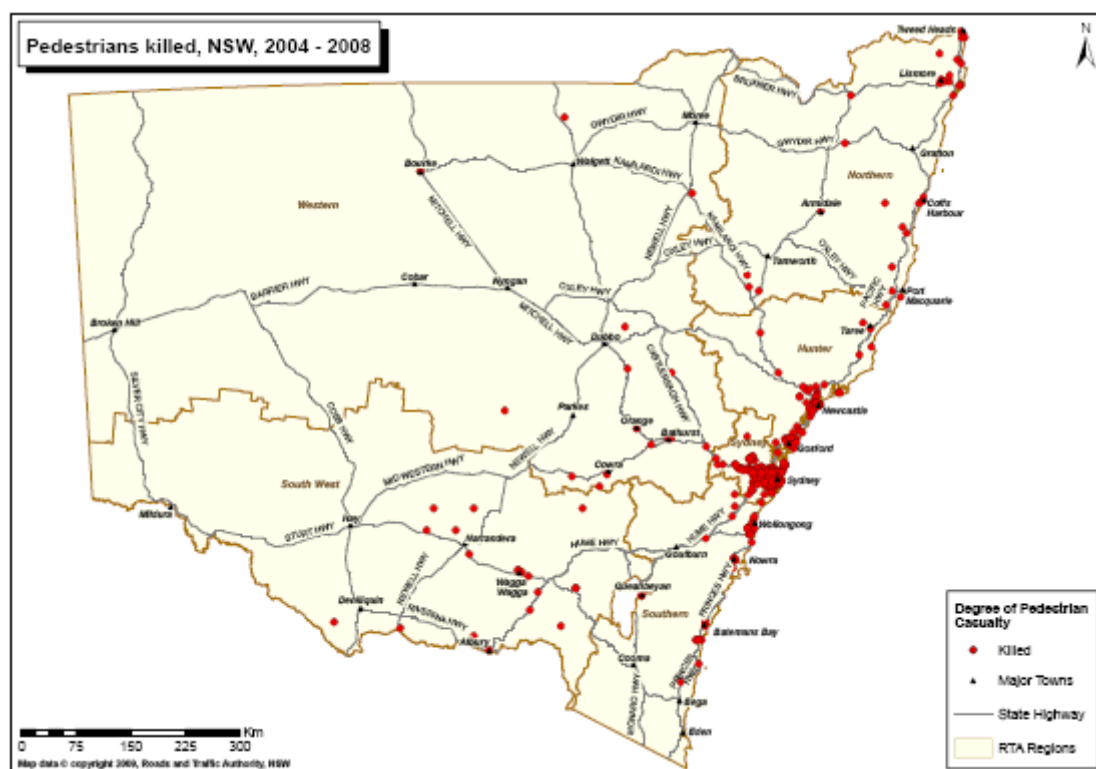
Recent Trends in Pedestrian Fatalities and Injuries (2004 to 2008p)

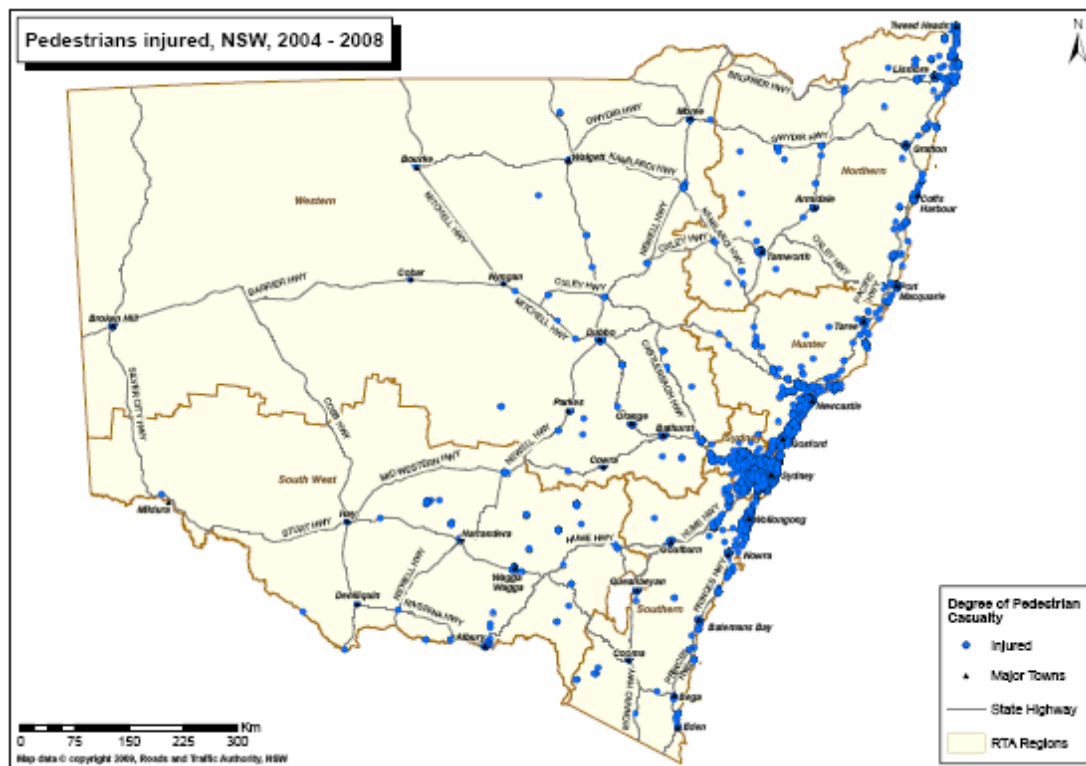
Location of Pedestrian Casualties

The following maps show the distribution of pedestrian fatalities over the five year period 2004 to 2008 for NSW, the metropolitan area (disaggregated by separate sub regions) and the non metropolitan area.

All NSW

There is a distinct clustering of the State's pedestrian fatalities and injuries in the metropolitan area, with only minor clustering of injuries along the coastal fringes to the north and south.





As the above maps show, pedestrian fatalities and injuries are highly concentrated in the metropolitan area of the State. Around 85% of all pedestrian casualties (72% of all fatalities, 86% of all injuries) during the five year period 2004 to 2008p occurred in the metropolitan area.

The following maps show the distribution of the metropolitan casualties by the following sub regions within the metropolitan area:

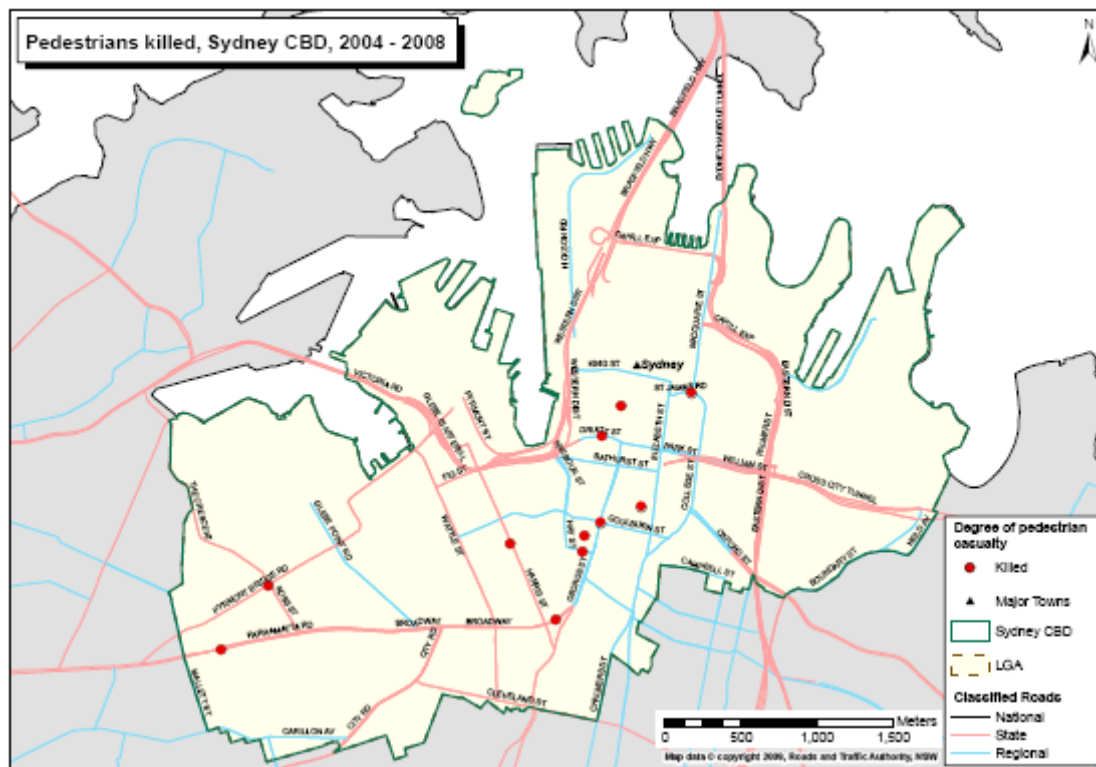
1. City of Sydney local government area (3% of all fatalities, 14% of all injuries in the State)
2. Inner Sydney Metropolitan Area (18%, 24%)
3. Rest of Sydney Metropolitan Area (32%, 36%)
4. Outer Sydney ABS Region excluding Central Coast (5%, 1%)
5. Central Coast (5%, 3%)
6. Newcastle Metropolitan Area (5%, 4%)
7. Wollongong Metropolitan Area (4%, 3%)

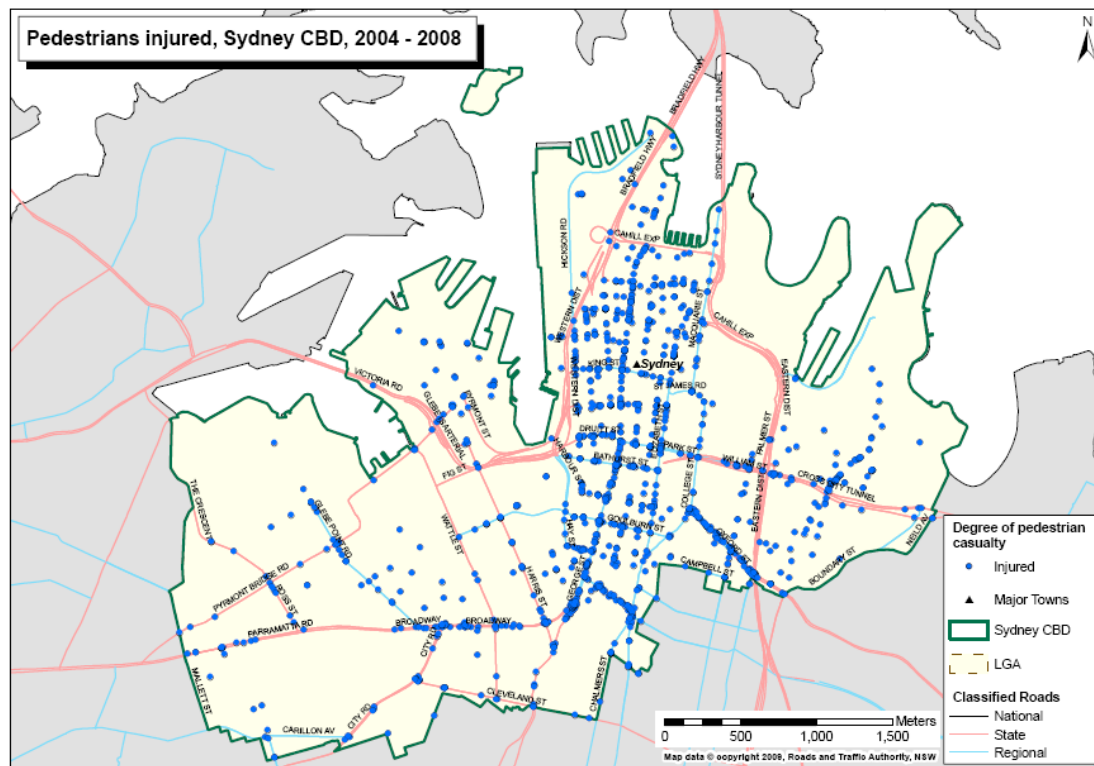
Pedestrian casualties for the non metropolitan area of the State are also shown separately.

Metropolitan area

Sydney City Local Government Area

Given the large number of injuries in the Sydney City LGA, there is a relatively low number of fatalities over the five year period. The 11 pedestrian fatalities were mostly located in the mid central business district and Haymarket area. In contrast, injuries were concentrated along George Street (from Circular Quay to Railway Square), Eddy Avenue / Elizabeth Street near Central Station, Oxford Street, Darlinghurst Road at Kings Cross and Broadway / Parramatta Road from the UTS to Victoria Park.

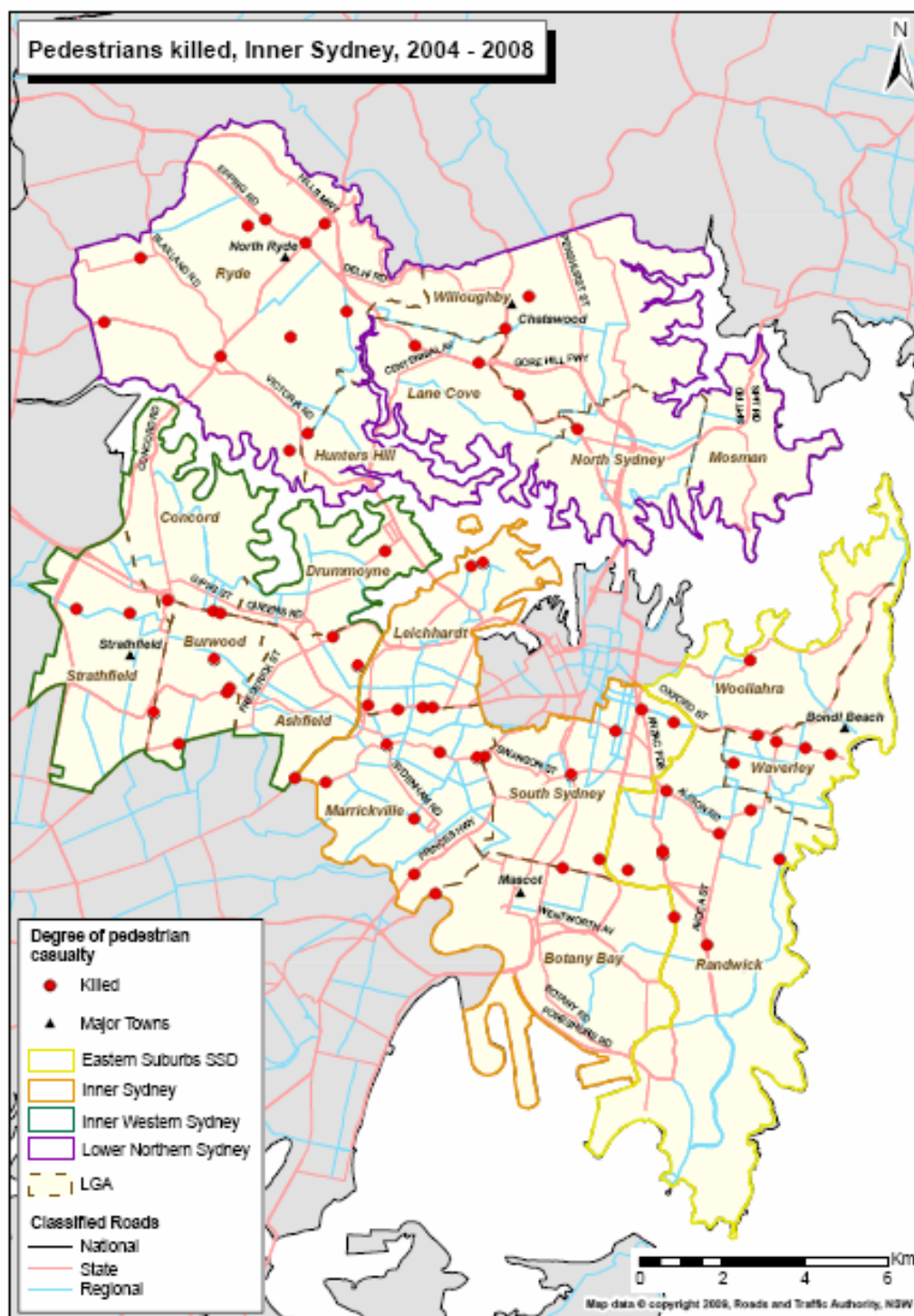




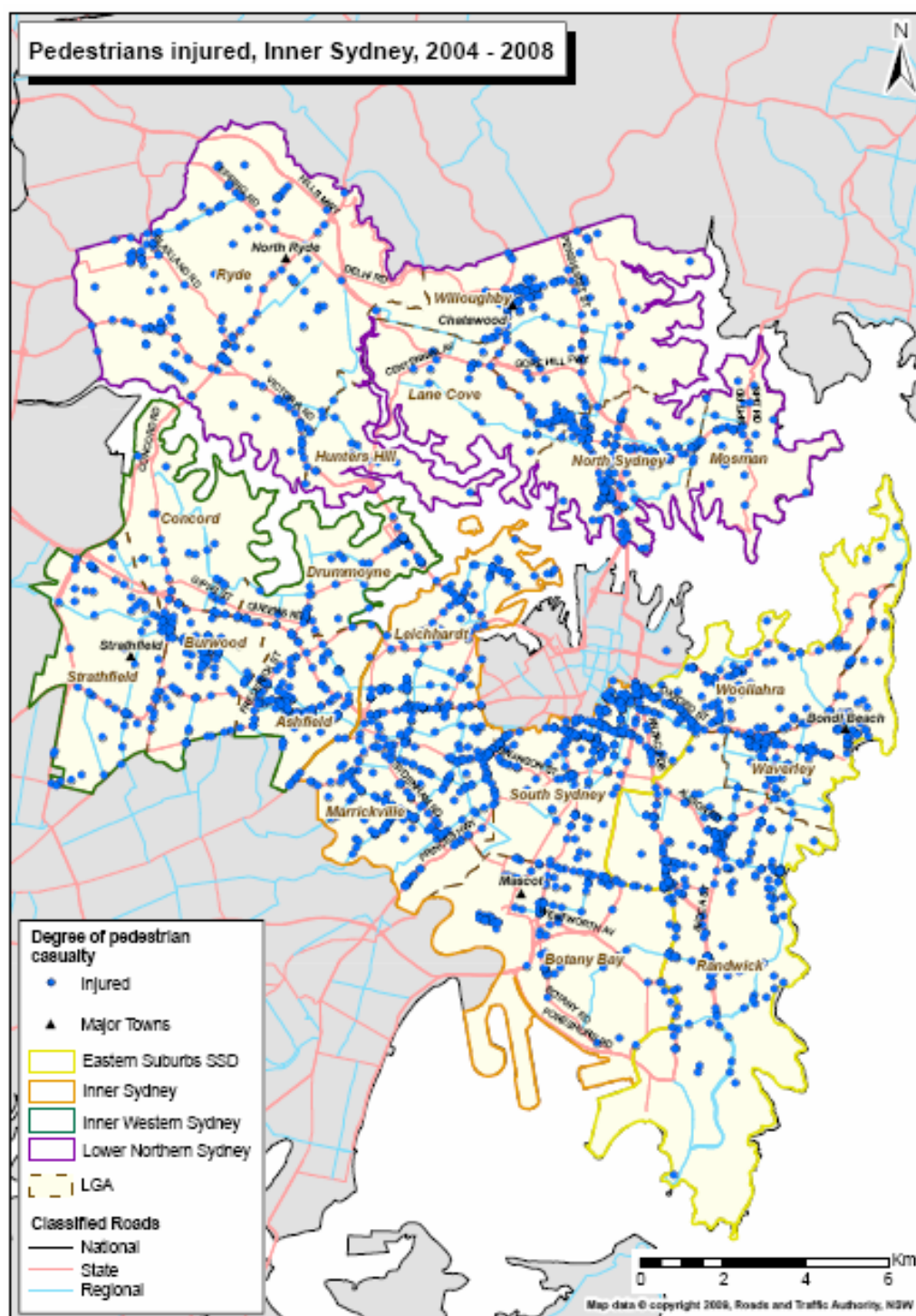
Inner Sydney Areas

Fatalities are more densely located across a central band from Strathfield and Ashfield through South Sydney and Marrickville and then extending through to Bondi and Waverley. On the north side of inner Sydney, fatalities are more sparsely spread west of North Sydney. A significant proportion of fatalities have occurred on RTA classified (State) roads.

Interestingly, there are no fatalities east of North Sydney and the Warringah Expressway, as well as north of Bondi Beach and south of Randwick.

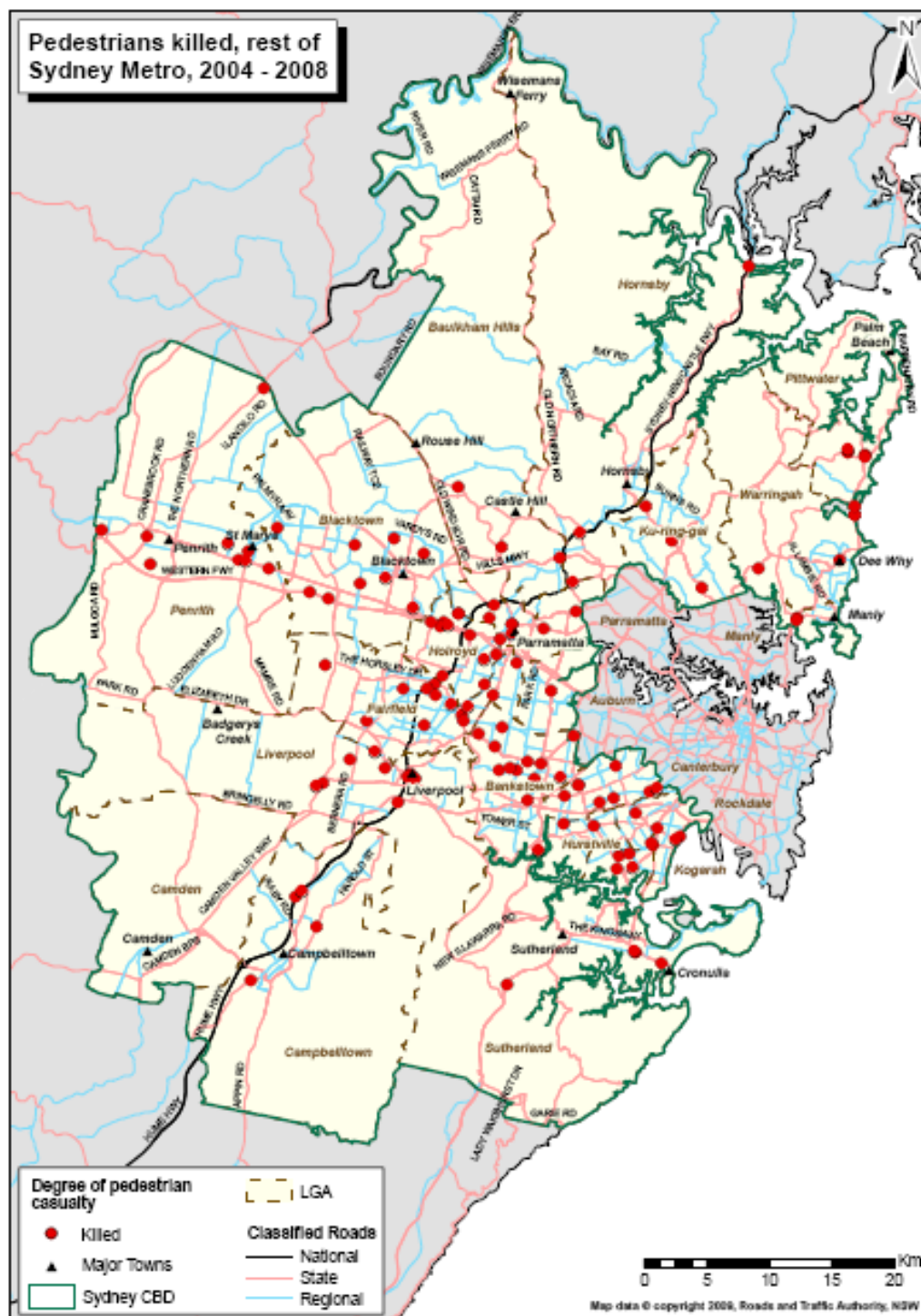


There are heavy concentrations of pedestrian injuries around the major commercial and high density residential areas of Strathfield, Burwood, Ashfield, Newtown / Enmore / St Peters, South Sydney / Surry Hills / Paddington, Kingsford, Randwick, Bondi Junction, North Sydney, Crows Nest / St Leonards, Chatswood and Epping.



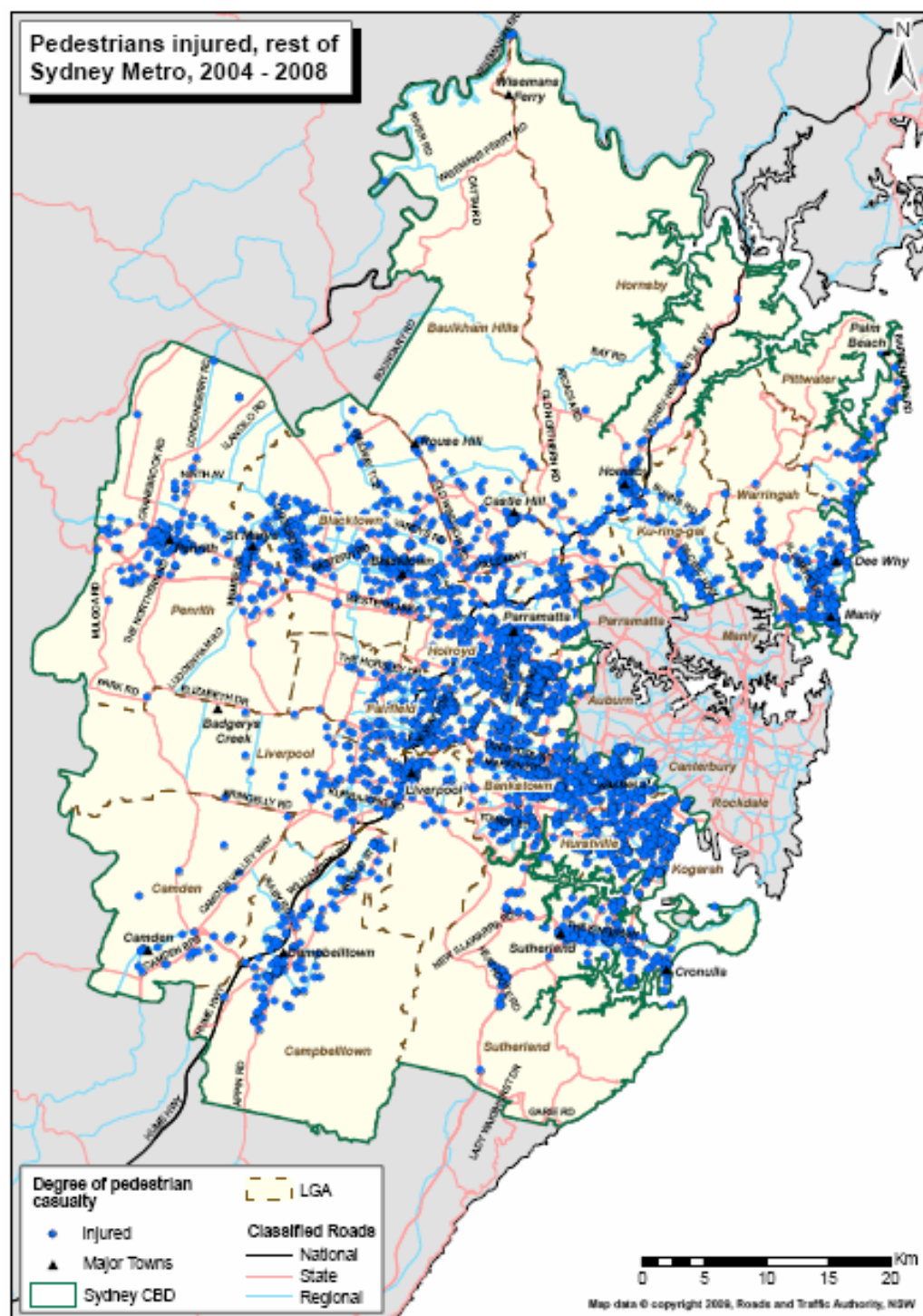
Rest of Sydney Metropolitan Area

There is a concentration of fatalities along a south east band from Parramatta / Smithfield through to Hurstville / Brighton-le-Sands. In contrast there are few fatalities in the Northern Beaches, outer northern hills district suburbs, outer south west suburbs and the Sutherland Shire.



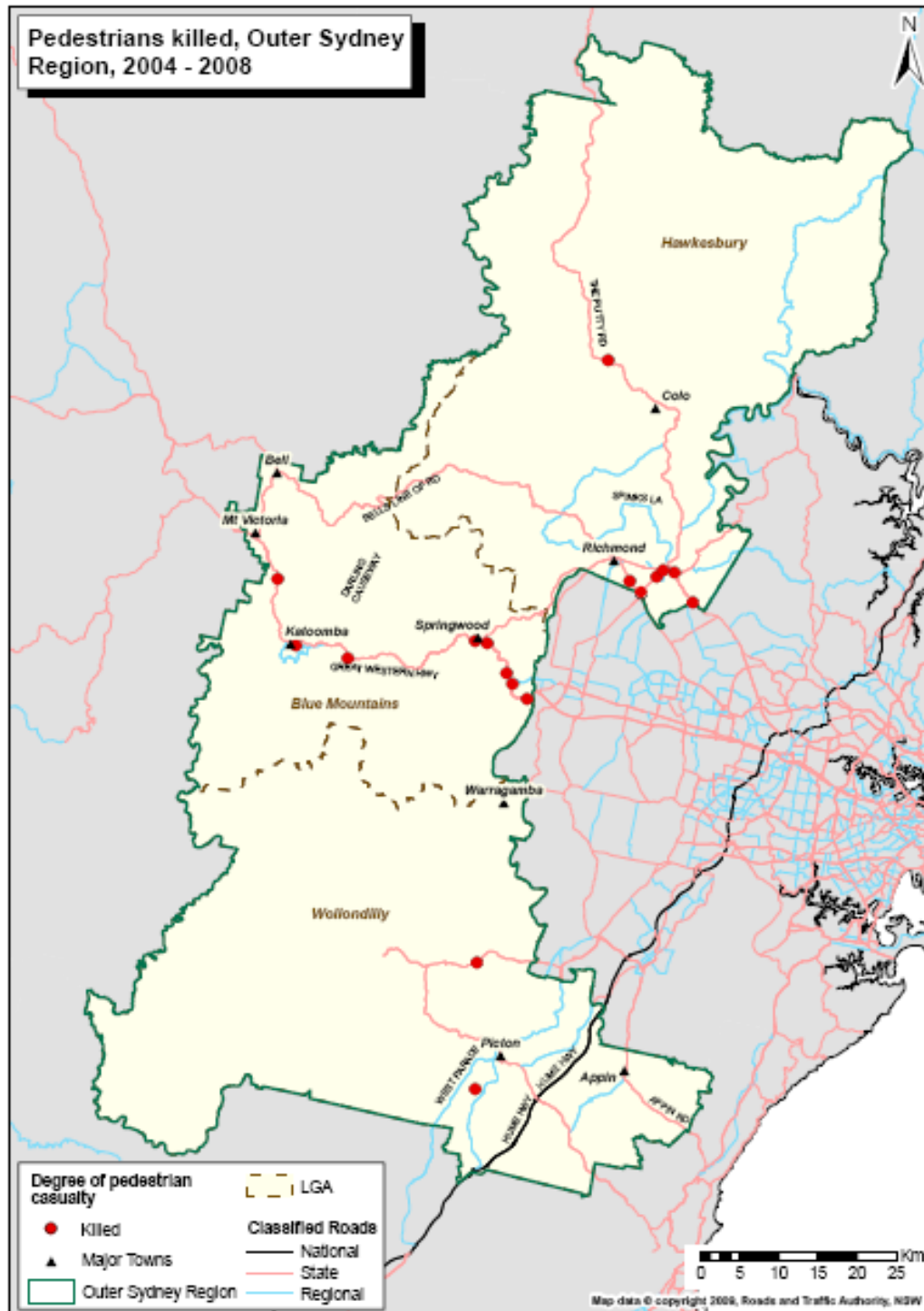
The heaviest concentrations of injuries are found in the same areas as fatalities as well as Penrith, St Marys, Mt Druitt / Lethbridge Park, Blacktown, Fairfield, Liverpool, Campbelltown, Sutherland, Cronulla, Manly, Hornsby and Carlingford.

Fatalities and injuries in the rest of Sydney area are generally clustered on RTA classified roads, or local roads around the local commercial centres.

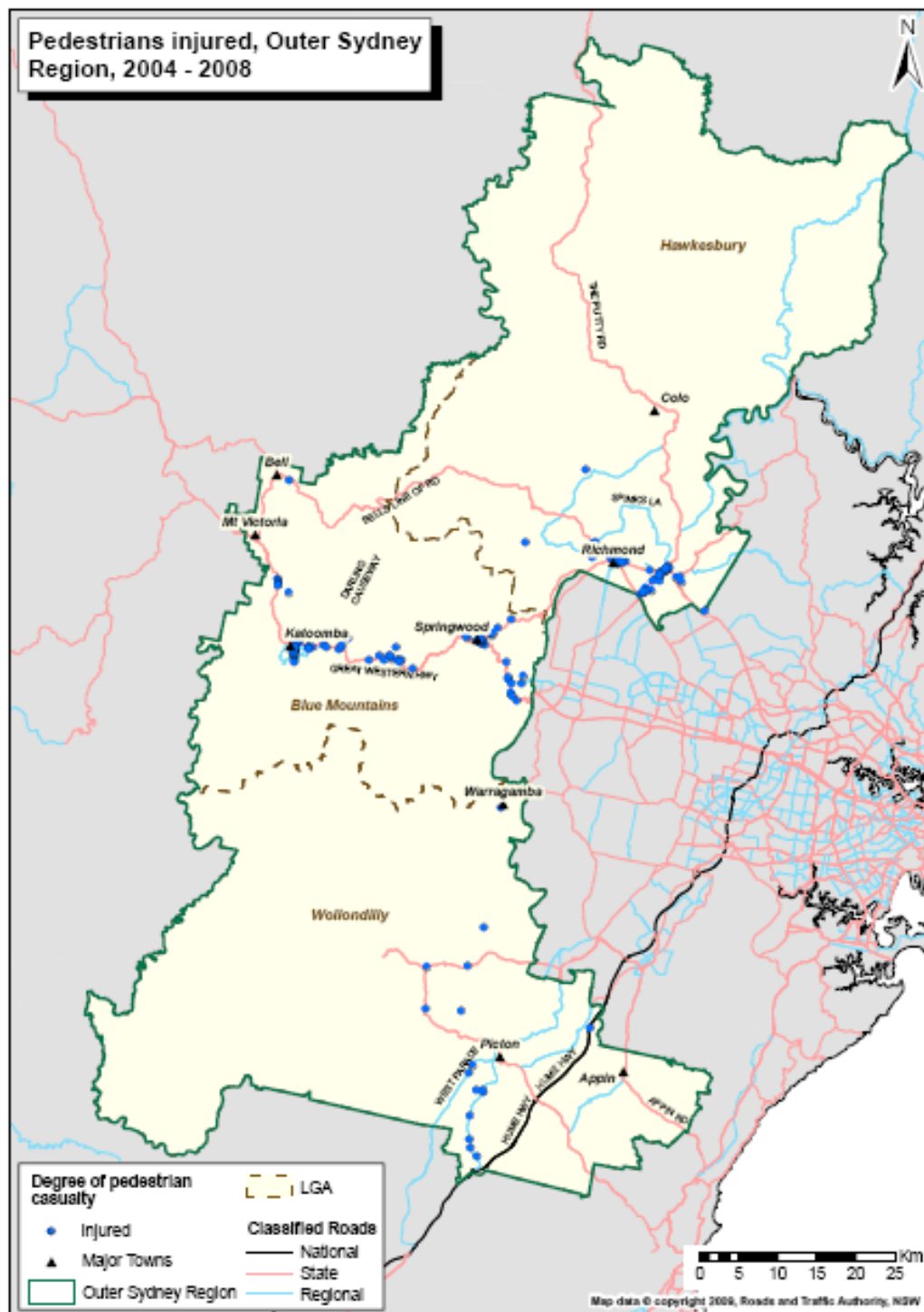


Outer Sydney Area (excluding Central Coast)

The outer Sydney area consists of the large local government areas of Hawkesbury, Blue Mountains and Wollondilly. Compared with the rest of the Sydney metropolitan area there is a relatively small population and fewer major roads. As such, pedestrian fatalities are quite small, with clusters around Windsor and the Great Western Highway in the lower Blue Mountains.

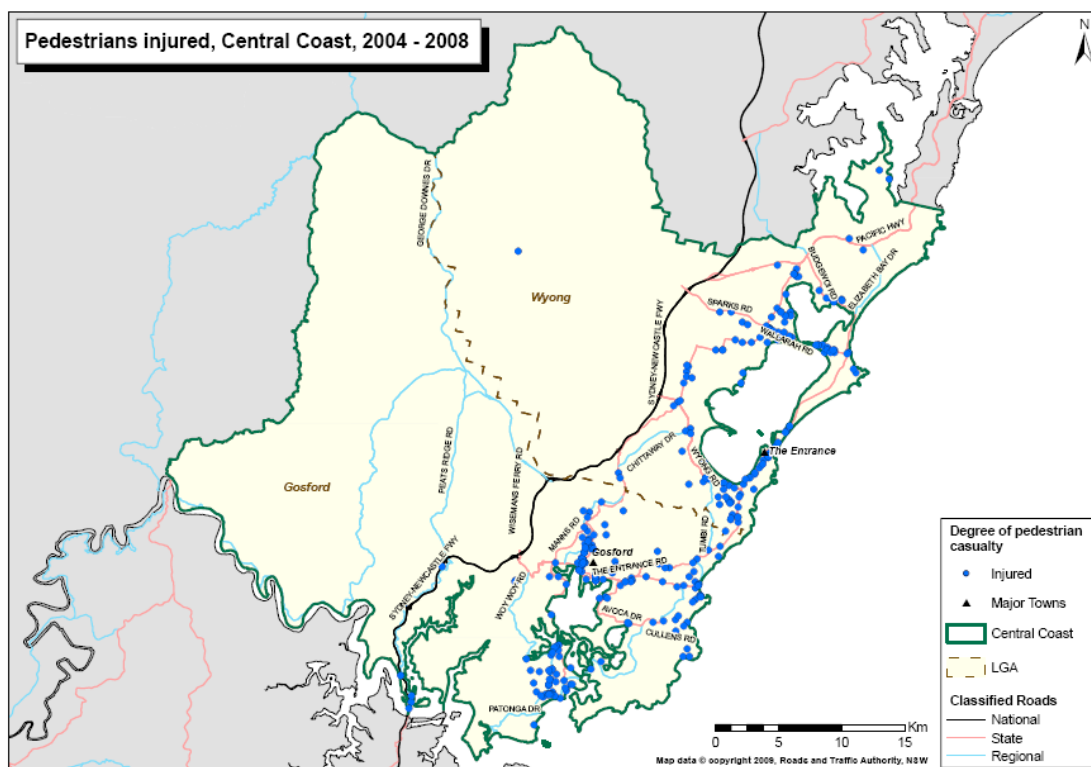
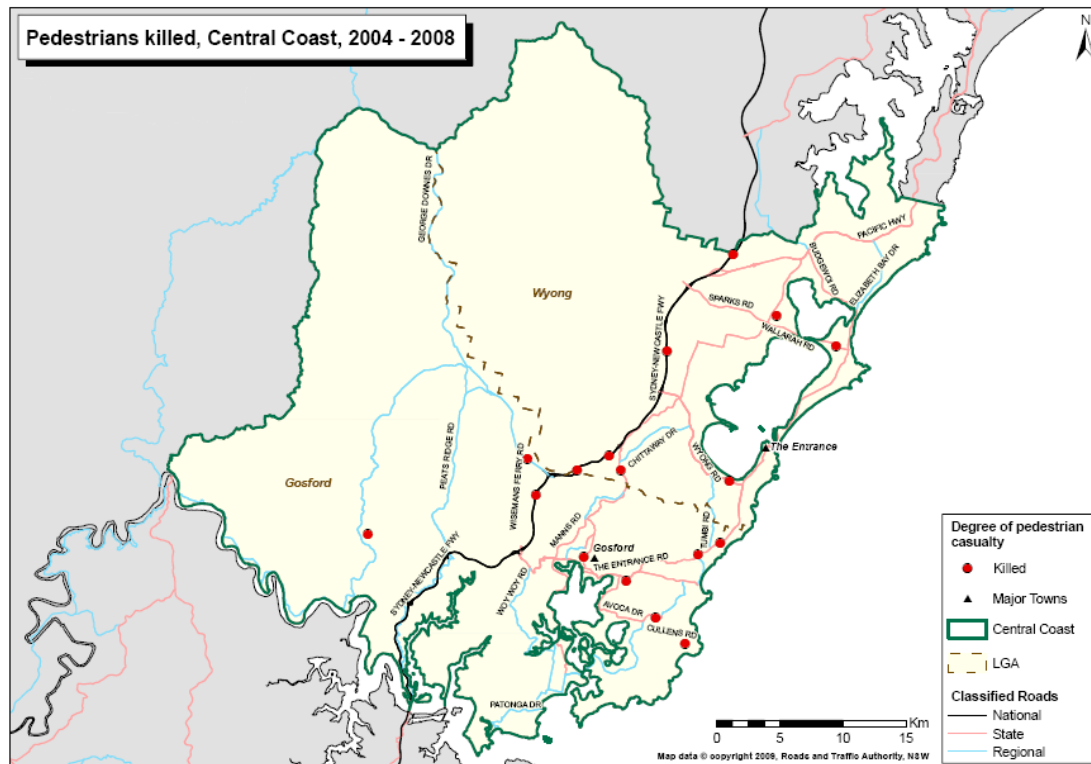


Similarly, injuries are clustered around Windsor, the Great Western Highway (now from the lower Blue Mountains through to Katoomba) as well as Remembrance Drive south of Picton.



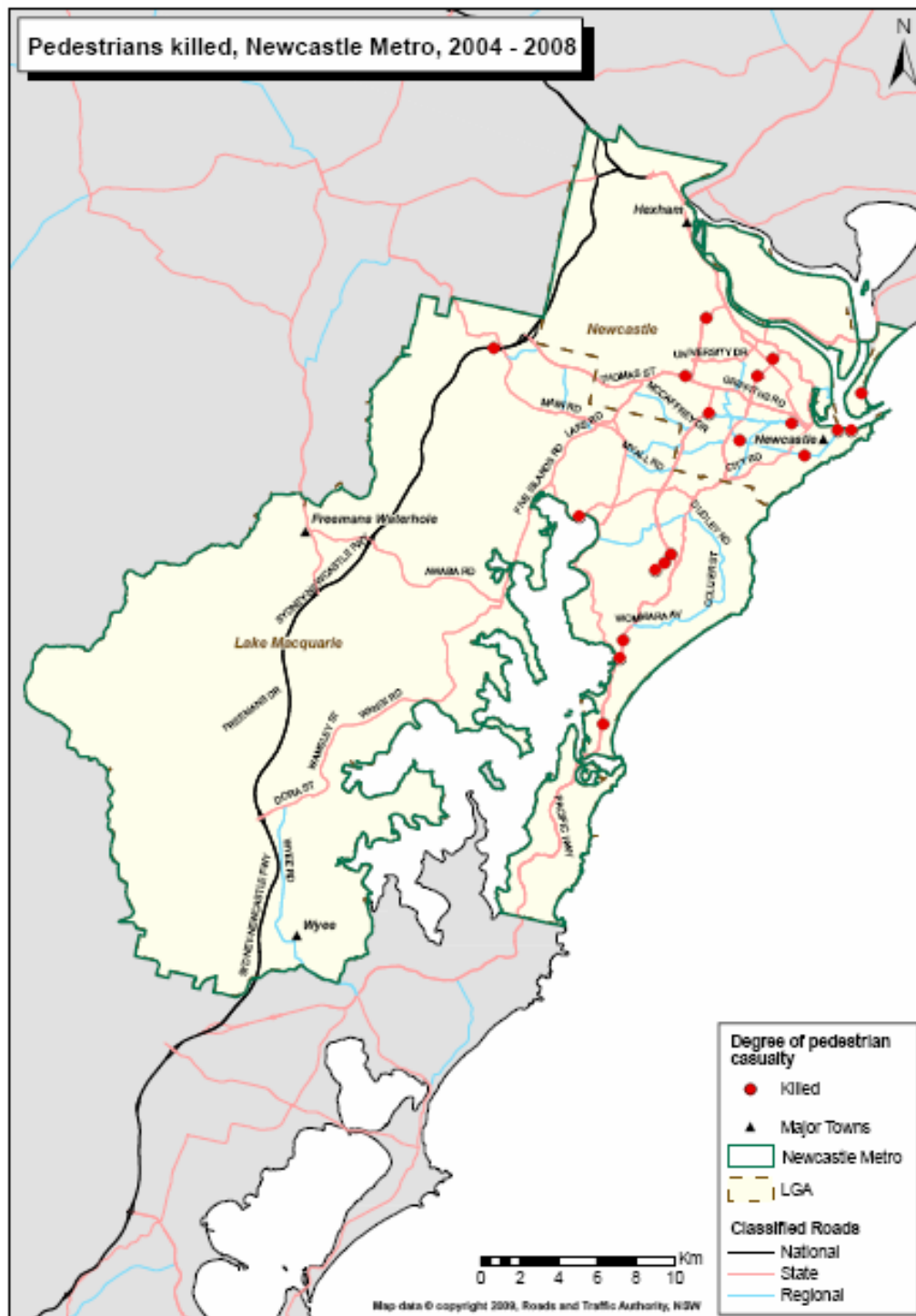
Central Coast

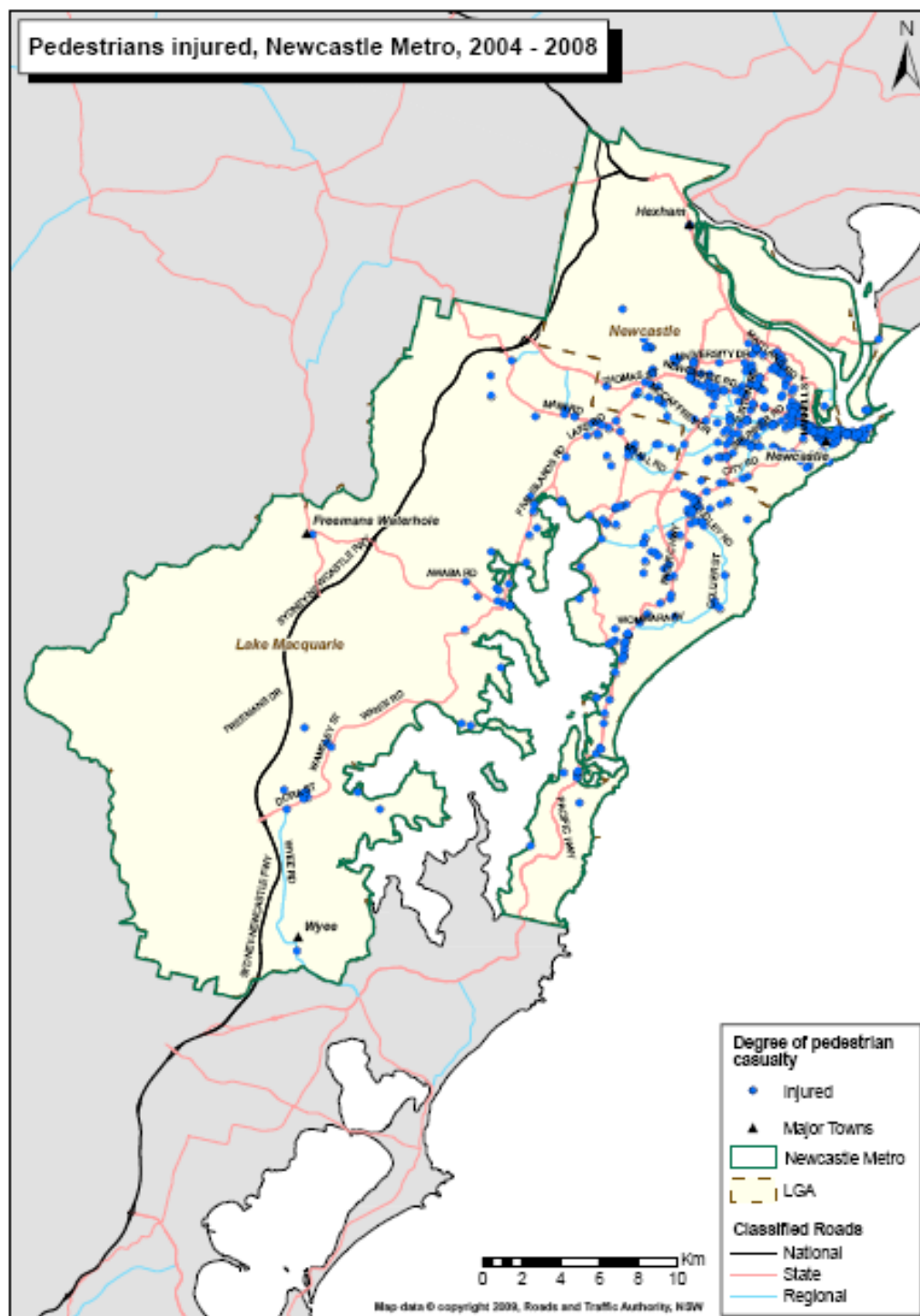
In the Central Coast local government areas, the majority of fatalities (as with the population) are found at or to the east of the F3 with no apparent clusters present. Injuries are found slightly further to the east with clusters located at Gosford, Woy Woy / Umina, The Entrance and Toukley.



Newcastle Metropolitan Area

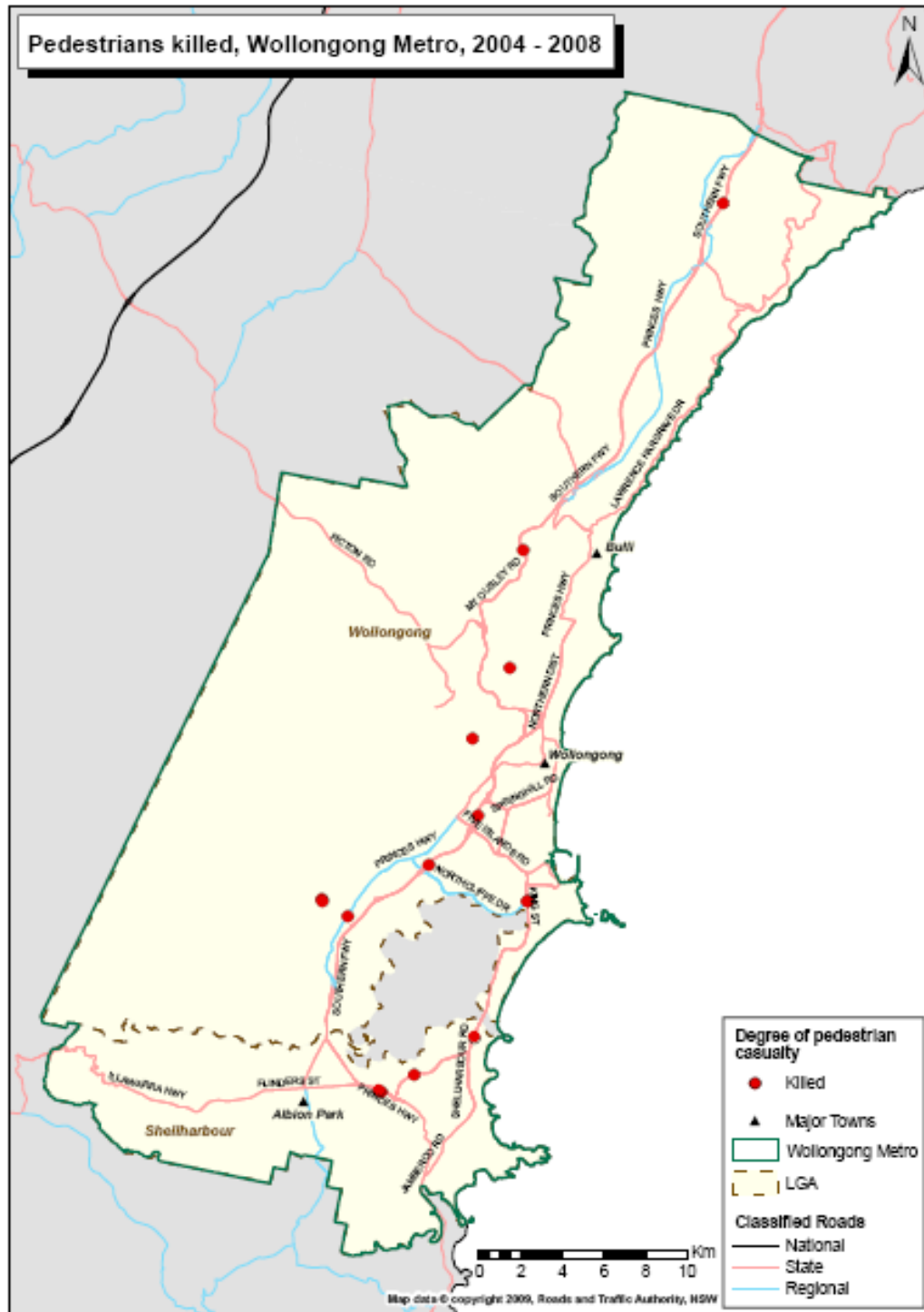
Fatalities are generally located in the Newcastle suburbs and the north eastern parts of Lake Macquarie. Injuries are concentrated in the Newcastle City centre and western suburbs but not necessarily the north eastern parts of Lake Macquarie.

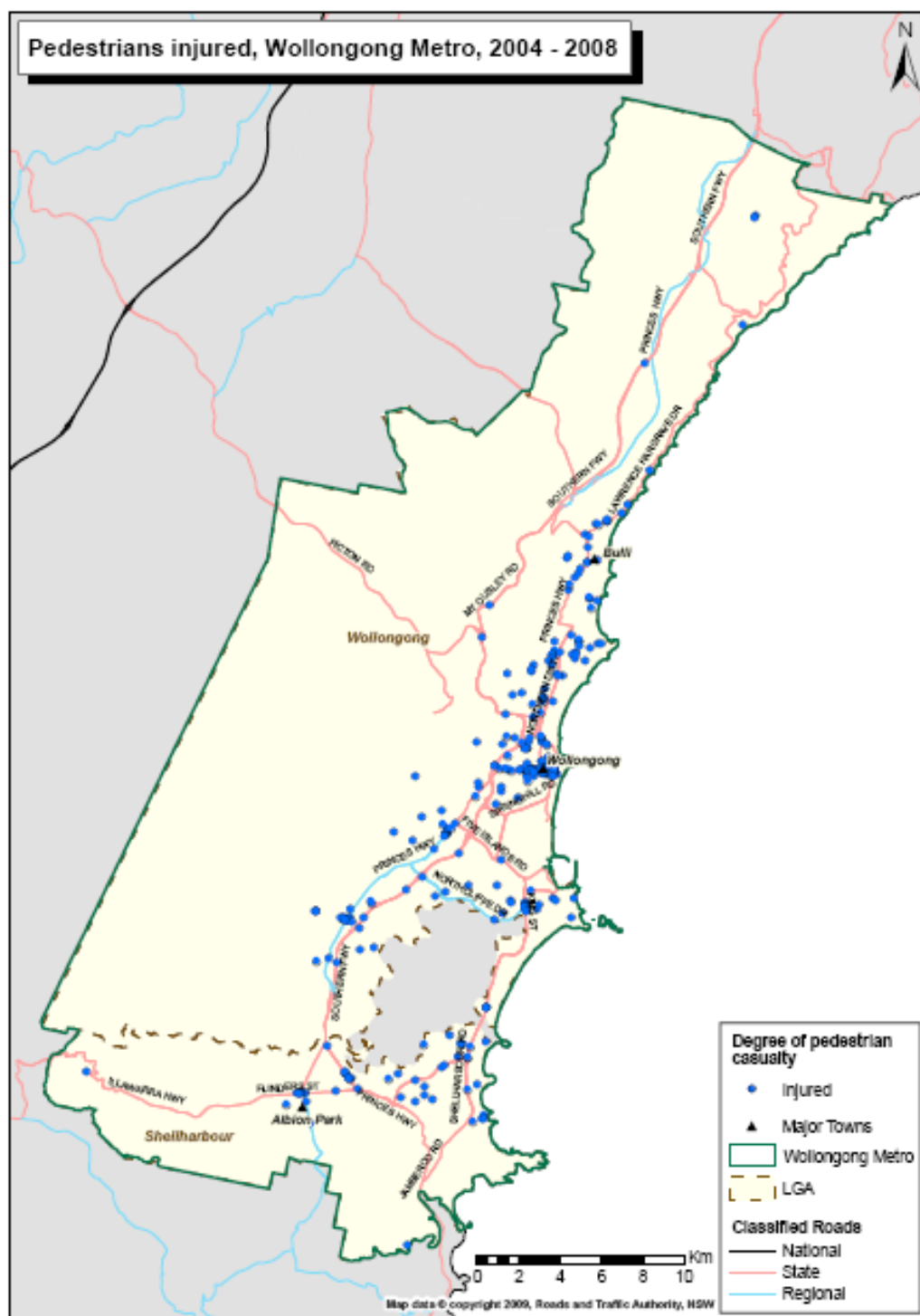




Wollongong Metropolitan Area

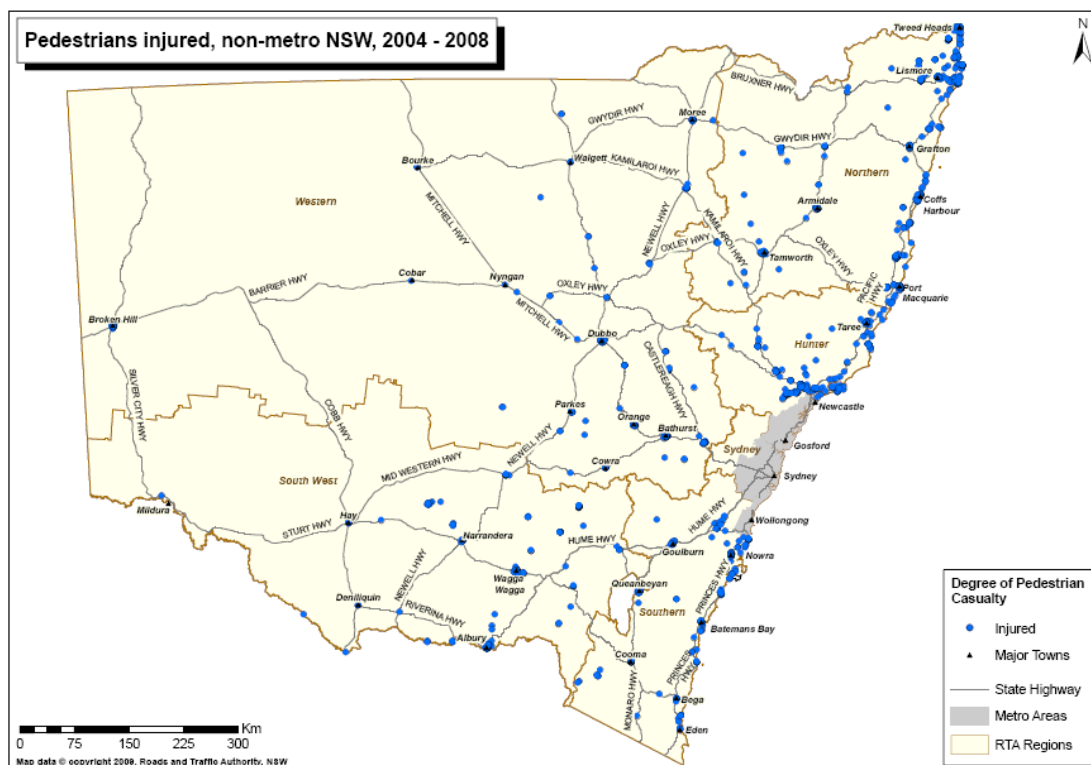
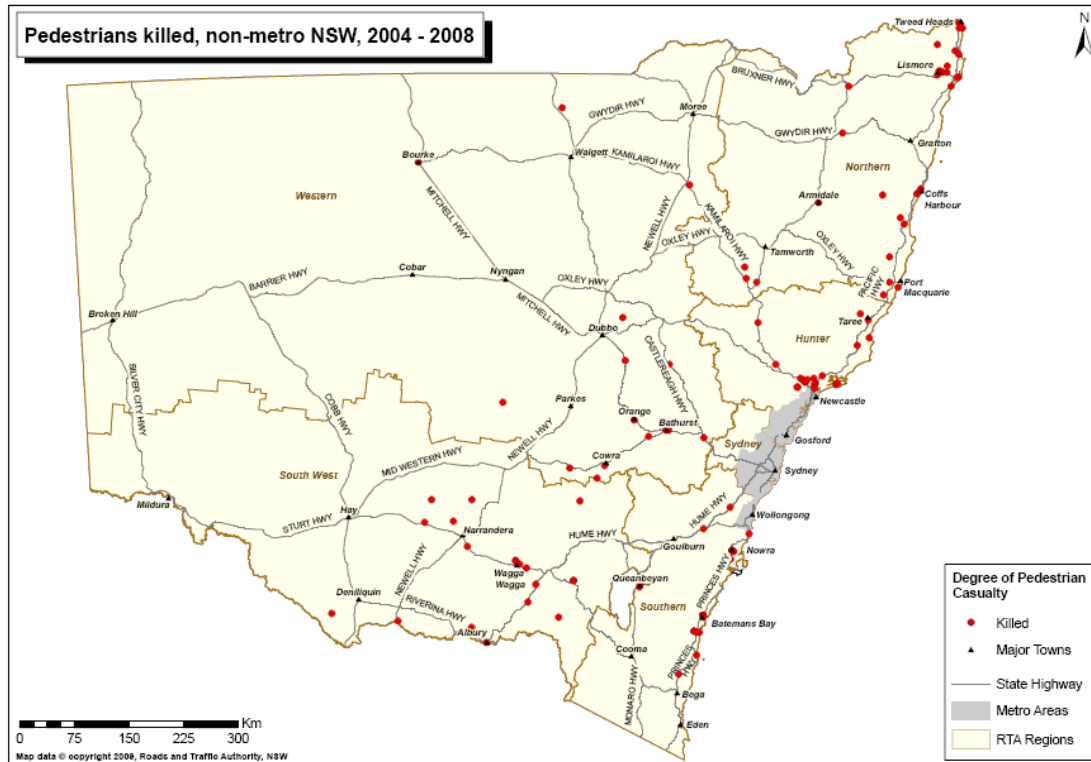
Fatalities in the Wollongong Metropolitan area are generally found located around the suburbs that circle Lake Illawarra, but not the Wollongong central business district. On the other hand, injuries are clustered in the Wollongong central business district and its northern coastal suburbs.





Non Metropolitan Area

Fatalities for the rest of NSW are widely distributed, with only two clusters centred upon the far north coast and the lower Hunter / Port Stephens area. Injuries are similarly widely distributed, though clusters are apparent in the same areas, as well as the coastal strip concentrations around Nowra, Taree, Port Macquarie and Coffs Harbour.

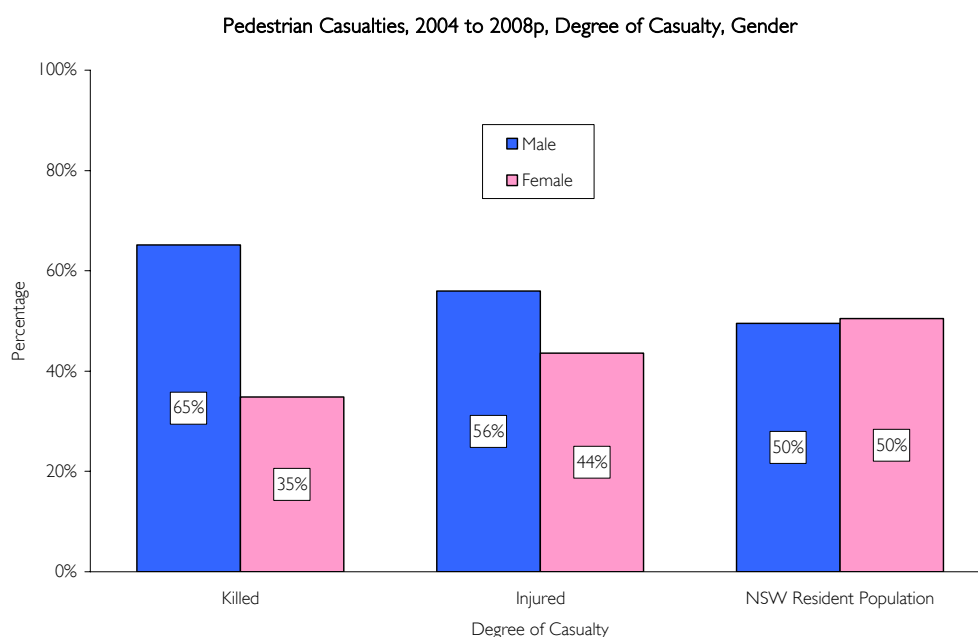


Underlying Factors / Characteristics of Pedestrian Fatalities and Injuries, 2004 to 2008p

Tables detailing the characteristics of pedestrian fatalities and injuries for the most recent five year period (2004 to 2008) are found in [Appendix I](#). These tables cover gender, age, location type, speed limit, road classification, pedestrian controls, day of week, time of day, Mclean period, natural lighting, weather, Road User Movement (RUM) code, type of crash, pedestrian manoeuvre, pedestrian error and blood alcohol concentration.

Gender

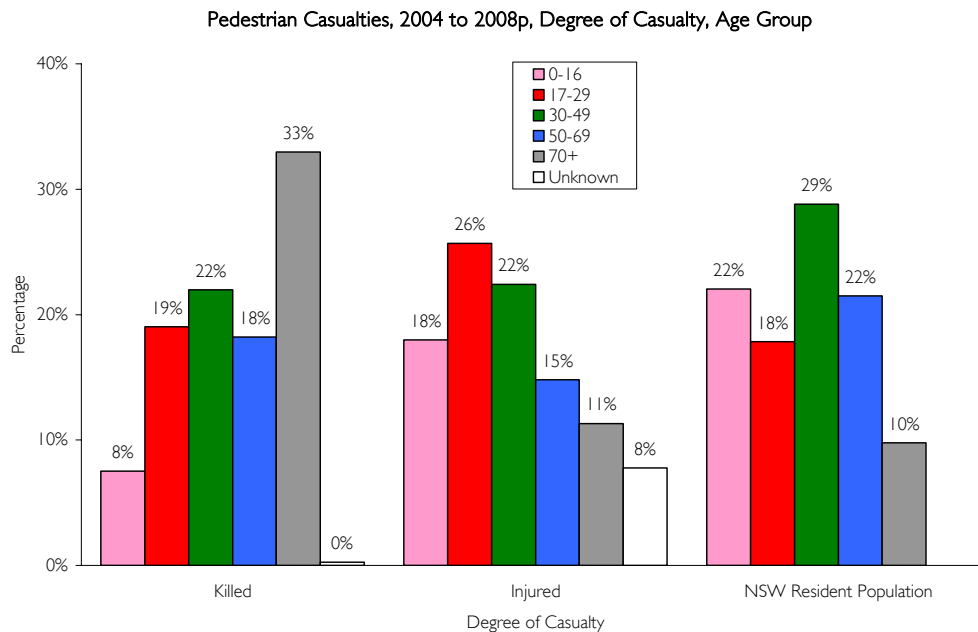
Despite comprising just under half of the NSW resident population, males account for the majority of pedestrian fatalities (65%) and pedestrian injuries (56%). Males have an even greater over-representation in the non metropolitan areas.



Age Group

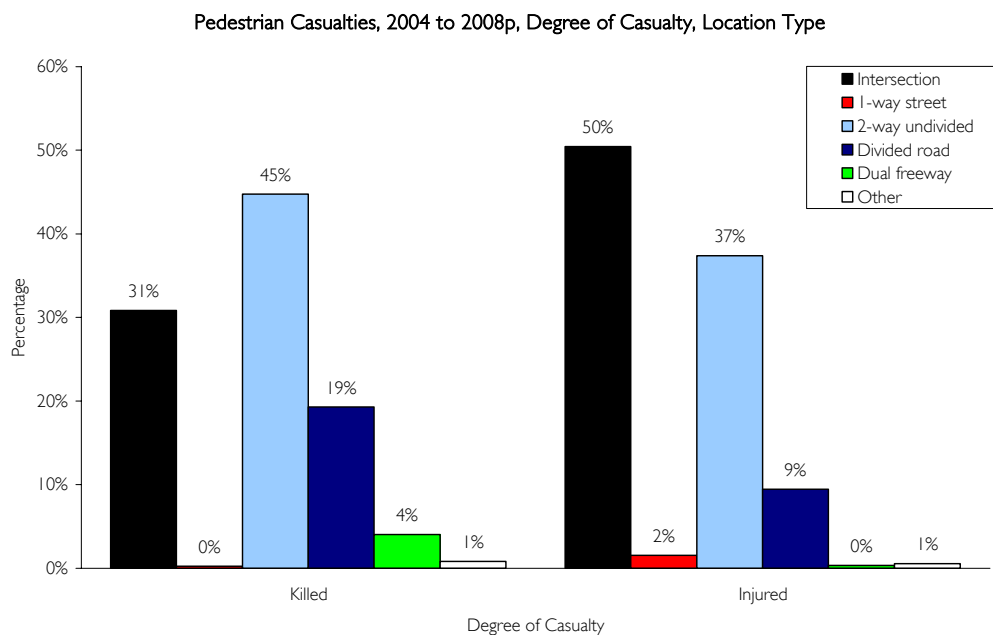
The elderly are over-represented in pedestrian trauma. With around 10% of the NSW resident population, the 70 years and over age group accounts for around one-third (33%) of all pedestrian fatalities. However, this age group accounts for 11% of all injuries, suggesting that the frailty of the elderly is the main reason for this over-representation amongst pedestrian fatalities. Elderly fatalities are slightly over-represented in the metropolitan areas, accounting for 36% of fatalities.

In contrast, the young adult age group (17 to 29 years) comprise 18% of the NSW resident population and 19% of all pedestrian fatalities, but account for 26% of all pedestrian injuries across the State. This suggests that there exists an increased risk of pedestrian trauma for this age group (through risk taking behaviours such as drink walking, late nights etc) which is offset in terms of fatalities by lower levels of frailty than older age groups.



Location Type

The majority of fatalities occur at mid-block locations, with 45% of all fatalities occurring at mid block locations on 2 way undivided roads and a further 19% of all fatalities occurring at mid block locations on divided roads. This over-representation at mid block locations on 2 way divided roads is even more pronounced in the non metropolitan areas, with 68% of all fatalities occurring at this type of location.

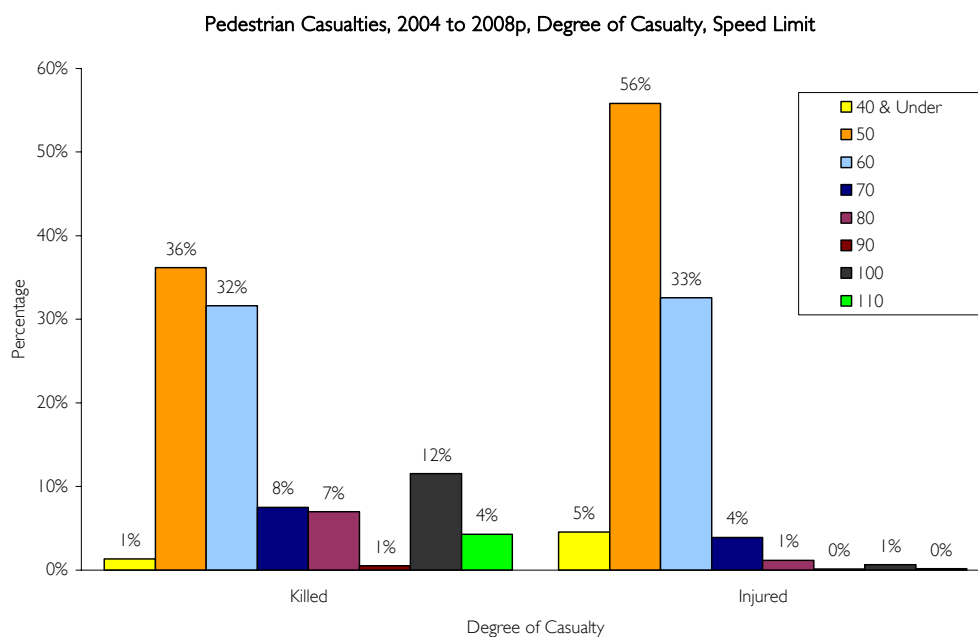


Half of all pedestrian injuries across the State occur at intersections (or within 10 metres of an intersection).

Posted Speed Limit

Most pedestrian casualties occur in 50 km/h or 60 km/h speed zones whilst the majority of pedestrian injuries (56%) occur in 50 km/h speed zones. It should be noted that the general urban speed limit of 50 km/h was introduced in NSW in November 2003, though 50 km/h speed zones were quite widespread prior to this date.

Amongst pedestrian casualties, fatalities are over-represented in the higher posted speed zones. The proportion of fatalities in a 70 km/h zone is twice that for pedestrian injuries in a 70 km/h zone. For higher speed zones the disparity is even greater – 12% of all fatalities occur in 100 km/h zones compared with only 1% of all injuries.

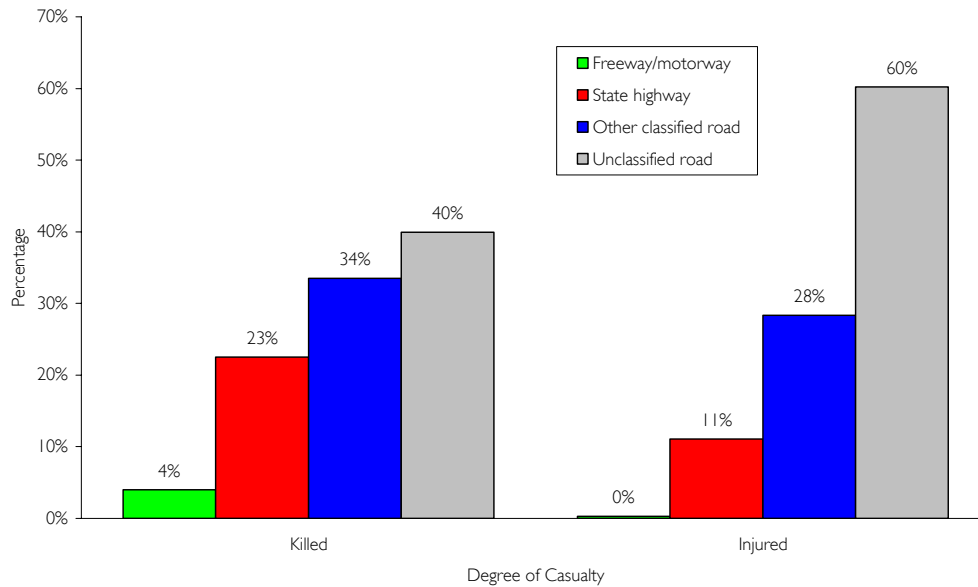


In the non metropolitan areas, more than one third (37%) of all fatalities occur on roads with a speed limit of 100 km/h or more.

Road Classification

Local roads (unclassified roads) account for the largest percentage of pedestrian fatalities (40%) and the majority of injuries (60%). At the same time, one in four fatalities (27%) occur on Freeways/Motorways/State Highways but these high level roads account for only 11% of all injuries. This result is not surprising given that local roads tend to have lower posted speed limits and Freeways/Motorways/State Highways tend to have higher posted speed limits.

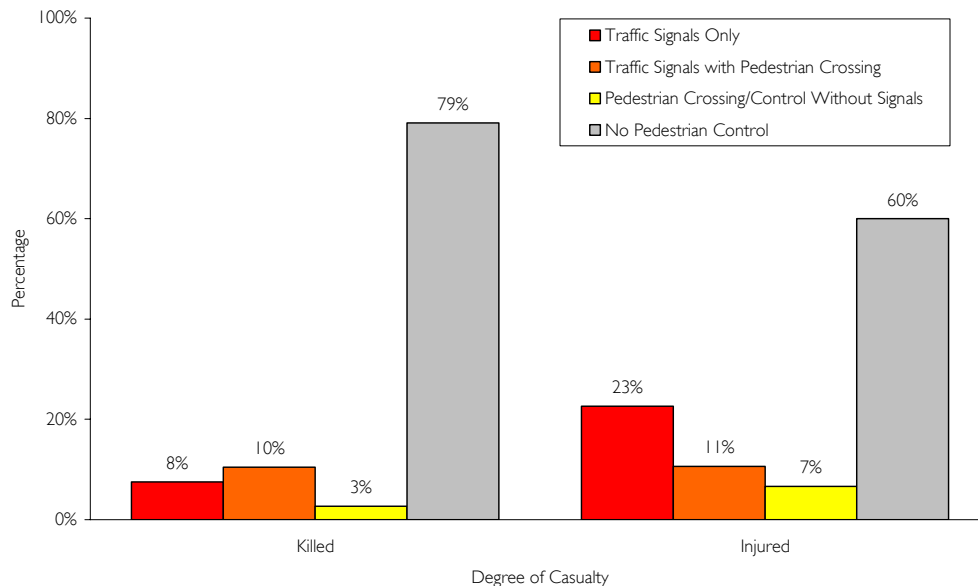
Pedestrian Casualties, 2004 to 2008p, Degree of Casualty, Road Classification



Traffic Signals / Pedestrian Controls

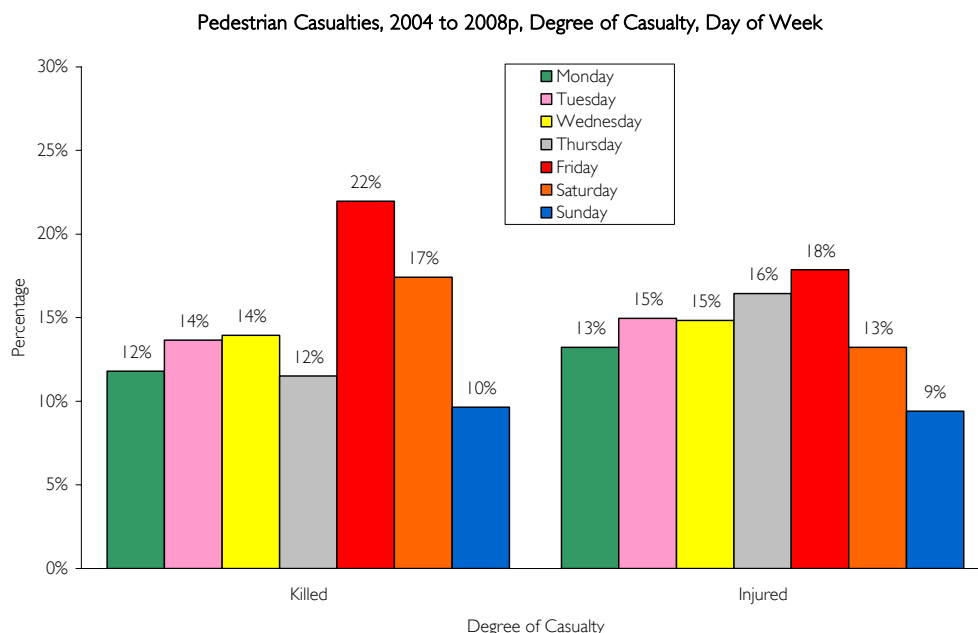
Most pedestrian casualties occur at locations without some form of pedestrian control present - over three-quarters (79%) of fatalities and three-fifths (60%) of injuries occur at these locations. In non metropolitan areas the percentage of injuries at locations without a pedestrian control rises to 81%, for fatalities the percentage increases to 92%.

Pedestrian Casualties, 2004 to 2008p, Degree of Casualty, Pedestrian Controls



Day of Week

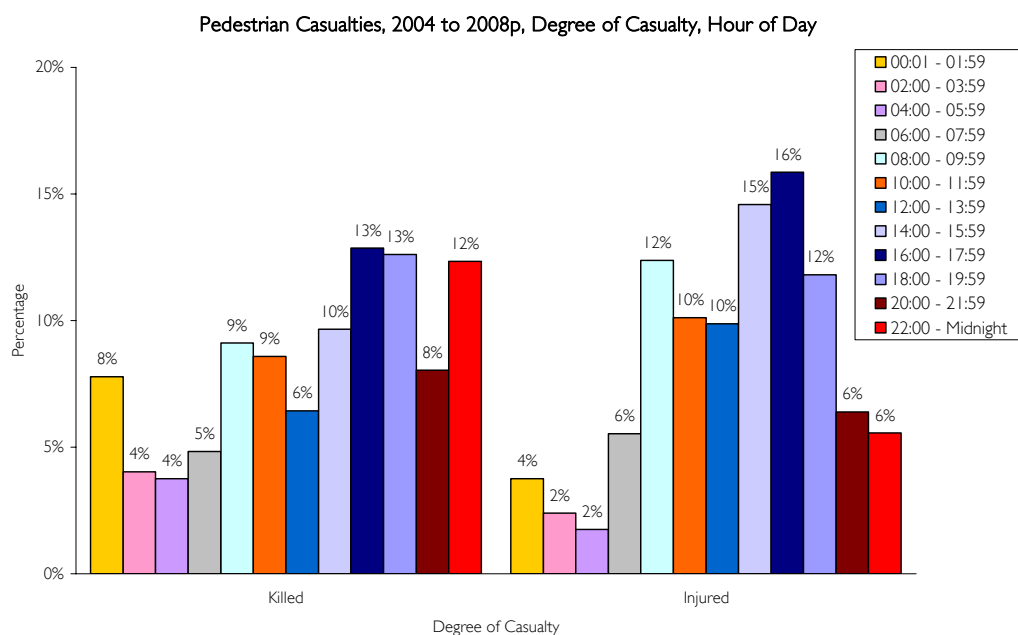
Fatalities are skewed towards Fridays (22% of all fatalities) and Saturdays (17% of all fatalities) whilst injuries are more prevalent during the weekdays, rising through the week to Fridays with 18% of all injuries. Compared with the metropolitan area, there is a slightly higher percentage of pedestrian casualties in the non metropolitan areas occurring on weekends.



Time of Day (2 Hour Periods)

Compared to the distribution of pedestrian injuries, fatalities are over-represented during the late evening and early morning hours of the day. Around 28% of fatalities occur between 10 pm and 6 am whilst only 14% of injuries occur during this period. This over-representation is more extreme in non metropolitan areas where 40% of all fatalities occur during this period.

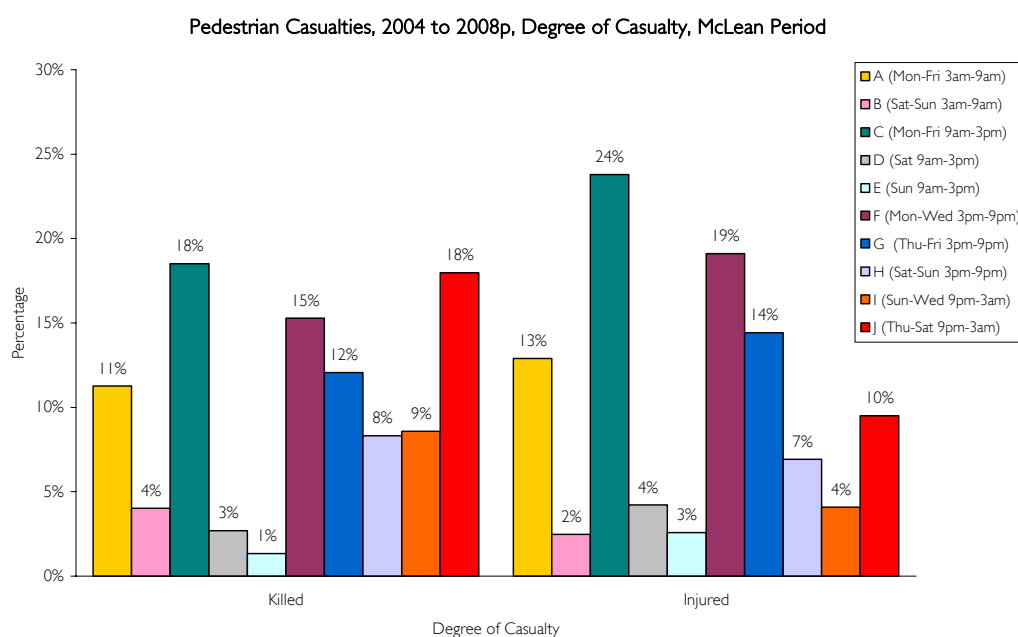
Injuries, particularly in the metropolitan area, peak during the mid morning hours (8 am to 10 am) and mid afternoon (2pm to 6 pm).



McLean Periods

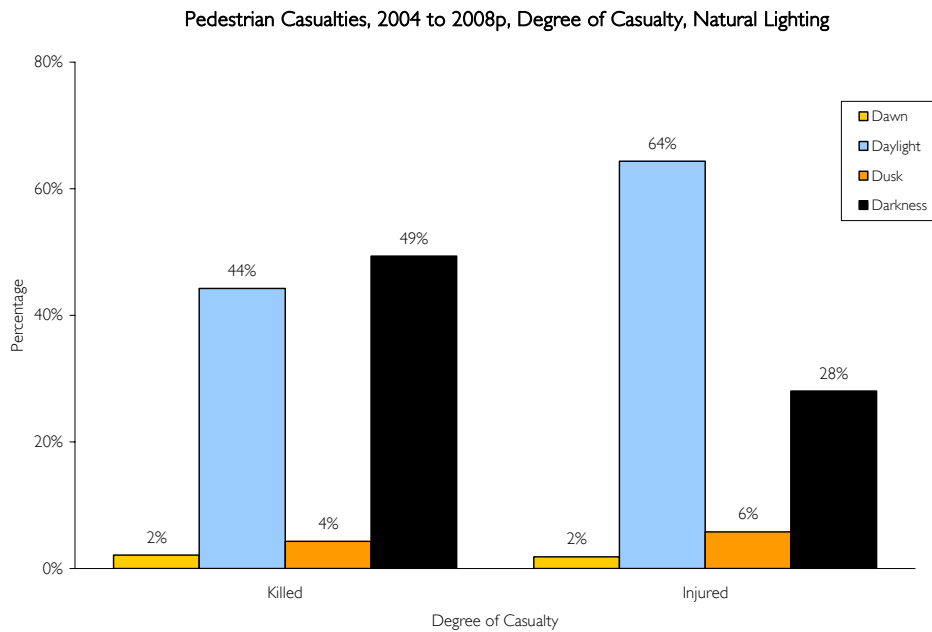
The previous two sections suggested a relationship between day of week / time of day and the severity of a pedestrian casualty. The following disaggregation of the pedestrian casualty data by McLean periods crystallises this relationship. The following McLean time periods were defined by A.J. McLean, O.T. Holubowycz and B.L. Sandow in their report *Alcohol and Crashes: Identification of Relevant Factors in this Association*, Department of Transport, Australia, 1980. The ten time periods, A to J, exhibit different characteristics of traffic conditions, driver/rider behaviour and trip purpose.

Compared with pedestrian injuries, fatalities are over-represented during McLean periods I and J (late evenings and early mornings through the week). Injuries are over-represented during McLean periods C, F and H (during daytime on weekdays and late afternoon / early evening through the week).



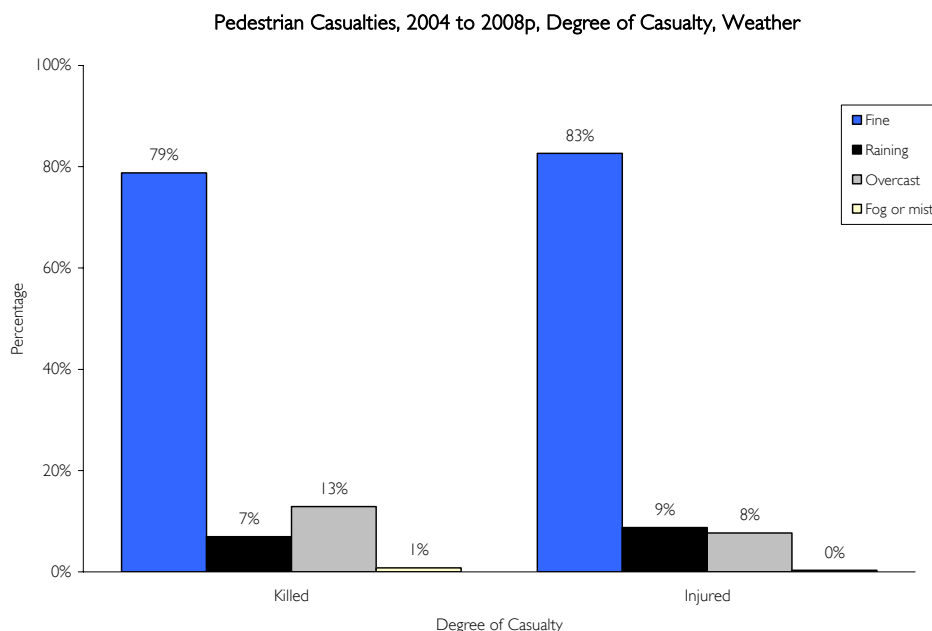
Natural Lighting

Almost half (49%) of all pedestrian fatalities occur where the natural lighting was darkness, rising to 58% in non metropolitan areas. In contrast, only one-quarter (28%) of injuries occur in darkness. Given the previous information on time of day and McLean periods, it is not surprising that most injuries (64%) occur in daylight conditions.



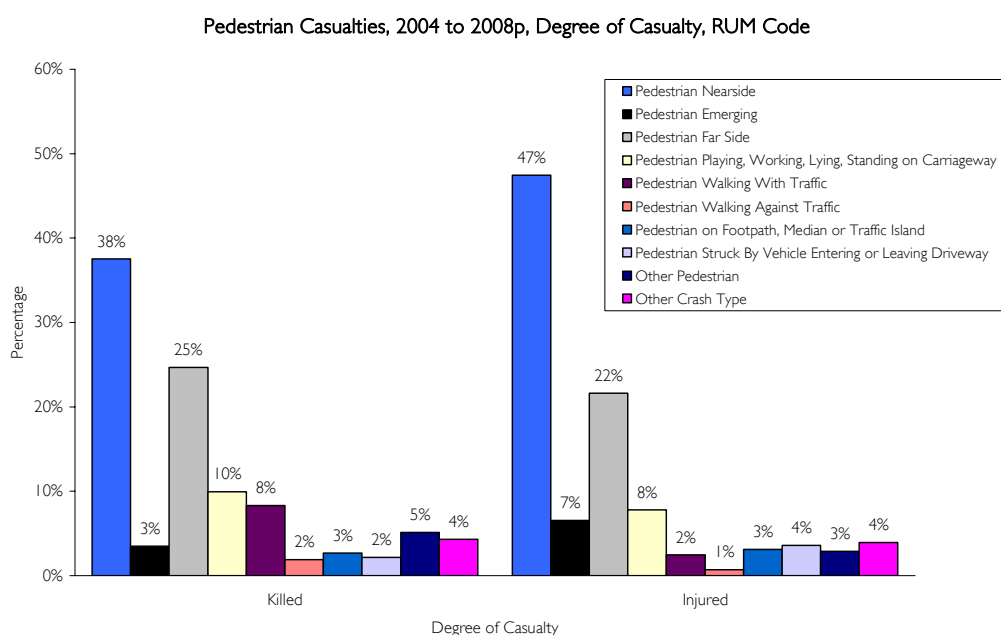
Weather

The overwhelming majority of pedestrian casualties (up to 83% for injuries) occur during fine weather. However, almost one in ten injuries occur during rainy weather, possibly an over-representation given the likely underlying extent of these conditions across the State during the five year period 2004 to 2008.



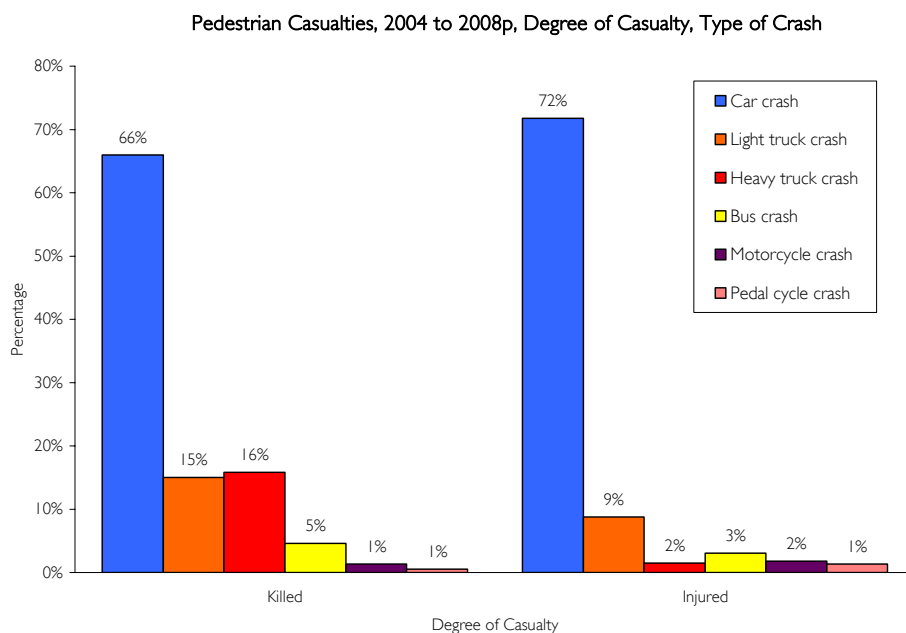
Road User Movement (RUM) code for Crash

The overwhelming majority of pedestrian casualties involve a pedestrian struck in the first impact, with the most common movement being the pedestrian struck whilst crossing the road on the nearside of the vehicle (pedestrian struck by vehicle travelling on their right side). The next most common movement involves a pedestrian struck whilst crossing from the far side of the vehicle (pedestrian struck by vehicle travelling on their left side).



Crash Type (Type of Vehicle Involved)

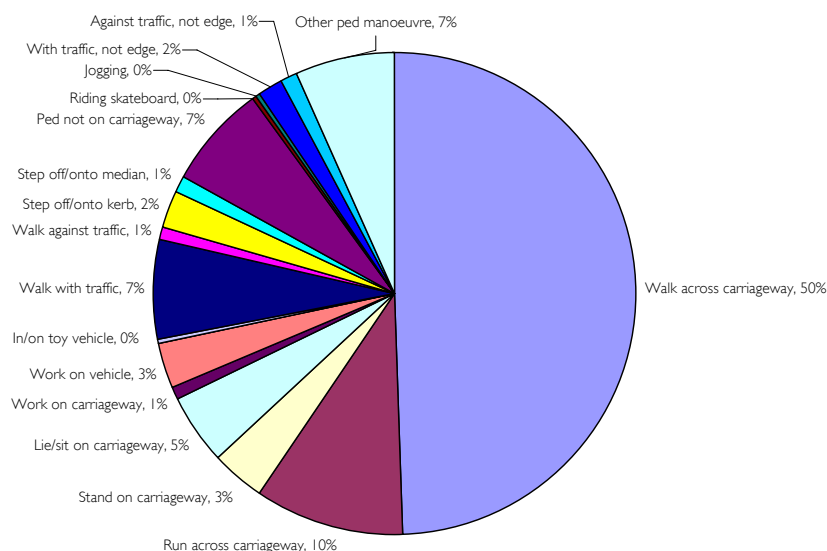
Most pedestrian casualties involve a car or car derivative. However, compared with pedestrian injuries, there is a strong over-representation of light trucks, buses and, in particular, heavy trucks amongst fatalities. Heavy trucks are around eight times more likely to be involved in a pedestrian fatality - involved in only 2% of all pedestrian injuries but accounted for 16% of all fatalities.



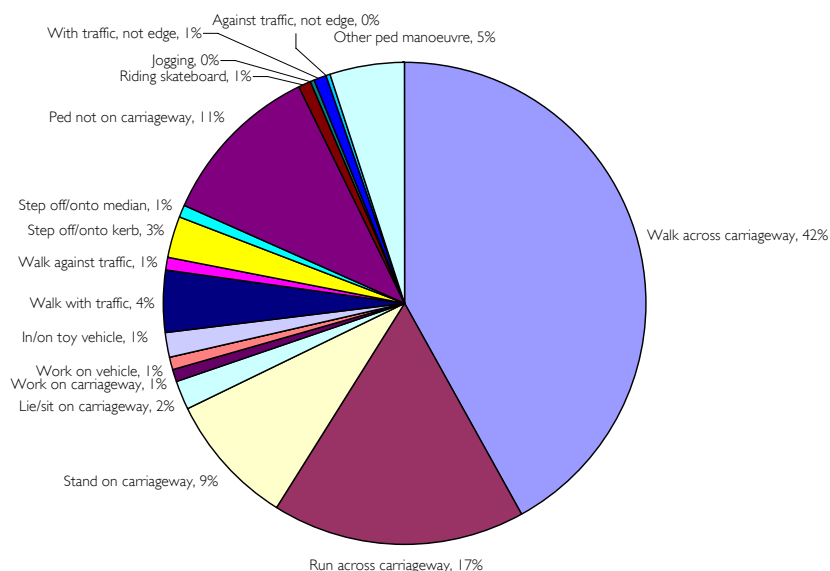
Pedestrian Manoeuvre

Most pedestrian casualties involve the pedestrian walking across the carriageway, accounting for 50% of all fatalities and 42% of all injuries. The next most common pedestrian manoeuvre involved the pedestrian running across the carriageway, with one in six injuries and one in ten fatalities involving this manoeuvre. Interestingly around one in ten pedestrian casualties were struck whilst not on the carriageway and a further 5% of all pedestrian fatalities were struck whilst sitting or lying on the carriageway.

Pedestrian Fatalities, 2004 to 2008p, Pedestrian Manoeuvre

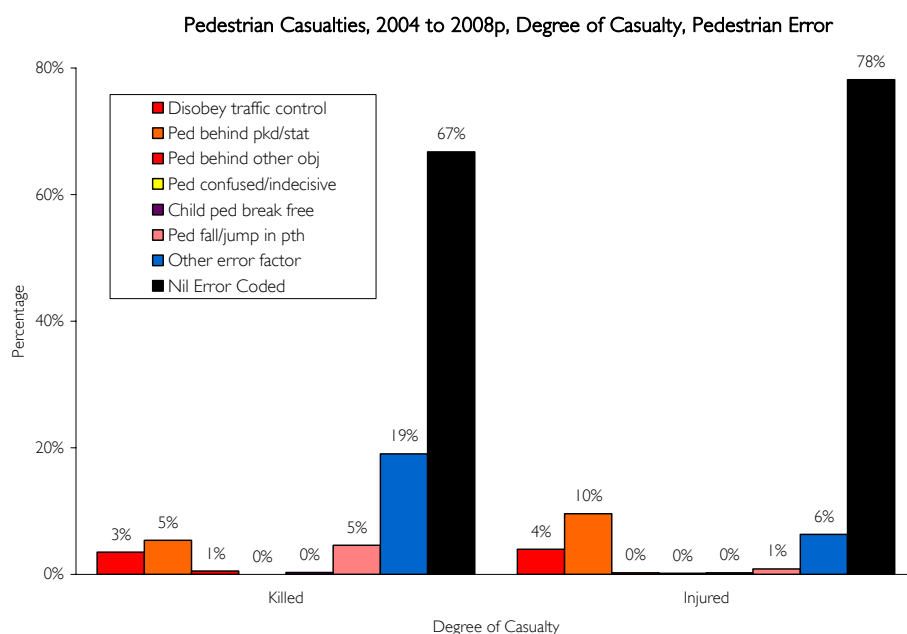


Pedestrian Injuries, 2004 to 2008p, Pedestrian Manoeuvre



Pedestrian Error

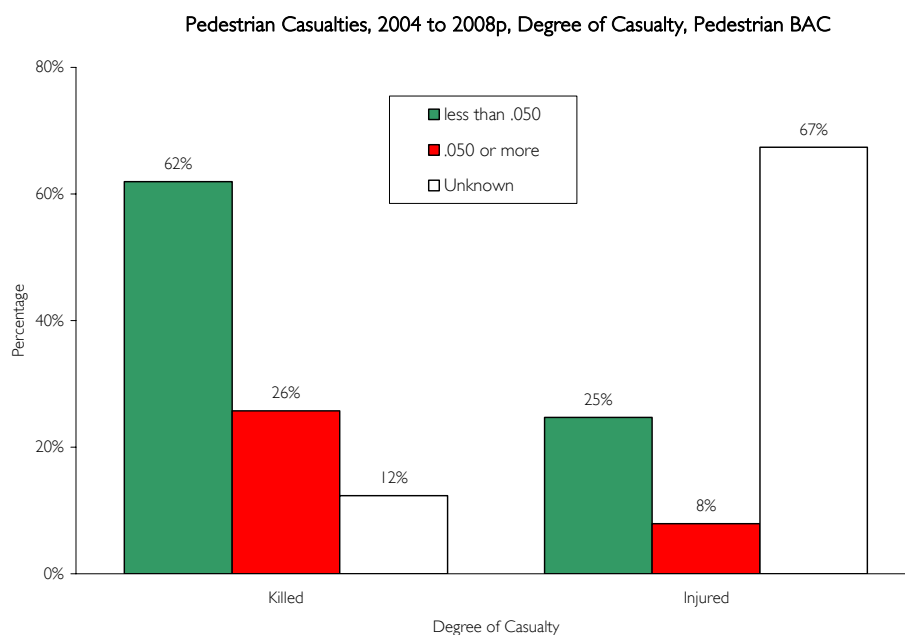
Most pedestrian casualties have no error coded for the pedestrian. However, around 10% of fatalities and 14% of injuries involve the pedestrian disobeying a traffic control or emerging from behind a parked or stationary vehicle.



Blood Alcohol Concentration

Alcohol results vary across pedestrian severity, with relatively low levels of unknowns for fatalities (12%) compared to the levels for injuries (67%). Alcohol samples for pedestrians are required for persons aged over 16 years and are usually taken for fatalities or where injuries are presented at a hospital within a two hours of the crash.

Where alcohol results are known, around 30% of fatalities and 24% of injuries involve a pedestrian with a blood alcohol concentration of 0.05 or more. The incidence of alcohol (where it is known) is higher in the non metropolitan area with 45% of fatalities and 37% of injuries in this area involving a pedestrian with a blood alcohol concentration of 0.05 or more.



Risk Factors of Drivers and Riders Involved in Pedestrian Casualties (Speed, Fatigue and Illegal Alcohol)

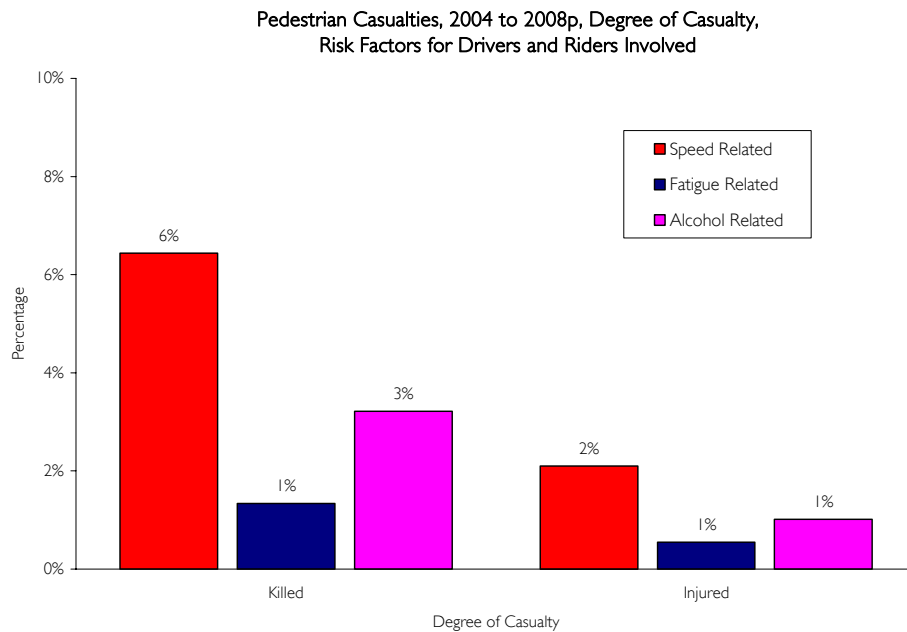
Compared with crashes not involving pedestrians, the involvement of behaviour risk factors (as coded for the driver or rider involved) such as speed, fatigue and illegal alcohol are relatively low in pedestrian casualty crashes. However, compared with pedestrian injuries, the involvement of these risk factors are generally higher for pedestrian fatalities.

Amongst all road fatalities over the five year period 2004 to 2008p speed was involved in around 37% of fatalities and 17% of injuries, fatigue is involved in 18% of fatalities and 8% of injuries whilst illegal alcohol for drivers and riders are involved in 19% of fatalities and 6% of injuries.

Speed (defined as excessive or inappropriate speed for the conditions) was involved in around 6% of pedestrian fatalities and 2% of pedestrian injuries.

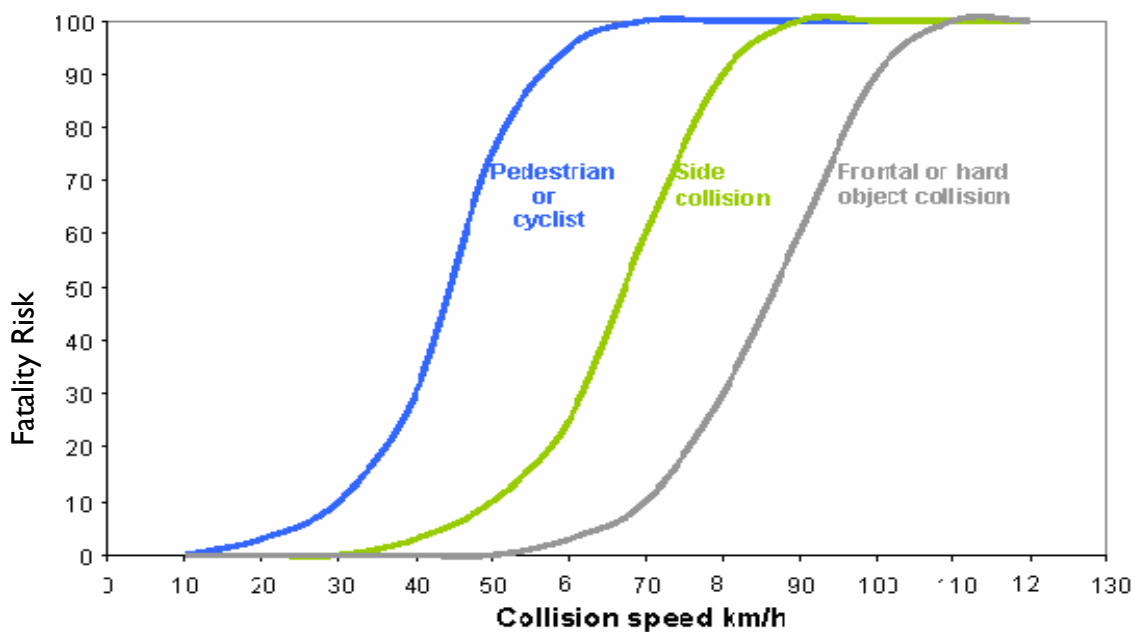
Driver or rider fatigue is involved in around 1% of pedestrian fatalities and pedestrian injuries.

Illegal alcohol for the driver or rider is involved in around 3% of pedestrian fatalities and 1% of pedestrian injuries. These results contrast with the high levels involvement of alcohol amongst the pedestrian casualties – at least 26% of pedestrian fatalities and 8% of pedestrian injuries have a BAC over 0.05.



Although these results suggest that speed is not a highly prevalent factor in pedestrian casualties, studies of survival and impact speed show that small differences in vehicle speed can greatly affect the risk of a pedestrian fatality and that the threshold for pedestrian survivability is much lower than for occupants in vehicle impact.

At an impact speed of 30 km/h the average pedestrian has a 95% chance of surviving the crash. However this reduces to around 74% at 40 km/h, around 16% at 50 km/h whilst at impact speeds above 60 km/h pedestrian survivability is less than 5%. For older pedestrians these survival chances would be even less at each of these impact speeds. In contrast for vehicle occupants there is a 90% survival chance in a side collision and a 99% survival chance in a frontal collision at an impact speed of 50 km/h.

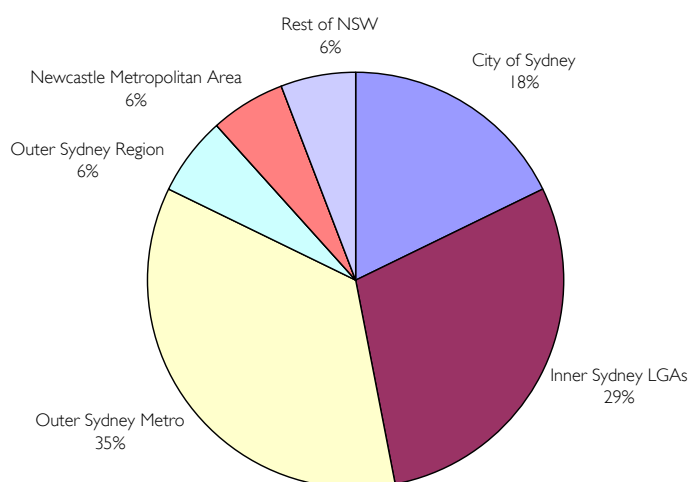


Other Issues Relevant to Pedestrian Casualties

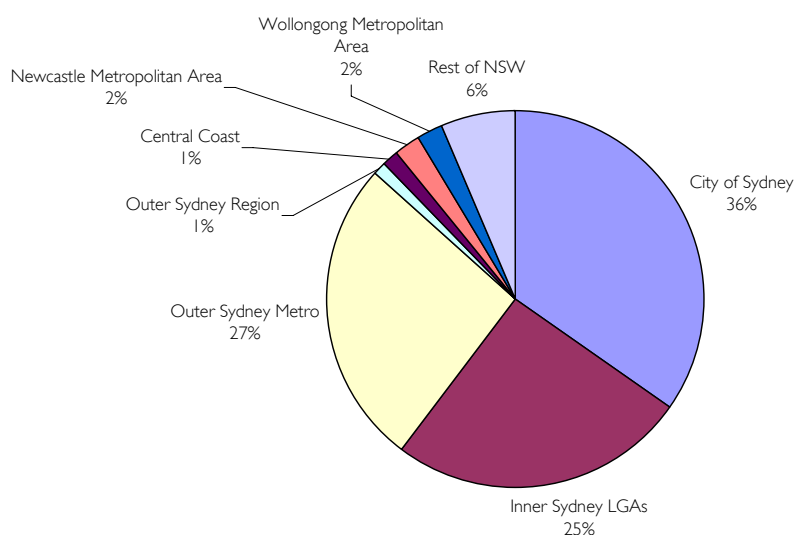
Pedestrian Casualties Which Involve a Bus in the First Impact

During the five year period 2004 to 2008p, buses were involved in the first impact in 17 pedestrian fatalities (4.6% of all fatalities) and 310 pedestrian injuries (2.9% of all injuries). The majority of bus involved pedestrian casualties occurred in the metropolitan area (94%), with most of the 16 fatalities and 283 injuries occurring within the Sydney Metropolitan Area.

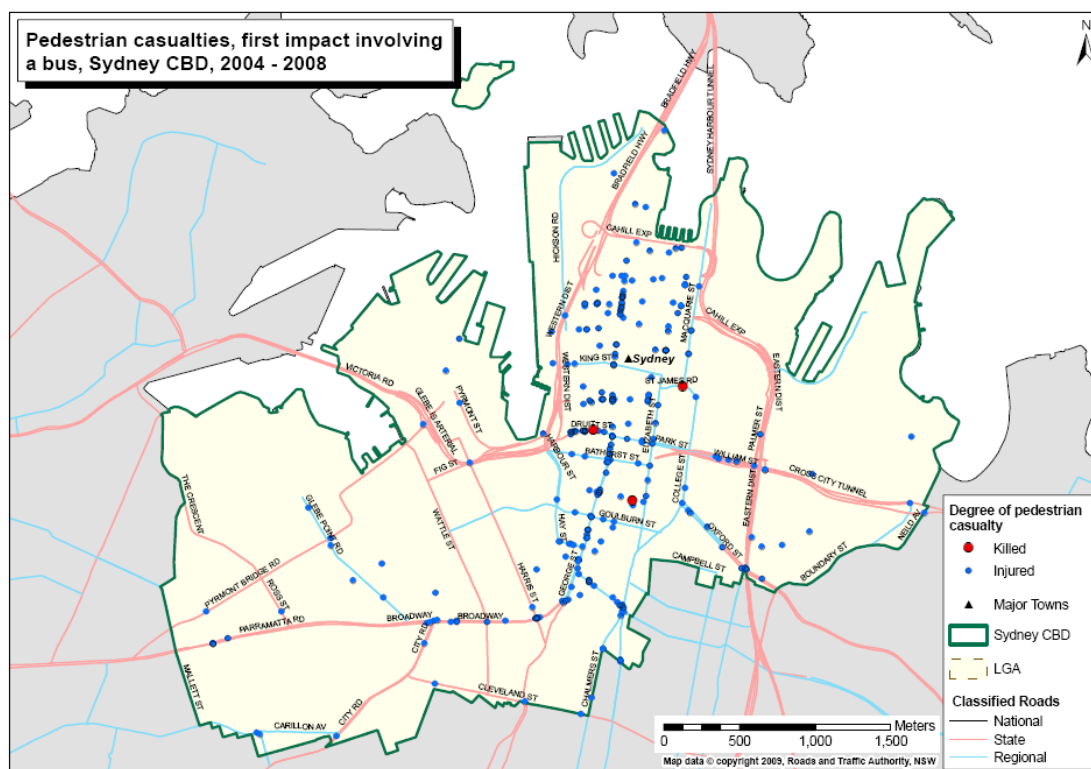
Pedestrian Fatalities Struck By a Bus, 2004 to 2008p, Location



Pedestrian Injuries Struck By a Bus, 2004 to 2008p, Location

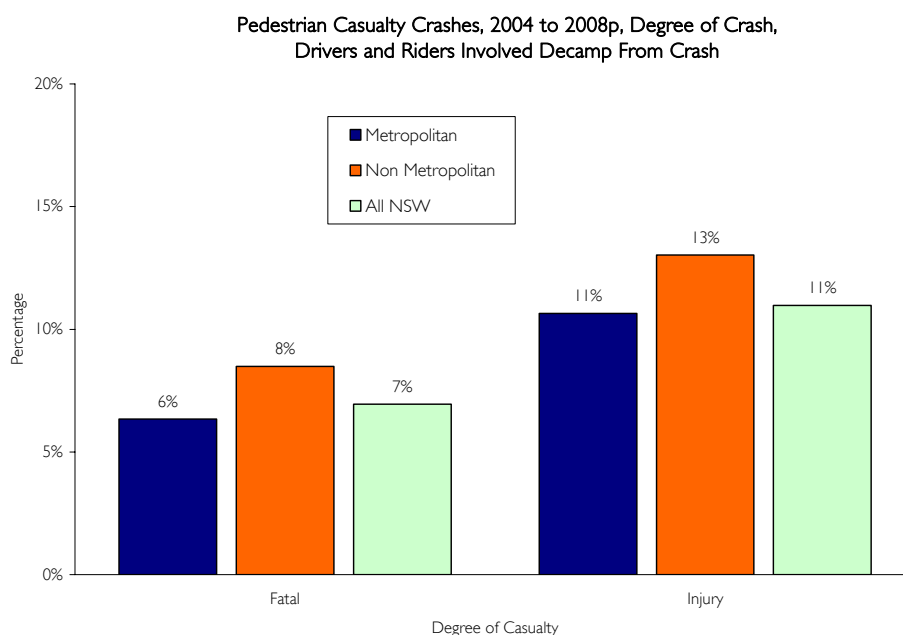


Notably, the City of Sydney local government area is over-represented in bus involved pedestrian crashes. Three out of the 11 fatal pedestrian crashes involved a bus whilst the largest proportion of bus involved injuries are found concentrated in the City of Sydney local government area (36% of all bus involved injuries). The following map showing the location of these pedestrian casualty crashes within the City of Sydney local government area highlight that the problems occur along the main bus corridors of the Sydney central business district.



Driver or Rider Involved in Pedestrian Crash Decamped

Around 7% of pedestrian fatal crashes and 11% of pedestrian injury crashes involve the driver or rider of a motor vehicle involved leaving the scene of the crash without rendering assistance /exchanging particulars (driver or rider decamped). The incidence is slightly greater in the non metropolitan areas.

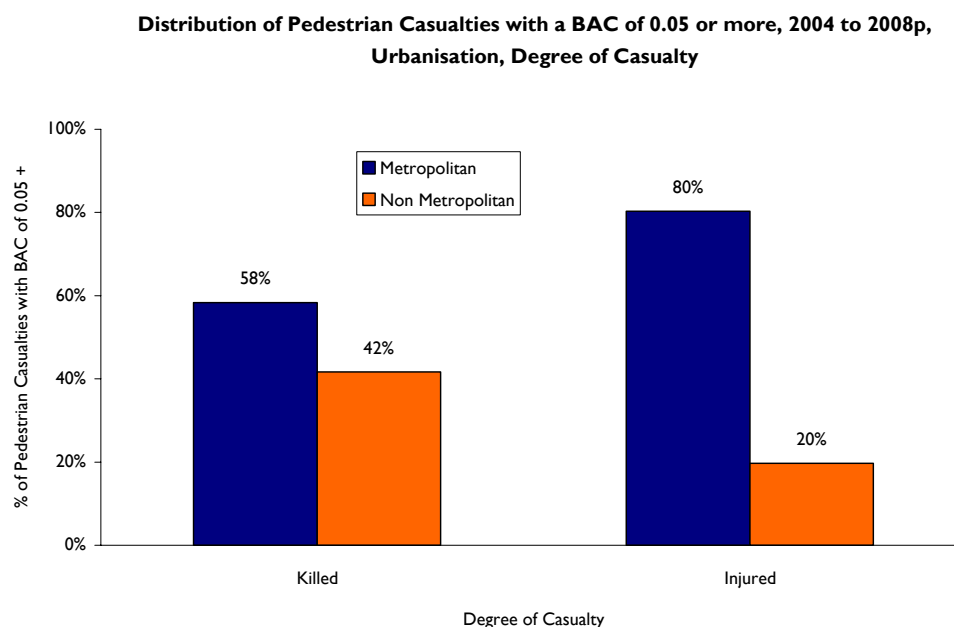


Drink Walking Amongst Pedestrian Casualties

As discussed previously, it was found that alcohol involvement for drivers and riders involved in pedestrian casualties is low compared to all casualties and especially low compared to the incidence of alcohol for pedestrian casualties. This section looks into the characteristics of the alcohol affected pedestrian casualty.

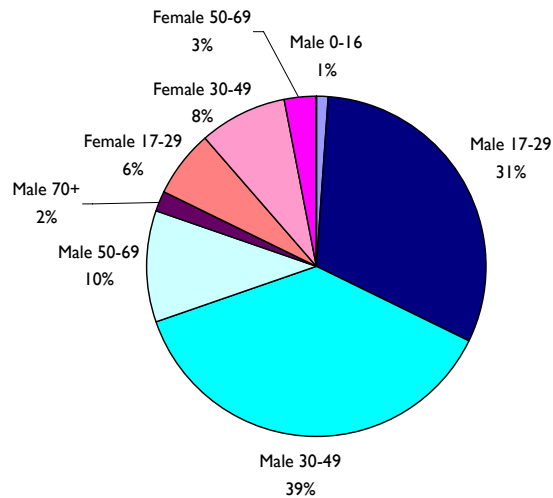
The alcohol affected pedestrian casualty is typically male, young to middle aged and struck during high alcohol times such as Thursday to Saturday nights and early mornings.

Alcohol affected pedestrian casualties are over-represented in the non metropolitan area. The non metropolitan area accounted for only 28% of all pedestrian fatalities and 14% of all pedestrian injuries in the State but accounted for 42% of alcohol affected pedestrian fatalities and 20% of alcohol affected pedestrian injuries. However, the majority of alcohol affected pedestrian casualties still occur within the metropolitan area.



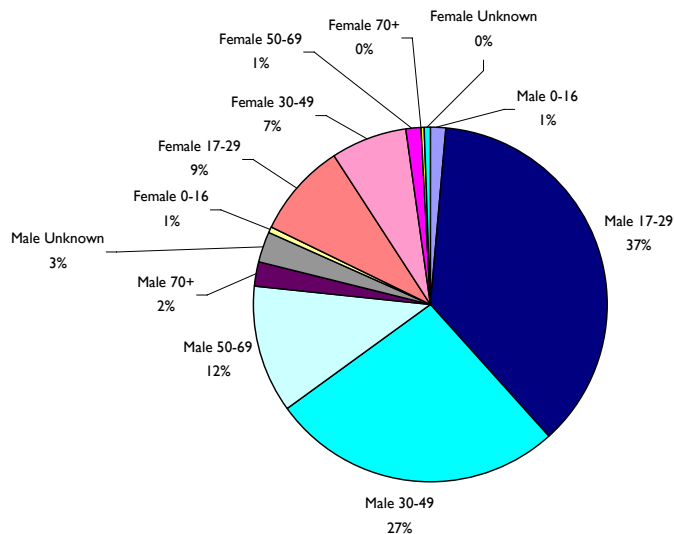
Males accounted for more than 80% of alcohol affected pedestrian fatalities with the young (17 to 29 years) to middle aged (30 to 49 years) groups accounting for 70% of all alcohol affected pedestrian fatalities. In the non metropolitan area the middle aged group were the largest demographic.

Pedestrian Fatalities With a BAC of 0.05+, 2004 to 2008p, Gender by Age



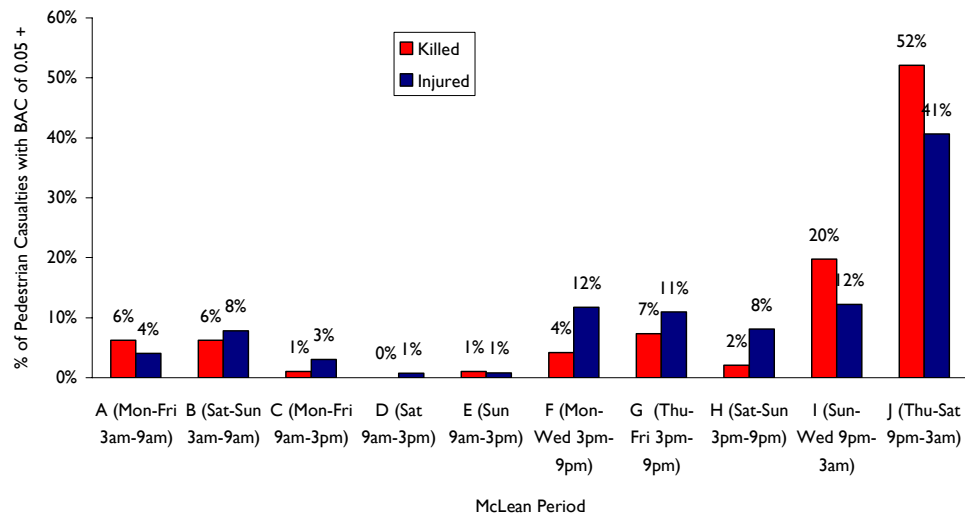
Amongst alcohol affected injuries the young males were the largest demographic, with 37% of all alcohol affected pedestrian injuries, compared with the middle aged demographic with 27% of all alcohol affected pedestrian injuries.

Pedestrian Injuries With a BAC of 0.05+, 2004 to 2008p, Gender by Age

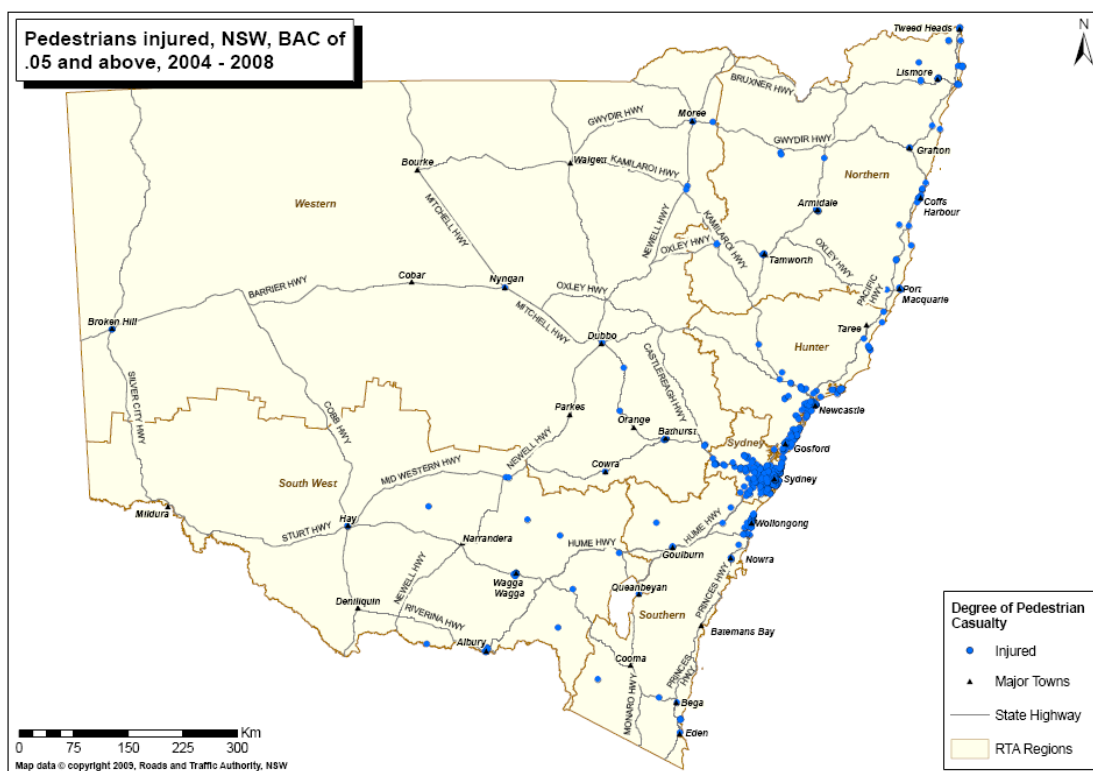
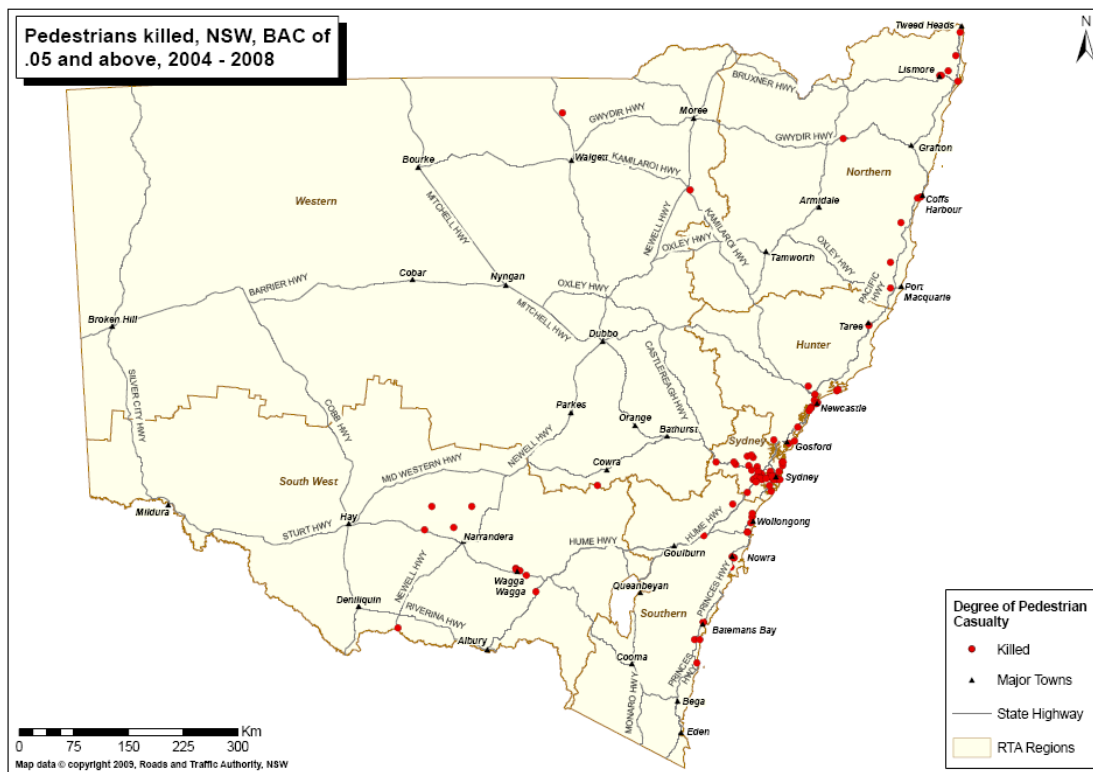


Not surprisingly the majority of alcohol affected pedestrian casualties occur during the late evening and early morning hours, particularly on Thursday, Friday and Saturday nights. Just over half of all alcohol affected pedestrian fatalities and 41% of all alcohol affected injuries occur at these times.

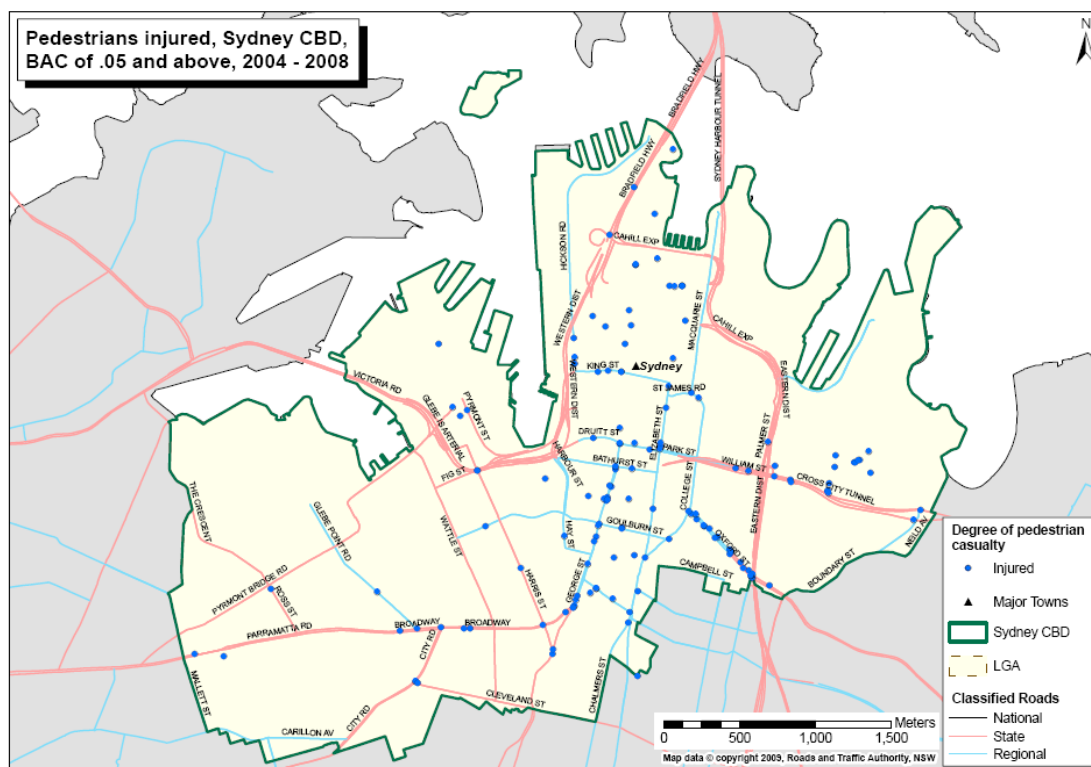
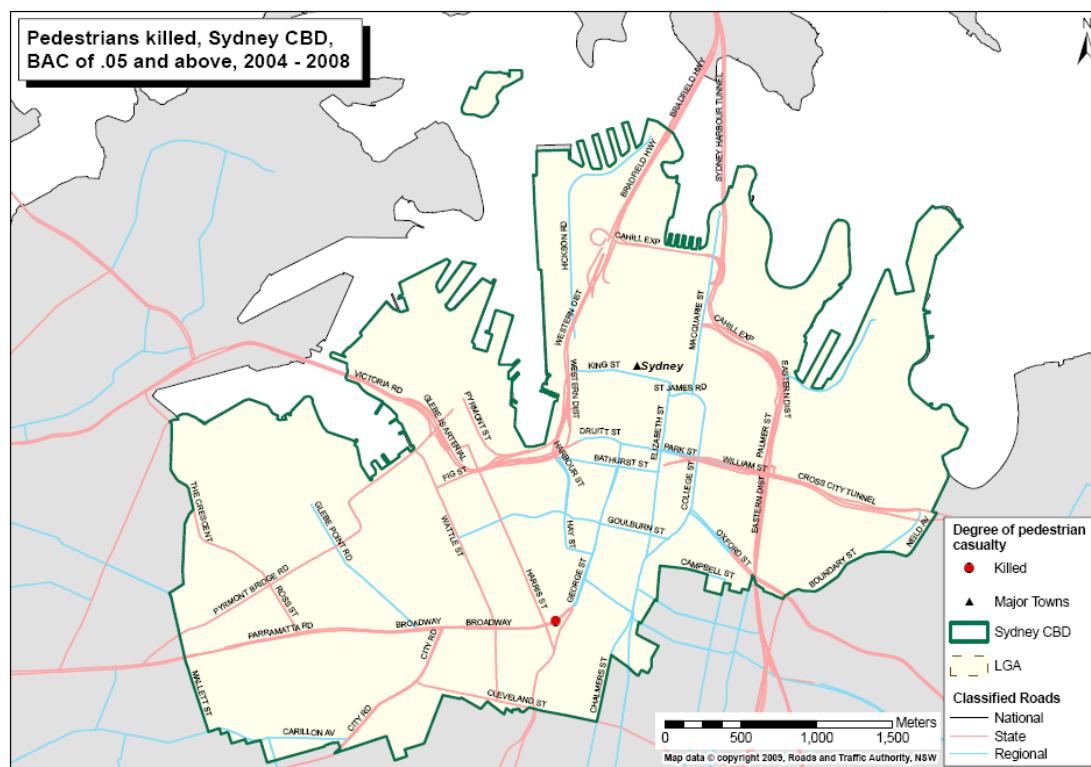
**Distribution of Pedestrian Casualties with a BAC of 0.05 or more, 2004 to 2008p,
McLean Period, Degree of Casualty**



Mapping of the alcohol affected fatalities and injuries show that they are concentrated in the metropolitan area.

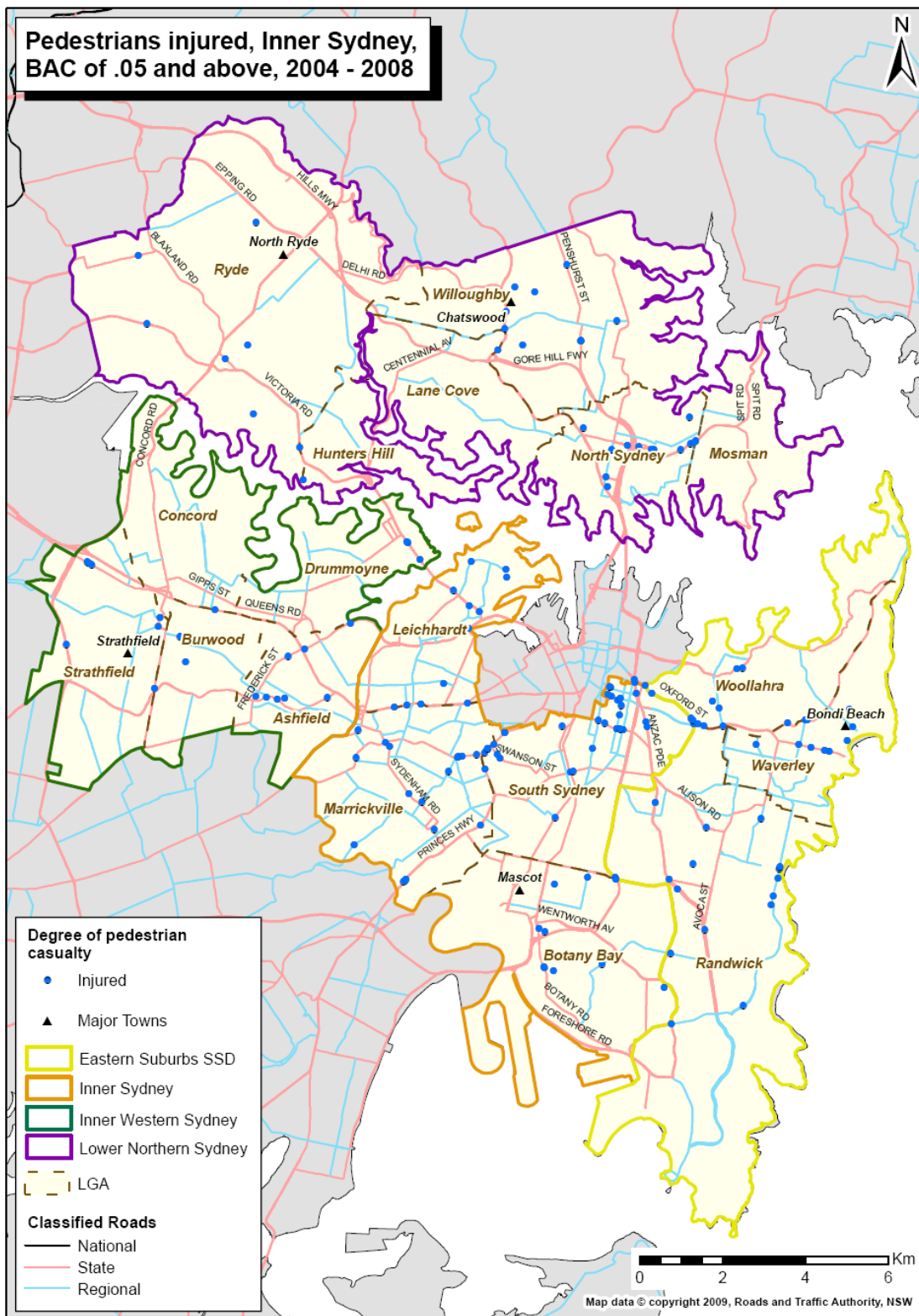


Whilst only one alcohol affected pedestrian fatality occurred in the City of Sydney local government area, injuries were more prevalent and they were clustered along Oxford Street and George Street (between Town Hall and Railway Square).

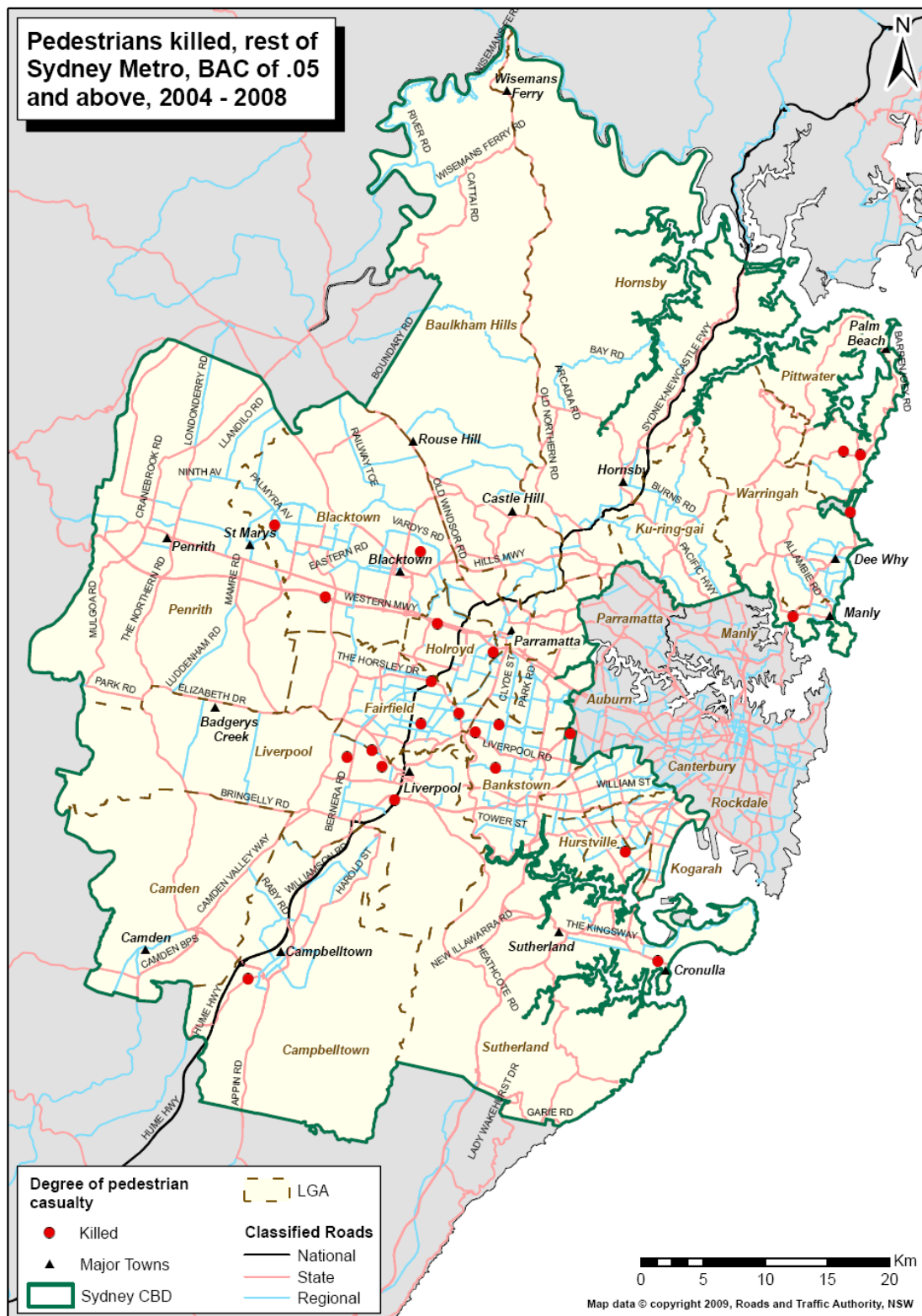


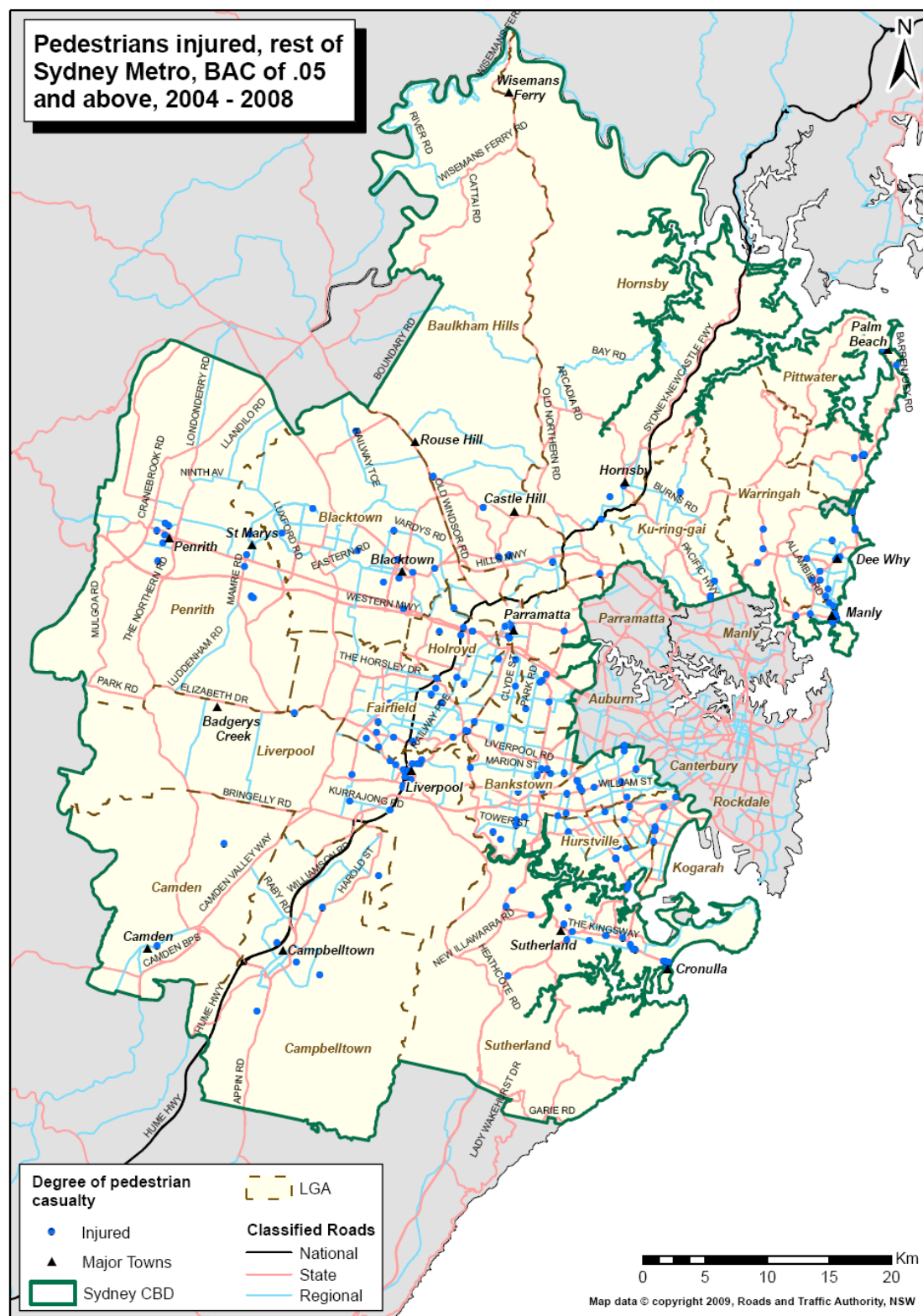
Most alcohol affected pedestrian casualties in the Inner Sydney area were clustered around the South Sydney and Newtown / Enmore areas.





Most alcohol affected pedestrian fatalities in the Outer Sydney metropolitan area were located in a band from Parramatta through to Liverpool, whilst there were additional clusters of injuries in the Penrith, Bankstown and Manly areas.





Maps of other areas have not been shown because of the relatively small numbers of alcohol affected casualties present for these areas.

Characteristics of Pedestrian Fatalities in 2009

(January to May data only, 2009 versus 2008)

As indicated previously the number of pedestrian fatalities so far in 2009 is more than 50% higher than for the same period in 2008, a figure which is greater than the increase in the overall road toll over the same period.

Appendix 2 provides a summary for each pedestrian fatality that has occurred in NSW during the first five months of 2009.

The following table details a breakdown of the characteristics of pedestrian fatalities so far in 2009 compared with the same period in 2008. Note that the disaggregated numbers are generally quite small, so any changes between 2009 and 2008 needed to be treated with caution.

Number of Pedestrian Fatalities
(January to May Only, 2009 v 2008)

Gender	2009	2008	Change	Urbanisation	2009	2008	Change
Male	20	15	5	Syd, New, Woll Metro	20	13	7
Female	9	4	5	Rest of NSW	9	6	3
Total Fatalities	29	19	10	Total Fatalities	29	19	10
Age Group	2009	2008	Change	RTA Region	2009	2008	Change
0-16	2	0	2	Sydney	16	10	6
17-29	10	4	6	Northern	3	2	1
30-49	4	5	-1	Hunter	4	4	0
50-69	4	2	2	Southern	3	2	1
70+	7	8	-1	South West	1	1	0
Unknown	2	0	2	Western	2	0	2
Total Fatalities	29	19	10	Total Fatalities	29	19	10
Day of Week	2009	2008	Change	Speed Limit	2009	2008	Change
Sunday	4	3	1	Under 60km/h	7	6	1
Monday	3	1	2	60km/h	7	6	1
Tuesday	5	3	2	70km/h	6	2	4
Wednesday	2	1	1	80km/h	3	2	1
Thursday	5	1	4	90km/h	2	0	2
Friday	5	6	-1	100km/h	1	1	0
Saturday	5	4	1	110km/h	3	2	1
Total Fatalities	29	19	10	Unknown	0	0	0
McLean Period	2009	2008	Change	Total Fatalities	29	19	10
A (Mon-Fri 3am-9am)	5	2	3	Road Classification	2009	2008	Change
B (Sat-Sun 3am-9am)	3	2	1	Freeway/Motorway	1	1	0
C (Mon-Fri 9am-3pm)	3	6	-3	Highway	11	4	7
D (Sat 9am-3pm)	0	0	0	Other Classified	8	7	1
E (Sun 9am-3pm)	0	1	-1	Unclassified Road	9	7	2
F (Mon-Wed 3pm-9pm)	3	1	2	Total Fatalities	29	19	10
G (Thu-Fri 3pm-9pm)	6	2	4				
H (Sat-Sun 3pm-9pm)	3	0	3				
I (Sun-Wed 9pm-3am)	3	1	2				
J (Thu-Sat 9pm-3am)	3	4	-1				
Total Fatalities	29	19	10				

The above table suggests that the major increases have occurred in the 17 to 29 year age group, during the late afternoon and early evening periods, in the Sydney RTA Region, on roads with 70 km/h to 90 km/h posted speed limits and on State Highways.

However, most of these apparent changes are quite small and therefore subject to high levels of statistical random variation. Also note that the level of unknowns in the alcohol data are quite high at the time of this report and hence reporting of these data would be unreliable.

PART 3 - PEDESTRIANS & SPEED

Pedestrians form the largest single road-user group. Most individual trips, whatever the primary mode used, begin and/or finish with a walk section, so that walking is a fundamental component of travel. Pedestrian crashes occur most frequently in urban areas where pedestrian activity and traffic volumes are greater as compared to rural areas.

High volumes of traffic can inhibit a person's feeling of safety and comfort but traffic speed is the more critical aspect to walkability and pedestrian safety. Faster traffic speeds increase the likelihood of pedestrians being hit and increase the severity of the crash. At higher speeds, motorists are less likely to see a pedestrian, and even less likely to actually stop in time to avoid a crash. In addition, pedestrians are less able to judge a safe gap in which to cross.

Speeding is a major contributing factor in crashes of all types. In 2007, speeding was a contributing factor in 32 percent of all fatal crashes and the provisional data for 2008 indicate 39% of all fatalities were speed related. The preliminary fatal crash data for 2009 to date indicates that the NSW road toll has significantly increased and that at least 46% of all fatalities are speed related.

Lower speeds deliver significant road safety benefits reducing both the number and severity of crashes. A major study (Tziotis, 2001) that evaluated the introduction of the 50km/h urban speed limit in NSW found that a 23% reduction in road crashes was achieved on residential streets where the lower speed limit was introduced.

High travelling speeds greatly increase the risk of injury and death to pedestrians. Research conducted at the University of Adelaide (*Kloeden CN, McLean, AJ, Moore VM, Ponte G (1997). Travelling speed and the risk of crash involvement. Road Accident Research Unit, University of Adelaide*) has shown that the risk of a crash causing death or injury increases rapidly even with small speed increases above the posted speed limit.

As noted in Part 2, speeding has serious consequences when a pedestrian is involved. On average, when a pedestrian is hit at an impact speed of 30 km/h or less, the pedestrian has around an 85% chance of surviving. With an impact speed of 40 km/h, the pedestrian has a 74% chance of surviving. At an impact speed of 60 km/h or more, the pedestrian has almost no chance of surviving. (*McLean AJ, Anderson RWG, Farmer MJB, Lee BH, Brooks CG. (1994). Vehicle travel speeds and the incidence of fatal pedestrian collisions. Department of Transport, Federal Office of Road Safety, CR 146, Canberra, Australia*).

Factors such as speed are not readily identified by Police in pedestrian fatalities, for several reasons. Firstly, pedestrian crashes occur mainly in urban areas and thus features of excessive speed are less likely to be visible compared with high speed crashes in 100 or 110 km/h zones. A speed of 70km/h in a 60km/h zone is speeding, but not likely to be readily detected at the crash scene. Secondly, the most likely witness not in the high speeding vehicle (the pedestrian) is often unable to provide an account. Thus, the absence of speed as an identified factor in pedestrian crashes should be interpreted with caution.

Studies of survival and impact speed show that even small changes in speed will substantially influence the severity of pedestrian crashes. Consistent with this, experience from other jurisdictions shows that with slight reductions in speed, pedestrian fatalities are substantially reduced.

The RTA recently published the *NSW speed zoning guidelines* (2009) outlining the principles and procedures to be applied in determining appropriate speed limits on NSW roads. The guidelines (to be used in conjunction with relevant Australian Standards and Austroads documents) provide guidance for practitioners in reviewing and installing speed limits to achieve an appropriate balance between safety and mobility on public roads.

The NSW Centre for Road Safety (CRS) is monitoring implementation of the guidelines and will seek to ensure both regular and responsive speed limit reviews across all NSW roads.

PART 4 - PEDESTRIAN SAFETY COUNTERMEASURES

The RTA in conjunction with Local Councils and key partners such as NSW Police, implement a wide range of pedestrian safety countermeasures. Measures are based on the safe system approach and address safer roads, safer people, safer vehicles and road safety technology.

4.1 SAFER ROADS – ENGINEERING AND TRAFFIC MEASURES

Assessing the effectiveness of measures to address pedestrian safety

Based on literature reviews and crash data research, the RTA has formulated the following matrix, showing the relationship between various treatments and the anticipated reduction in pedestrian crashes. This tool is used to assess the effectiveness of measures to address pedestrian safety. Given the limited financial resources, it is imperative that priority be given to road and traffic engineering measures that offer the greatest potential for crash prevention or reduction in the crash severity.

The matrix has been developed to model the percentage change in crash rates to be achieved from implementing various treatments. If a cell is marked in grey, this means that the treatment cannot be applied in that speed zone. This matrix is to be used to assess road safety benefits derived from different treatments and is used to justify individual projects and specify the benefit of incorporating road safety treatments into a range of maintenance and upgrading works.

Values for each countermeasure are listed in the table below. These values represent the percentage change (reduction or increase) associated with various treatments.

CRASH TREATMENT REDUCTION RATES MATRIX			
Crash Group Number	17		
RUM Code groups	Hit Pedestrian 00-09		
Crash Description			
Speed zone	60k or less	70k or 80k	90k or greater
001 Roundabout 1-Lane	75	75	
002 Roundabout 2-Lane	75	75	
003 Install new traffic signals, filter turns allowed	5	5	
004 Install new traffic signals, no filter turns allowed	30	30	
005 Install fully control right turn with arrows	30	30	
006 Introduce right turn phase while leaving filter	5	5	
007 Upgrade signal display, mast arm/additional lanterns	10	10	
008 Install mid-block pedestrian signals on high volume roads	30	50	
009 Install mid-block pedestrian signals, pelican, on high volume roads	25		
011 Install mid-block slow point on urban road, raised threshold / horizontal deviation	30		
012 Remove sight distance restrictions at intersection	15	15	15
014 Move limit lines forward using kerb extensions on priority road	20	20	20
018 Separate through and parking lane, with painted line reinforced with kerb blisters	20		
028 Install new "Stop" signs	10	10	10
033 Install street lighting, night time crashes only	10	25	
034 Install intersection lighting, night time crashes only	20	25	30
035 Install lighting at pedestrian facilities, night time crashes only	25	30	

CRASH TREATMENT REDUCTION RATES MATRIX				
Crash Group Number		17		
RUM Code groups		Hit Pedestrian 00-09		
Crash Description				
Speed zone		60k or less	70k or 80k	90k or greater
036	Street closure - cross intersection, targeted crashes only	30	30	30
037	Street closure - T intersection	100	100	100
038	Close intersection with median	50	40	30
040	Install a painted median greater than 1.5m wide	20	20	20
041	Install extended length of deflective median, not closing intersection	50		
042	Install extended length of mountable median, not closing intersection	50	50	
043	Install median islands with Additional Priority Signs (MIST)	25	25	25
044	Install a raised threshold at pedestrian crossing	80		
045	Install marked pedestrian crossing	5		
046	Install kerb blisters with marked pedestrian crossing	10		
047	Install kerb blisters without marked pedestrian crossing	10		
048	Install pedestrian refuge with kerb blisters with marked pedestrian crossing	20		
049	Install pedestrian refuge with kerb blisters without marked pedestrian crossing	20		
050	Install pedestrian refuge without kerb blisters with marked pedestrian crossing	10		

CRASH TREATMENT REDUCTION RATES MATRIX				
Crash Group Number		17		
RUM Code groups		Hit Pedestrian 00-09		
Crash Description				
Speed zone		60k or less	70k or 80k	90k or greater
051	Install pedestrian refuge without kerb blisters without marked pedestrian crossing	10		
052	Install pedestrian fencing on median	50		
053	Install pedestrian fencing on kerb	20		
054	Install pedestrian grade separation	80	90	90
055	Install a seagull island without acceleration lane, painted island	15	15	15
056	Install a seagull island without acceleration lane, raised island	25	25	25
057	Install a seagull island with acceleration lane, painted island	15	15	15
058	Install a seagull island with acceleration lane, raised island	25	25	25
061	Upgrade T junction from no existing treatment to channelised right turn treatment, pavement widening with a right turn lane	10	10	10
063	Upgrade T junction from BAR to CHR	10	10	10
064	Upgrade T junction from AUR to CHR	20	20	20
067	Install a 1.25 m wide painted profile (audio-tactile) centre line		10	10
085	Improve vertical alignment		20	20
086	Improve co-ordination of horizontal and vertical alignments		40	40
104	Reduce speed limit by 10 km/h	30	20	15
105	Reduce speed limit by 20 km/h	40	30	20
106	Install new seal on poor surface, wet surface crashes only	10	10	10
109	Install non-skid surface, wet surface crashes only	20	15	15

40km/h speed limit in high pedestrian activity area

Walking is such a basic human activity that it has frequently been overlooked in the quest to build sophisticated transportation systems. People want to live in places that are welcoming, safe, and enjoyable. This can be achieved by redesigning streets through traffic calming or by designing new streets with speed reducing features and lower speed limits. Speed reductions can increase pedestrian safety considerably. The safety benefits of reduced speeds extend to motorists and cyclists as well, although the advantage to pedestrians is the most substantial.

One of the most prominent road safety initiatives aimed at reducing pedestrian crashes has been '*40km/h speed limit in high pedestrian activity areas*' - engineering treatments designed to increase the safety and amenity of pedestrians in high volume pedestrian areas such as shopping precincts, including the Sharing the Main Streets Program and local area traffic management (LATM) Programs.

The 40 km/h speed limit is used in areas where vulnerable road users are present and include:

- High pedestrian activity areas (relatively large volume of pedestrian activity); and
- Local traffic area (i.e. network of local roads bounded by arterial roads)

There are approximately one hundred and twenty (120) high pedestrian areas in NSW that have been treated with 40km/h schemes that include the:

- installation of traffic calming measures that create a self enforcing low speed road environment;
- safe and convenient pedestrian crossings; and
- 40km/h speed limits.

Current 40km/h High Pedestrian Activity Area programs

The following projects were being undertaken in the 2008/09 financial year:

Sydney Region

- Merrylands CBD
- Liverpool - medical precinct
- Cabramatta town centre
- Mortdale town centre
- Waitara - Alexandria Parade
- Campsie - Beamish Street
- Glebe Point Road

The following existing 40km/h High Pedestrian Activity Areas had additional devices installed to improve pedestrian safety:

- Balmain Peninsula
- Paddington

Southern Region

- 40km pedestrian precinct Jindabyne

Northern Region

- 40k zones in Armidale and Port Macquarie are being constructed and shall be completed during this financial year.

Hunter Region

- Enhancement of the existing 40km/h high pedestrian area was undertaken in Nelson Bay. This includes the installation of speed calming devices (raised thresholds) with the construction of new pedestrian facilities.
- Funding provided to Great Lakes Council to progress with concept design of future 40km/h areas at Forster Main Beach and Tea Gardens foreshore.

Safety around schools - School Zones

The RTA has a strong commitment to improving the safety of children around schools.

A range of initiatives to improve the safety of children around schools has been introduced by the RTA. 40km/h school zones are installed at school access points. Most school zones across the state operate from 8:00 am to 9:30 am and 2:30 pm to 4:00 pm on school days. School zones are identified with signage that has been prescribed by the Australian Road Rules. These signs are complemented with large yellow painted 40 km/h road patches in both directions of a school zone, to alert motorists to the presence of a school zone. To make school zones more visible to motorists, line markings on the road pavement in the form of 'dragon's teeth' will be installed at the gateway to all school zones by the end of 2011. There are over 3,200 schools and more than 10,000 school zones in NSW.

To further enhance the safety of children in the traffic environment, the RTA employs school crossing supervisors at school pedestrian crossings where it is recognised that an additional measure is required to facilitate the safe and efficient movement of primary school-aged children in their travel to and from school. There are approximately 1,100 school crossing supervisors in NSW at more than 600 schools.

The School Drop-off and Pick-up initiative developed by the RTA aims to provide parent and carers with a safe environment to drop-off and pick-up their children when driving them to and from school.

The State Government's \$46.5 million flashing lights program, which began in 2008, is delivering flashing lights to approximately 100 school zones a year over four years.

To date, around 300 NSW school zones now have flashing lights.

School zones are being selected for the new technology rollout based on safety criteria including but not limited to, traffic and pedestrian volumes, crash history, crash risk, speed limits, road environment and visibility. This ensures that the schools with the highest priority get flashing lights first. All schools in NSW are assessed against these criteria.

It is important to note that flashing lights are just one component in improving school road safety. Other measures being implemented as appropriate are pedestrian overbridges, marked foot crossings, wombat crossings, pedestrian refuges, traffic signal-controlled pedestrian crossings or fencing which separates children from traffic and guides children toward a safer crossing facility.

Pedestrian Access Mobility Plan (PAMP)

The RTA assists Local Councils to prepare and implement a PAMP to enhance safety, convenience and mobility in key areas of pedestrian movement, such as between public transport and other public places.

A PAMP is a comprehensive strategic and action plan to develop pedestrian policies and build pedestrian facilities. PAMPs aim to co-ordinate investment in safe, convenient and connected pedestrian routes. It provides a framework for developing pedestrian routes or areas identified by the community as important for enhanced sustainability, safety, convenience and mobility. PAMPs are developed through partnerships between State and Local Governments, developers and other stakeholders.

86 Local Councils (out of 152) now have a PAMP.

Local traffic management treatments

The fundamental premise of pedestrian safety is to minimise conflict between pedestrians and vehicles. In terms of infrastructure, this can be achieved via regulatory devices, such as marked foot crossings at traffic signals, 'zebra' pedestrian crossings and children's crossings, or via a range of crossing treatments, such as pedestrian bridges or subways, kerb ramps and extensions, pedestrian refuges and pedestrian fencing.

The most safety-effective treatments physically separate pedestrians and vehicles, however physical separation is not always practicable. Improved safety from other crossing treatments may be achieved by enhancing pedestrian access and aligning crossings with desire lines, reducing crossing distances, and improving visibility for both pedestrians and drivers. Traffic calming devices also contribute to pedestrian safety by slowing traffic and raising driver awareness of the likely presence of pedestrians.

Many localised treatments are undertaken across the State every year which enhance pedestrian safety. Such works include the installation of pedestrian crossings (both signalised and non-signalised), pedestrian refuges, kerb ramps, audio and tactile devices at signalised crossings, adjustment of signal phasings, kerb extensions, line marking, pedestrian fencing, signage, and pull-over bays.

Pedestrian Bridges

The RTA provides bridges over arterial roads to improve pedestrian safety and access, particularly in areas of high pedestrian concentration. Two bridges are currently being constructed across Parramatta Road at Haberfield and Silverwater Road, Silverwater.

Pedestrian Crossings on multi-lane State Government controlled roads

Following the tragic crash involving Sophie Delezio on Frenchs Forest Road, Seaforth, the RTA conducted an audit of pedestrian crossings on multi-lane roads. The RTA found there were 59 pedestrian crossings on multi-lane State controlled roads which did not have traffic lights and other appropriate control measures. The RTA embarked on upgrading these crossings. It is envisaged that the majority of these crossings will be replaced with traffic lights. A variety of other solutions have also been used at a limited number of locations, such as reducing the number of traffic lanes. To date, of the 59 sites identified, 45 have been upgraded, with traffic signals installed at 35 sites. A further one site is under construction, with the remaining 13 sites in the design and community consultation stages.



Pacific Highway near Cowan in Northern Sydney: The Pedestrian improvements narrowed the road into a single lane to force drivers to proceed with greater caution. It also improved the pedestrian footpath around the crossing.



Installation of traffic control signals at Myall Road, Cardiff

Pedestrian Crossings, Refuges, Kerb ramps

In 2008/09 approximately 87 individual pedestrian projects to provide treatments such as crossings, refuges and kerb ramps are being funded jointly by RTA and Local Councils.

Measures implemented also focus on increasing the visibility of pedestrians. For example, roadway lighting at key crossing points is regularly reviewed and the location of bus stops near major crossings are also monitored.

Additionally, the RTA reinforces the importance of enforcing the need for drivers to comply with pedestrian crossings. Drivers who fail to give way to pedestrians on pedestrian crossings are liable to a fine of \$324 and the loss of 3 demerit points. In a school zone, the fine is \$405 with the loss of 4 demerit points. This demonstrates the seriousness of this offence.

A number of Technical Directions for traffic and transport practitioners have been issued in relation to these important pedestrian safety features. These include:

- *Technical Direction for Traffic and Transport Practitioners on Pedestrian Refuges;*
- *Technical Direction for Traffic and Transport Practitioners on Use of Traffic Calming Devices at Pedestrian Crossings; and*
- *Technical Direction for Traffic and Transport Practitioners on Kerb Ramps.*

Pedestrian Fencing

Pedestrian fencing is installed to stop jay walking across heavily trafficked roads by directing pedestrians to controlled crossings. The crashes that occurred at uncontrolled sites (sites *without* any pedestrian or traffic signal controlled crossing present) along the section were compared to the crashes that occurred at controlled sites (sites *with* a pedestrian or traffic signal controlled crossing present).

The sections of road were Military Rd between Ben Boyd Rd and Spit Rd at Mosman, Princes Highway between Bestic St and Lister St at Rockdale and Copeland Rd at Liverpool. These sites had a substantial number of pedestrian crashes prior to fencing installation and were reviewed to analyse the effectiveness of pedestrian fencing in reducing pedestrian crashes.

Analysis of pedestrian crashes in Military Rd showed a 75% reduction in pedestrian crashes. At uncontrolled sites in the 6 years before the fencing was installed there were 68 pedestrian crashes. These dropped to 26 in the 6 years after the fencing was installed. At the controlled sites over the same time period there were 25 pedestrian crashes which dropped to 12 when the fence was installed.

Princes Hwy and Copeland St showed similar reductions in targeted crashes.

Traffic Control Signals

The crash history of locations is used to prioritise the need for new traffic control signals.

The RTA's adaptive SCATS system enables demand to influence the timing of traffic signals. The RTA continually reviews signal times for pedestrians based on activity monitoring and requests from Councils, schools and agencies representing the needs of pedestrians and people with disabilities. If warranted, the RTA increases the pedestrian signal phase.

All new traffic control signals are required to incorporate a pedestrian phase (except in rural areas, locations with no footpath or at locations where encouraging pedestrian crossing could compromise safety).

Red Light Cameras

The principal road safety benefit of red-light cameras is a reduction in the number of right angle crashes which are highly likely to result in injury and death. However, red-light cameras at intersections also help protect pedestrians who are vulnerable to vehicles running red-lights. These crashes are particularly severe because they often involve the front of a vehicle impacting with the side doors of another vehicle or a pedestrian impact.

Red-light cameras are used widely to address this issue and a review of several evaluations of the red-light speed cameras conducted in both Australia and international jurisdictions has found that red-light cameras are clearly effective in reducing casualty crashes at intersections. When the evaluations were considered together they reported a 25-30 % reduction in injury crashes (Retting, R.A., Ferguson, S.A., Hakkert, A.S., 2003).

The RTA will be replacing the existing outdated wet-film red-light cameras with digital red-light cameras at 200 signalised intersections. They will be placed in locations with a history of a high crash rate, where they will have the greatest road safety benefit. Furthermore, digital red-light

cameras also have the ability to conduct speed enforcement. The combination of red-light and speed enforcement will further enhance the safety of some red-light camera locations where there is a significant crash problem along the length of road adjacent to and including the intersection.

Drivers who disobey a traffic light/arrow are liable to a fine of \$324 and the loss of 3 demerit points. In a school zone, the fine is \$405 with the loss of 4 demerit points.

Facilities for people with disabilities

The RTA implements a range of measures to assist pedestrians with disabilities. For example:

- The installation of audio tactile push buttons at traffic signals to assist vision impaired pedestrians. RTA has installed 18,846 audio tactile buttons to date.
- Tactile paving on kerb ramps.

Shared Paths

A shared path is used by pedestrians, bicycle riders, wheeled toys (e.g. scooters) and wheeled recreational devices. To this end the RTA has produced and distributed:

- *NSW Bicycle Guidelines* to assist councils engineers on how to design shared paths appropriately
- *Technical Direction for Traffic and Transport Practitioners on Shared Paths – User Advisory Signs*. This technical direction provides clear guidance for the installation of user advisory signs for shared paths. The objectives are to provide a framework for the consistent delivery of behavioural messages to users of shared paths and to reduce conflicts between shared path users throughout NSW.
- A brochure *Share and be aware - travelling together safely*. The brochure includes safety messages for both pedestrians and bicycle riders on how to use shared paths to avoid collisions and to make using these paths a pleasant experience.

Shared Zones

A shared zone is an area or length of road that is shared by vehicles and pedestrians, in which pedestrians have priority. A shared zone is defined as a network of streets in which drivers must give way to pedestrians (Australian Road Rules, rule 83).

Motor vehicles can use the shared traffic zone but at a greatly reduced speed of 10 km/h. Shared zones have been installed in many areas across NSW.

Footpath Parking

In some areas in Sydney (e.g. Balmain) the streets are very narrow and there is no off-street parking for residents. This lack of parking has led residents to park their cars illegally on the footpath. The identification of solutions to address this complex issue needs to be undertaken on a case by case basis. Any footpath parking scheme which does not provide sufficient space for pedestrians on the footpath would require installation of a shared zone with a range of treatments, particularly traffic calming modifications.

Parking Enforcement

Parking enforcement is also a key measure to ensure that pedestrians are visible to motorists and to increase the vision and sightlines of pedestrians. A review of evidence based traffic engineering measures designed to reduce pedestrian-motor vehicle crashes (Retting, Ferguson and McCartt, 2003) noted that because parked vehicles obscure the vision of pedestrians and drivers, parking restrictions can be very effective. In a controlled study of child pedestrian injuries, the number of parked vehicles was one of the strongest factors contributing to crashes involving children on residential streets (Agran, Winn, Anderson, Tran & Del Valle, 1996:98).

The RTA has issued *Technical Direction for Traffic and Transport Practitioners on Stopping and Parking Restrictions at Intersections and Crossings*.

Obstructions that hinder pedestrian movement or obscure visibility

The placement of structures (temporary and fixed) on footpaths and near crossings is controlled by Local Councils. However, the RTA provides guidance through technical directions and other guides and monitors potential issues and will discuss issues with Council if safety is being compromised.

For example, the RTA has issued a *Technical Direction for Traffic and Transport Practitioners to provide 'Guidelines for the Location and placement of Variable Message Signs'*.

The Technical Directions (TDs) listed in the sections above are contained in [Appendix 3](#). The list of TDs is not comprehensive and is meant as a representative sample of the sort of guidelines issued by the RTA in relation to pedestrian facilities and other issues impacting pedestrian safety.

Current Pedestrian Safety Initiatives

The list below represents a sample of the various pedestrian safety initiatives currently being undertaken by RTA Regions.

- Pedestrian crash clusters are reviewed regularly and are prioritised into the programs available to treat these types of crashes.
- Ongoing work with RTA's Project Management Services (PMS) following on from the Pedestrian Learning Workshop held a couple of years ago in Sydney. This workshop sought to increase awareness of pedestrian requirements and ensure consideration in Major Projects - e.g. the inclusion of pedestrian fencing or landscaping to restrict pedestrian access, provision of safe crossing locations, location of bus stops in relation to safe crossing points.
- Provision of additional *Pedestrian Legs* at existing signalised sites where there is a need or a crash history.
- Pedestrian fencing projects are often undertaken to separate pedestrians from traffic or restrict the movement of pedestrians across a major road. This forces pedestrians to cross at the existing signalised crossing points. Sydney Region is currently planning to install pedestrian fencing on Druitt Street, Sydney; Anzac Parade in front of UNSW, Cabramatta Road, Pittwater Road, Brookvale; Botany Road, Mascot; Pittwater/Barrenjoey Road, Mona Vale; Sydney Road, Seaforth; Princes Highway, Rockdale; Victoria Road, Gladesville and Parramatta Road, Petersham.
- Reduction of speed limits in busy commercial areas including Great North Road, Five Dock; Lyons Road, Drummoyne; Barrenjoey Road, Newport; King St/Enmore Road, Newtown/Enmore and Argyle Street, Camden.
- Speed Limit reductions from 60km/h to 50km/h on residential roads in Fairfield, Camden and Canada Bay LGA's. This is an ongoing review process.
- Behavioural campaigns have been implemented including Drink Walk campaigns targeting Randwick races etc.
- Road Safety Audits focussing on pedestrians have been undertaken and a range of remedial treatments have been implemented at high crash sites.

- Implementation of pedestrian education campaigns within Local Government Areas.
- Upgrade of all existing pedestrian crossings on State Roads in the Hunter Region with fluorescent warning signs.
- Upgrade of existing pedestrian refuge near Belmont 16ft Sailing Club.
- Installation of new pedestrian refuge at Hillsborough.
- Installation of Pedestrian midblock traffic control signals at Burwood Road crossing of Fernleigh Track Cycleway.
- Variable Message Signs (VMS) have been provided to improve safety on main roads around major regional events, such as at all Knights (Rugby League) and Jets (Soccer) home games, Surfest 2009 and King Street Fair. VMS display messages advising motorists of the presence of pedestrians.
- Seniors Pedestrian Project – to address geographic areas where elderly pedestrians are at risk. Project involved consultation with stakeholders at identified locations around residential facilities for the elderly.
- Newcastle Late Night Transport and Alternative Transport Projects – distributes timetable information (wallet cards, posters, coasters etc) advising drink walkers (and drink drivers) of their transport options for getting home e.g. bus, train and ferry timetables, taxi locations, Courtesy Bus Services.
- Working with various Liquor Accords to develop local strategies to address drink walking/drink driving.
- RTA attends monthly meetings, proposes strategies to address senior pedestrian issues and distributes current research and information to key organisations working with Seniors.
- Several Councils have upgraded their “LOOK” stencilling at pedestrian crossings and on pedestrian/cycle paths.

4.2 SAFER PEOPLE – BEHAVIOURAL MEASURES

The RTA utilises a range of programs to enhance pedestrian safety throughout the State. These programs include in-school education, public awareness campaigns, safety around schools, participation in alternate transport schemes and local Liquor Accords, speed management and camera enforcement, enhanced police enforcement, as well as undertaking and funding a suite of major and minor engineering treatments.

In-school education

The RTA funds the NSW School Road Safety Education Program which addresses child pedestrian safety in the early childhood, primary and secondary school settings.

Road safety is addressed as a component of the NSW Board of Studies Personal Development, Health and Physical Education syllabuses and as such is mandatory in all NSW schools.

Program resources meeting the outcomes of the appropriate Personal Development, Health and Physical Education syllabus are developed by the RTA in conjunction with the NSW education agencies, and are available free of charge for teachers, students, parents and school communities throughout NSW.

These road safety resources are constructed around age-appropriate, research-based main messages explored in teaching and learning experiences and in the wide variety of resource components. Teacher resource booklets, videos, student worksheets, full-colour photographs, story books, song and story cassettes, board games, posters, stickers and interactive CD ROMs are developed to ensure effective communication of each main pedestrian message to students.

Pedestrian safety messages and information on pedestrian safety issues around schools and centres are conveyed to parents, carers and the school community through the provision of free publications – brochures, booklets, take home notes, and material designed for inclusion in school newsletters. These resources are provided routinely to early childhood centres and primary schools. The primary school road safety catalogue provides schools with ongoing access to these resources. The recently released *Kindergarten Orientation Day* road safety resource provides information on road safety to parents at a time when their child will have a greater exposure to the traffic environment as a school student.

The Road Safety Education program is delivered to early childhood centres and schools through a network of RTA-funded road safety education consultants and advisers working within each education sector. Consultants and advisers are best placed to provide teachers, centres and schools with ongoing curriculum and policy advice and to manage the professional development processes required during the implementation of each newly-released resource.

The Road Safety Education program is evaluated regularly and is well-regarded nationally within schools and education sectors.

Pedestrian awareness campaigns

The RTA conducts, or funds through the Local Government Program, public awareness campaigns targeting pedestrians. These campaigns are highly localised and generally timed to coincide with activities or events where high volumes of pedestrians are expected, such as sporting events or festivals.

Campaign materials include radio and print advertisements, event or in-venue announcements, and bus shelter advertisements. Other materials may be produced that are particular to an event, such as alternate transport information for event patrons.

In areas where there are large numbers of elderly residents, awareness programs for senior pedestrians may be conducted. These programs consist of information sessions to help older people understand their increasing road safety risk, refresh their knowledge of the road rules, and provide advice regarding the use of pedestrian facilities and mobility aids.

Pedestrian safety messages are also provided to the public via the RTA's *Road Users' Handbook*, and brochures such as *Pedestrian Crossings* (which is also available in eight community languages) and *'A guide to using motorised wheelchairs'*.

While awareness campaigns for adult pedestrians inform and educate small sections of the community, they are largely ineffective for influencing pedestrian behaviour on a broader scale. Research repeatedly shows that, while adult pedestrians understand the purpose of pedestrian facilities and know how to use them, they are consciously prepared to take risks, particularly if they are in a hurry or may be inconvenienced by using a facility. Therefore, pedestrian campaigns are usually run in conjunction with other activities such as driver awareness

campaigns, police enforcement, and local traffic management treatments such as temporary or permanent pedestrian fencing, and signage.

Driver awareness campaigns

Campaigns directly aimed at raising drivers' awareness of pedestrian safety are generally run at the same times as pedestrian awareness campaigns, i.e. in association with local activities or events. Campaign materials include radio advertisements, portable variable message signs, and banners which provide timely reminders to be aware of pedestrians.

However, pedestrian safety is enhanced by virtually all driver awareness campaigns, including speeding, drink driving and fatigue. These campaigns are run at strategically targeted times throughout the year, and include the full range of multi-media such as television, radio, variable message signs, bill boards, banners, convenience and print advertisements.

Enhanced enforcement program

The RTA funds additional Police operations which target behaviours which contribute to road trauma, such as speeding, drink driving and non-use of restraints. The RTA also provides public education to align with the police operations to increase the visibility and effect of the extended police presence and increase motorists' perceptions of being caught by Police.

RTA funding supports additional enforcement hours as part of both major State-wide Operations and targeted local enforcement initiatives. Approximately \$10M is provided by RTA per annum to fund additional Police hours and associated public education and awareness campaigns.

Safety around schools - School Zones

The RTA generally conducts school road safety advertising in conjunction with the start of new school terms via state-wide radio and the RTA's variable message signs on roadways to alert motorists that school zones are in operation.

Drink walking/driving programs

Alcohol impairment impacts on pedestrian safety whether the impaired person is a driver or a pedestrian. Therefore, the RTA has an extensive program aimed at reducing the road safety risks associated with drink driving and drink walking.

State wide media campaigns are run at strategic times. These campaigns are complemented by local campaigns which target particular events or festivals, and generally include enhanced enforcement operations.

Campaigns directed toward motorists (i.e. advising drivers to be aware of pedestrian activity/look out for pedestrians) are seen as more effective than campaigns seeking to discourage walking whilst under the influence of alcohol as alcohol affected pedestrians are unlikely to recall key messages.

The RTA works very closely with local community stakeholders to address drink driving and drink walking issues. It provides seed funding and continued support for local Liquor Accords, which help to promote and facilitate the responsible service of alcohol, and provides breath testing units in selected venues. Other issues addressed by liquor accords include the availability of taxis at appropriate times, the location of taxi ranks, venue closing times, the establishment of alternate transport schemes, a range of alcohol-related harm minimisation strategies, issues relating to the road and environment around venues, and the venue's responsibility beyond its immediate premises.

As part of its ongoing commitment to reducing drink driving and drink walking, the RTA provides seed funding and continued support for alternate transport schemes, which may include the establishment of temporary special bus services and/or the provision or subsidisation of taxi vouchers for impaired patrons.

4.3 SAFER VEHICLES – MOTOR VEHICLE MEASURES

A safe system approach to pedestrian safety includes consideration of the motor vehicle, as part of that system. Pedestrians are the most vulnerable of road users, as they have little protection against the solid front of a motor vehicle, which is often travelling at high speeds.

Clearly the safest solution would be to physically separate pedestrians from motor vehicles in all circumstances. As this is neither practical nor affordable, those responsible to design and manage the road system must accept that pedestrians and vehicles will mix in the same available space and need to provide a range of treatments and solutions that take this into account.

This section of the report aims to identify those vehicle characteristics and technologies that can improve pedestrian safety. Unfortunately, when looking at vehicle design technologies there will be a lag period between when the technology first becomes available and achieving sufficient penetration into the fleet to make a discernable difference to road safety trends. Most of the issues discussed here are longer term objectives.

PEDESTRIAN IMPACTS

In contrast to traditional thinking that pedestrians get 'run over' by cars, In most impacts between a motor vehicle and a pedestrian, the vehicle 'runs under' the pedestrian, causing the body to roll over the bonnet. The most serious contacts will occur between the bumper and the lower leg, the leading edge of the bonnet and the upper leg and hip and then the head impacting on the bonnet, windscreen or A pillars. Often, the head impact will be the most serious (highest likelihood of life threatening injury) of the whole event.

In a study by University of Adelaide's Centre for Automotive Safety Research (CASR) in 2005, Professor Jack McLean described the sequence of events in a collision between an upright adult pedestrian and a motor vehicle as follows:

The initial impact is from the bumper bar which strikes the lower leg. The effects of this impact for a given vehicle speed depend partly on the amount of body weight this limb is supporting at impact, and partly on the limb's own inertia. Almost at the same instant, but slightly later, the leading edge of the bonnet (hood) of the car will strike the hip of the pedestrian. If the speed of the car is great enough the pedestrian then rotates about this secondary impact point until his head and chest strike the bonnet, windscreen and/or the windscreen surroundings. The higher the impact speed the further back along the car this third impact point will be.

At still higher speeds the pedestrian now rotates about his head and shoulders, i.e., the third impact point. This can result in either a fourth impact with the car or in the car passing under the pedestrian who then falls to the road. On this fourth impact with the car the pedestrian's legs strike the rear of the roof of the car. From this point, if the car does not slow down, the pedestrian, who is now travelling almost at the speed of the car, will fall to the road, either behind or on one side of the car.

If the driver of the car should suddenly brake, the car will then slow down at a much faster rate than the pedestrian, who tends to continue forwards with undiminished speed, sliding over the roof and bonnet and then falling to the road in front of the car. He finally comes to rest after sliding and rolling along the road."

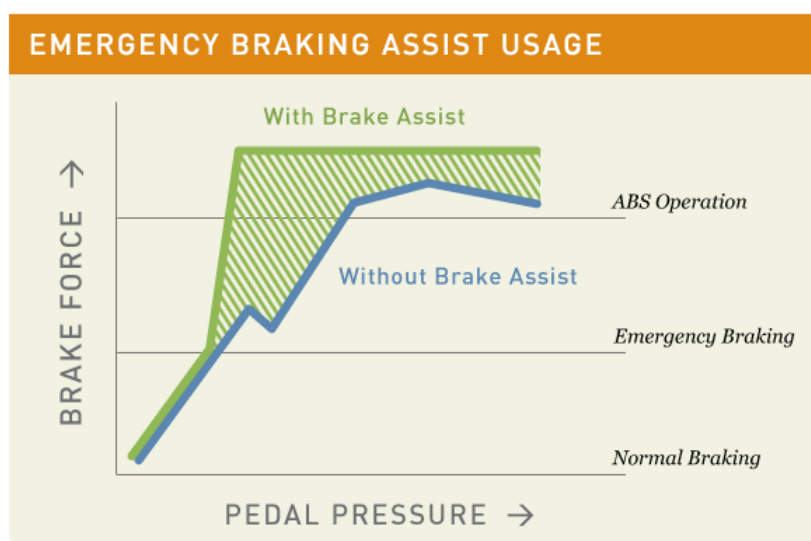
While this description may appear macabre to some, it is important to understand this sequence of events, as it establishes a number of potential improvement areas that can be addressed within vehicle technology to achieve a reduction in the number and severity of pedestrian – vehicle impacts. These can generally be grouped as follows:

- Avoid the impact
- Reduce impact speed and collision energy
- Reduce impact severity (absorb energy)
- Reduce injury severity (smooth rounded surfaces)

Avoid the Impact

As mentioned above, for many reasons the physical separation of vehicles and pedestrians is not always possible. Alternative solutions include improving stopping distances and early detection of the pedestrian and lower speed limits.

Emergency Brake Assist (EBA) is a technology becoming more readily available on modern motor vehicles that recognises when a driver has started an emergency brake application and applies maximum brake force, to reduce the stopping distance. Studies have shown drivers do not apply sufficient brake pedal pressure early during an emergency to stop a vehicle in the shortest distance possible. EBA detects when a pedal is depressed in an emergency and applies maximum brake pressure until the driver releases the pedal or the vehicle stops. The diagram below shows how EBA applies additional brake force during an emergency stop. EBA is shown to reduce stopping distances by up to 15%.



EBA is recommended by the RTA as an important safety feature to consider when purchasing a new motor vehicle.

Another modern technology that can help drivers avoid an impact is **Electronic Stability Control (ESC)**. ESC compares the rate at which a vehicle is turning to the input demanded by the driver (steering wheel angle) and reduces engine power and/or applies brake force to one or more wheel, to help bring the vehicle onto or to stay on its intended path. Studies by Monash University Accident Research Centre (MUARC) suggest ESC will contribute significantly to reducing single vehicle off-path crashes. The technology also assists a driver to avoid obstacles, such as pedestrians and although not included in previous study data, by improving the vehicle's response to emergency steering inputs, increased uptake of ESC will help drivers avoid a pedestrian impact in some circumstances.

The Council for the Australian Federation, which comprises all States and Territories, has agreed to a Victorian proposal to progressively mandate safety technologies, including ESC, on all new cars from 31 December 2010 as a condition of registration. The RTA is currently examining the required legislative, regulatory and system changes necessary to implement this commitment. ESC has been included in the ADR for inclusion in all new model vehicles from November 2011 and all new vehicles from November 2013. The RTA actively promotes ESC for all new vehicles at every opportunity.

Technologies like EBA and ESC will help avoid or reduce the severity of a collision in an emergency, but early detection of a pedestrian will do the most to avoid a collision altogether. This can be aided by addressing driver distractions (inside and outside the vehicle), and the use of active and passive on-board detection and vision enhancement systems.

Driver distractions come in many forms, but basically can be categorised into those that are inside or outside the vehicle. Distractions inside the vehicle such as **mobile telephones** have been addressed by legislation, however with growing popularity of hand held merged technology devices (such as the i-phone) there is increased risk of distraction.

These present two problems: The first is typified by **GPS devices**. Although allowed under road transport legislation as a form of 'driver's aid', most are installed after-market. Many people position these devices to optimise their view of them, which is frequently in their direct field of vision of the road ahead. Whereas this may not present a problem in detecting other vehicles on the road, smaller objects, including pedestrians, can easily be obscured from the driver. This is especially significant at night, where the after-market device does not have automatic back-light dimming control and thus provides a bright screen in front of the driver (making it nearly impossible to see the dark clothed pedestrian in the darkness ahead of the vehicle). Overall road transport legislation is vague on this matter – the ADRs, the Regulation and the [NSW] Road Rules 2008 specify that a driver's aid must not 'obscure the driver's view'. The NSW Centre for Road Safety intends to develop a Vehicle Safety Information sheet to provide drivers more definitive guidance on the placement of navigation devices in the driver's field of view.

A second problem concerns **multi-function devices** which may serve as a driver's aid and other devices such as 'i-pods' and 'i-phones'. Due to the number of functions they provide, and the video output of many, they present potential to distract a driver if they are not used sensibly while driving. The NSW Centre for Road Safety is working at the national level to introduce legislation to more specifically deal with this problem. (A recent survey in the UK reported by *Autocar* magazine reports that nearly 10% of UK drivers are using mobile internet sites while at the wheel!)

Driver distractions outside the vehicle include advertising, street signs and traffic directions as well as obstacles or safety threats that have to be watched and avoided (such as pedestrians on a road side, cyclists, animals or other vehicles). While large scale public advertising and street signage have been addressed by the revision of State Environmental Planning Policy (SEPP) 64, visibility of obstacles and safety threats remains a problem, especially at night. This may be overcome in the future by night vision or radar technologies.

Night Vision Systems. There are two fundamental technologies available to enhance vision at night. These are Image Intensification (II) and Thermal Imaging (TI). II works by taking available light (at very low levels) and amplifying it to increase the visible light. II requires some light to be present to work effectively, but at the other end of the spectrum, intense light (such as oncoming headlamps) cause the image to bloom and “white-out”. Systems with automatic gain control turn the image intensifier off at this instant, resulting in loss of image. TI works by filming thermal radiation in the near infra-red frequency band and projecting this onto a screen. TI is able to contrast objects of different temperatures, as well as seeing through fog and some dust, so will show up a pedestrian at night (warm against cold) or a vehicle engine or exhaust against a cold background. Where there is little or no thermal contrast (such as a rubbish skip left on the side of the road), TI systems are not effective.

Night vision systems (using both technologies) have been commercially available for the past 10 years, but have not taken off due to cost, reliability and performance issues (as discussed above). Recent developments in computer software that can merge the benefits of both systems and analyse these then present the results in a simplified “heads up display” image inside the vehicle have provided the potential to redress the weaknesses of night vision and make it an effective tool to improve road safety. Pedestrian safety, especially for those wearing dark clothing in a darkened area, could be significantly improved by the use of night vision technology.

With an aging population in Australia and knowledge that deterioration of eyesight results in older drivers (50 years⁺) requiring up to 10 times more available light to see an image that is clearly visible to a younger driver (early 20s), pursuit of night vision as a future safety technology in vehicles makes good sense.

Night vision technology is currently an expensive option (more than \$2,000) available on only a small number of vehicles and unless integrated properly into the full design of the vehicle, can act more as a distraction than an enhancement to road safety.

Radar is another technology proving useful in pedestrian safety developments. Post-processed millimetric wave radar can identify a human or vehicle form and advise a driver of a hazard

ahead that is not visible to the naked eye. Coupled with crash avoidance braking technology, the system can be used to slow a car to the speed of the vehicle ahead, or to slow or stop the car to avoid a collision with a pedestrian. Several manufacturers include this technology in some of their vehicles, including Mercedes, BMW, Volvo, Toyota and GM. Although an expensive technology still, radar has potential to reduce crash numbers and crash severity, including for pedestrian crashes.

Reducing Collision Speed and Impact Energy

Fundamental to surviving an impact with a motor vehicle is the amount of energy that is involved in the collision. Kinetic Energy is a function of speed and mass ($E_k = \frac{1}{2} mv^2$) and a small increase in collision speed creates a significantly greater amount of energy that has to be managed during the crash event. In addition, the distance travelled during reaction time and while braking is increased as vehicle speed increases, making it less likely to be able to avoid a crash. Reducing vehicle speed prior to and during a crash is essential to reducing the pedestrian road toll.

Technology solutions, such as Intelligent Speed Adaptation, aim to reduce vehicle speeds in areas where pedestrian collisions are considered likely and thus will provide safety benefits. Enforcement of speeding by police and RTA requires **number plates** to be clearly identifiable.

There is anecdotal evidence that persons are more likely to speed if they believe that they will not be detected. Whereas speed cameras contribute to the likelihood of an offender being detected, this benefit is negated if the number plate cannot be identified by the camera.

While the Australian Design Rules (ADRs) and the Road Transport (Vehicle Registration) Regulation 2007 (the Regulation) have specific provisions for the positioning of number plates on a vehicle, the Centre for Road Safety has identified that many vehicles entering the NSW fleet do not meet these requirements. This problem includes front and rear number plates on both standard passenger cars and light commercial vehicles.

The Centre for Road Safety has produced a Vehicle Safety Information sheets (VSI) to address this problem and is working nationally – with the other road jurisdictions, the Federal Department of Infrastructure, Transport, Regional Development and Local Government and the Federal Chamber of Automotive Industries – to rectify this problem at the point of supply. In parallel, the RTA takes action through the safety inspection program (pink slip scheme) to ensure deliberate or intensive efforts to disguise or obscure number plates are identified and

corrected before vehicle registration will be renewed. Heavy vehicle compliance is checked by RTA as part of the Heavy Vehicle Inspection program and NSW Police conduct on-road enforcement of light vehicle compliance with number plate visibility.

Smaller Vehicles

One of the significant features of a vehicle that determines the degree of injury inflicted on a pedestrian is its mass – a heavy vehicle travelling at even low speeds is much more dangerous to a pedestrian than a light one. Whereas it is worthwhile encouraging people to purchase smaller and lighter vehicles, there are a number of obstacles to achieving this: Vehicles have to be 'fit for purpose' and smaller vehicles have more limitations on their performance (e.g. off-road capability), capacity (e.g. for larger families) and their payload, which is critical for commercial vehicles. Smaller vehicles generally provide better all round visibility, reducing the risk of pedestrians not being seen. Current community and government interest in environmental issues, coupled with ongoing high oil prices, is tending motorists toward smaller vehicle procurement.

Reduce Impact Severity (spread the impact)

Refer to active bonnet and bonnet air bags in New Technology Section (Part 5.1).



Figure 1 above shows a Fiat Stilo fitted with bonnet airbag that reduces risk of impact with exposed hard points (rear edge and A pillars) and raises the bonnet to reduce risk of hard impact on engine or similar object located beneath the bonnet.

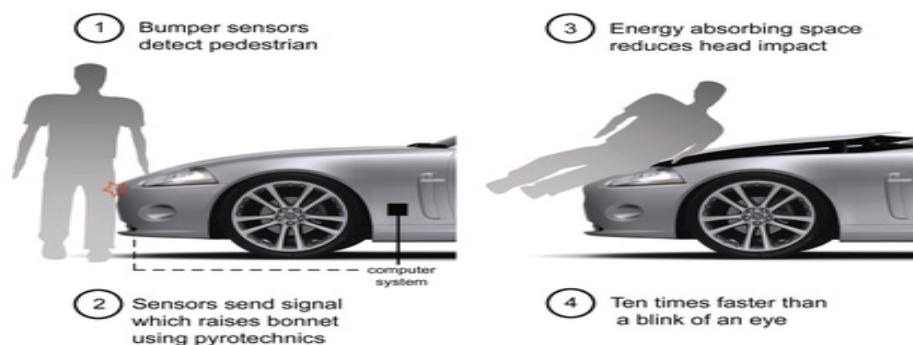


Figure 2 above shows Jaguar pedestrian deployable bonnet system that raises the bonnet to reduce risk of head impact with hard point beneath bonnet skin.

Reduce injury severity (smooth rounded surfaces)

Based on the sequence of events that occurs during a pedestrian collision (as described earlier) each phase of the collision event involves a transfer of some of the crash energy from one body to another. The vehicle is slowed slightly (in addition to its braking effort) and the pedestrian is accelerated. Minimising injury involves reducing the rate at which energy is transferred from the vehicle to the pedestrian. This requires controlling the design of the front of the vehicle and any attachment that may be fitted to it. Objects fitted to the front of a vehicle may inflict additional injury on the pedestrian. The following section discusses some of these features.

Bull Bars

The Australian Design Rules (ADRs) specify the safety, environmental and technical specifications every motor vehicle must be certified compliant with to be eligible to be sold in Australia. There is no allowance in the ADRs for vehicle frontal protection systems, including bull bars, but the Road Transport (Vehicle Registration) Regulation 2007 (the Regulation) allows them to be fitted as an after-market device.

There are a number of conditions associated with this provision – it only applies to vehicles with a GVM up to 3.5 tonnes, the bull-bars must comply with the Australian Standard AS 4876.1 *Motor vehicle frontal protection systems Part 1: Road user protection* (the Standard) except for Clause 3.2, and it only applies to bull bars fitted to vehicles built on or after 1 January 2003. NSW is the only jurisdiction that calls up the Australian Standard for frontal protection systems in regulations.

Crash information gathered in NSW does not include details about whether bull bars contributed to the cause or severity of any crash (including crashes with pedestrians) so it is impossible to determine the level of representation of bull bars in crash statistics or their contribution to injury severity. It is not unreasonable however, to assert that a vulnerable road user (such as a pedestrian) could fare worse if struck by a vehicle fitted with a bull bar, than one without, if the bar did not comply with the Standards.

The design feature of the Standard is to conform to the principal that the pedestrian should be rolled over the front of the vehicle, slowing the rate of transfer of energy and allowing the body or head to impact on the relatively soft bonnet, rather than against a hard point on the vehicle. Bull bars that are shaped so as to deflect a pedestrian back in front of the vehicle, or force them under the front of the vehicle are not permitted by the Standard.

Exclusion of clause 3.2 of the Standard from the Regulation allows bull bars to be manufactured to a design and of materials that impart a Head Injury Criteria (HIC) greater than 1500. The justification for exclusion of this clause is based on not requiring industry to supply or fit bull bars that achieve a level of protection that was greater than that provided by the base vehicle without any attachments fitted. Research has shown that polymer bull bars, as opposed to those manufactured from steel or aluminium can actually *increase* the level of protection a vehicle affords a pedestrian in the event of a crash.

Other Protrusions

Although the ADRs prohibit the fixing of a device with sharp edges or points to a vehicle, these only apply to new vehicles supplied into the marketplace. The Regulation has provisions for maintaining vehicles in a safe manner, and this allows an item to be fitted to a vehicle providing it is 'designed, built and fitted to the vehicle in a way that minimises the likelihood of injury to a person making contact with the vehicle'.

The RTA has published Vehicle Inspectors Bulletin Number 5 (Protrusions on the Front of Vehicles) which describes what is and is not acceptable in terms of fitting other protrusions to the front of vehicles. This includes attachment of items like fishing rod holders and radio antenna bases.

MEANS TO PROMOTE PEDESTRIAN-FRIENDLY VEHICLES

Australasian New Car Assessment Program

The Australasian New Car Assessment Program (ANCAP) was established to determine the comparable protection afforded to vehicle occupants in the event of a crash. In recent years it has extended its regime to cover pedestrian safety.

The ANCAP tests use four sub-system "impactors" to represent the three most commonly injured parts of the body in a pedestrian collision – the head, the femur and the knee joint. Vehicles are tested at a selection of points on the bonnet, windscreen and bumper bar – these impacts are considered the most likely areas to cause injury.

The tests estimate potential injuries to a person struck by a vehicle travelling at 40km/h, with results collated out of a potential score of 36 points to provide a star rating for pedestrian safety. The tests are conducted by the Centre for Automotive Safety Research at the University of Adelaide.

The success of ANCAP – and its European counterpart (EuroNCAP) on which it is based – can be seen in the increasing number of new cars that achieve the highest five-star occupant rating. It appears that vehicle manufacturers are deliberately designing cars with better occupant safety levels. Whereas this is a welcome development, apart from a few notable exceptions, there has been no real imperative to improve the pedestrian safety rating. To date, very few vehicles have achieved the maximum four-star pedestrian rating.

ANCAP, of which the RTA is a founding member, tries to encourage manufacturers to design vehicles with better pedestrian safety. The RTA will continue to promote ANCAP pedestrian safety scores, as part of an overall program to improve the take-up of safer vehicles.

Used Car Safety Rating

While ANCAP is concerned about new vehicles, another project with which the Centre for Road Safety is a constituent member is the Used Car Safety Rating (UCSR), which uses real world crash data to provide an assessment of the safety provided by in-service vehicles. In relation to pedestrian safety, this is important, given the average age of the vehicle fleet in NSW (around 10 years) and the probability of a pedestrian being struck by an older car rather than a new one.

Unlike the ANCAP ratings which provide separate passenger and pedestrian safety scores, since 2008 the UCSR ratings combine occupant protection and 'aggressivity', (which is the effect the vehicle has on other road users, including pedestrians).

The UCSR ratings are released annually as a brochure and are distributed through RTA motor registries. The Centre for Road Safety also makes the brochure available on-line via its website.

PART 5 - ADDITIONAL STRATEGIES TO INCREASE PEDESTRIAN SAFETY

5.1 New Technologies and Pedestrian Safety

When the NSW Centre for Road Safety (CRS) was established in January 2008 a specific section within the Centre was established to research and evaluate new technology based road safety countermeasures. Currently NSW is the only road authority or agency across Australia with a dedicated road safety technology section. The section primarily conducts research into systems that use devices with sensors and advanced processors to warn or interact with road users and vehicles to prevent crashes or minimise injuries.

Categorising Road Safety Technologies

Road Safety Technologies are commonly classified as “active” or “passive” road safety systems. Although these terms are sometimes used in different ways especially within the automobile industry at a fundamental level the categories relate to the road user’s involvement in the use of the safety device. With active safety systems the road user, usually a vehicle occupant must act in some way to make the device work. In passive systems no action is required by a road user for the device to operate, for example a driver’s air bag.

Recently a third category has been put forward by the German technology company Bosh, namely Combined Active and Passive Systems or CAPS. In CAPS technologies typically drivers are initially alerted to dangerous situations through an alarm, if they fail to act and a crash is inevitable the passive system takes over and automatically activates measures to minimise the severity of the impact and to protect all people involved in the crash. (Bosh 2008).

The NSW Centre for Road Safety's has been reviewing the benefits of a number of new technologies that could have a positive impact on pedestrian safety in the future. Many of these technologies are not currently available in NSW but are expected to become more common over the next five to ten years.

This section expands on the vehicle safety technology information provided in Part 4.3.

Implementing New Technologies

It is important to note that it will take a considerable number of years before many of the new safety technologies identified in this report to become widely available on roads or in vehicles in NSW. With the Australian annual new vehicle fleet comprising around only one per cent of the world's new car market, the availability of new safety technologies will depend on the demand for these devices in overseas markets, namely Europe and North America. How long new technologies take to become common place in the NSW vehicle fleet is very difficult to estimate but an example can be seen in the length of time it took supplementary restraint system (SRS) air bags to become a common feature in vehicles driven on NSW roads. American inventor John Hetrick designed the original "safety cushion" in 1952. Mercedes-Benz patented an air bag system in 1971 but it wasn't until 1974 that General Motors made dual-stage twin front airbags an optional feature available on Buick, Cadillac and Oldsmobile models (Wikipedia 2009). Air bags were first available in Australia as an option on the 1981 model of Mercedes-Benz's luxury S Class sedan (Ausmotive 2008). However, it was not until 1993 that GM Holden produced the first locally made vehicle with an air bag in the form of the VR Commodore (GM Holden 2008). By 2002 the Hyundai Getz one of the cheapest cars available in Australia was released with a SRS Driver only air bag system; more than 30 years after they first became available in the United States.

The take up of vehicle based technology is highly dependent on private market forces and economic reality.

Passive Safety Systems

Pedestrian systems

Pedestrian tracking and location services

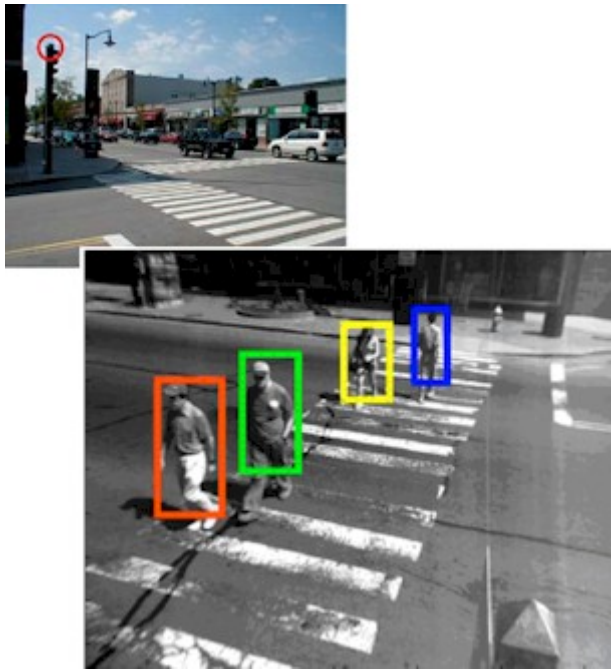
In May 2009 it was reported that the Nissan Motor Company planned to commence a large-scale community-based test of its Intelligent Transport System (ITS), to integrate cellular communications with vehicle telematics to help prevent pedestrian-related crashes. The two month pilot represents the first and largest such experiment of its kind, involving 500 pedestrians and 200 drivers. Using a special cellular phone that is compatible with the Nissan navigation system on-board test vehicles, participants will follow their regular daily routines and commuting routes. The system works as a warning system; for example, when a vehicle approaches an area where there are many blind intersections, the navigation system can warn the driver about a pedestrian out of sight around the corner by voice message and screen display. The information server detects data transmitted via GPS to the cellular phone carried by the pedestrian and sends it to the vehicle navigation system, which then triggers the alert.

In February 2009 Google launched *Latitude* a free mobile phone application which uses the GPS hardware found in smart phones (such as Google Android phones and Blackberry and Windows Mobile handsets) to pinpoint your position on a map and share that information with others. Whilst currently not as sophisticated as the system used in Japan it may be possible in the near future to use such a product to alert drivers of the presence of pedestrians especially in times of low visibility. However, such location information has significant privacy implications.

Roadside systems

Roadside video detection systems

The CRS is currently examining the potential of using automatic detection of pedestrians through intelligent object recognition systems. These systems originally designed for military and security applications have the capability of detecting and tracking pedestrians as they approach a crossing point and then warning drivers of a potential collision.



Video based pedestrian detection system tracking pedestrians across a marked crossing
 Source: <http://www.migmasys.com>

Warning messages from this system could be displayed on roadside variable message signs located on the approach to the crossing point or inside the vehicle via Dedicated Short Range Communication (DSRC) systems.

Vehicle based systems

Advisory Intelligent Speed Adaptation

Intelligent speed adaptation is a vehicle based technology in which the vehicle knows the speed limit. There are different types of ISA systems, an Advisory ISA System alerts the driver when the speed limit is exceeded, usually with an audible alarm or message, as well as visual feedback.

The CRS is conducting the largest, though not the first light vehicle demonstration project of Intelligent Speed Adaptation Technology in Australia throughout 2009 and 2010. By the end of the project more than 100 vehicles will have had an ISA device installed. The trial is being conducted in the Illawarra Region of NSW. The project will deliver an extensive report on the benefits. Costs and issues associated with the installation of Intelligent Speed Adaptation devices in business fleet vehicles. The report will examine the following broad areas:

- Speed Limit Compliance
- Travel time
- Driver acceptance and usability
- Fleet manager acceptance
- Fuel consumption
- Greenhouse gas emissions

It is expected that there would be substantial benefits to pedestrian safety especially in urban areas if speed limit compliance was improved. Research recently released from the United Kingdom suggested that a vehicle with an advisory ISA systems installed travelling on a major urban road (30 mph speed zones) would reduce its crash risk by approximately 2% (Carsten 2008).



Advisory ISA System being tested by CRS

In addition to the trial the CRS is taking a leading role in the development of an Australia and New Zealand wide ISA system and leads a multi agency group of transport authorities examining the systems required to develop an Australia and New Zealand wide ISA system.

In vehicle pedestrian detection systems

The NSW Centre for Road Safety is currently examining the potential of using infra red camera technology to detect pedestrians in reduced visibility and low light situations. An application has been lodged with the US Department of Commerce to import a 25Hz FLIR camera system for installation into the Centre's research vehicle. The system can detect a 1.8m tall pedestrian up to 310m in front of the vehicle thus giving a driver extra time to avoid a potential collision. The system can operate in total darkness and also see through fog, rain and even snow.

BMW offers an infra red detection system marketed as BMW Night Vision on a number of its models sold in Australia.



BMW Night Vision Infra red pedestrian detection display

Source: Source: www.bmw.com.au

Adaptive headlights

In October 2006, German car maker Opel launched a mid-class vehicle with an adaptive headlamp system. The system is based on powerful bi-xenon headlamps and has nine different lighting functions. At speeds below 50 km/h, town light provides a wider light distribution at reduced range, helping drivers to see pedestrians on the edge of the road better. The pedestrian area light, which is activated at speeds between 5 and 30 km/h, has been designed for zones where drivers must exercise extreme caution. The dynamic bend lighting ensures curves are illuminated better. Depending on speed and steering angle, the movable bi-xenon headlamps swivel by up to 15 degrees into the curve, obstacles become more easily visible (Autochannel 2008). This vehicle is not currently sold in Australia.

European vehicle manufacturers BMW and Mercedes do offer adaptive headlight technology in Australian models that interact with steering wheel movements, to provide better illumination at night on roads with curved alignments.

Integrated systems

Dedicated Short Range Communications

Dedicated short-range communications (DSRC) are one-way or two-way short- to medium-range wireless communication channels specifically designed for automotive use and a corresponding set of protocols and standards. It offers communication between the vehicle and roadside equipment. It is a sub-set of the RFID technology used for electronic tolling in NSW. This technology will provide the communications link for vehicle to vehicle (V2V), vehicle to roadside infrastructure (V2I) and potentially vehicle to pedestrian (V2P) active and passive systems.

The CRS is currently working closely with the Australian Dedicated Short Range Communications Cluster (AusDSRC) to develop a national DSRC road safety trial. The AusDSRC consists of road authorities, vehicles manufacturers, universities and communication companies. DSRC systems would enable vehicles to be alerted to pedestrians on the road at night or around blind corners.

Active Safety Systems

Vehicle based systems

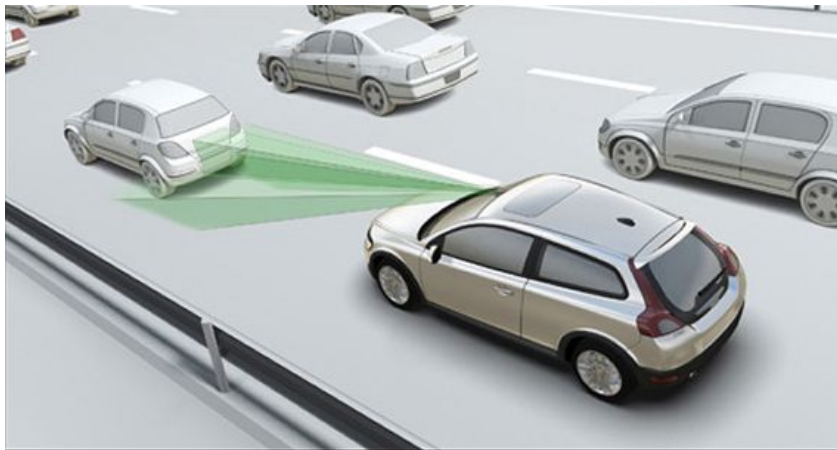
Supportive and Limiting Intelligent Speed Adaptation (ISA)

Supportive and limiting ISA systems prevent a vehicle under power from exceeding the legal speed limit. The supportive ISA system can be overridden by the driver whereas the limiting system cannot. Research suggests that supportive and limiting ISA systems are more effective than advisory devices. Carsten et al (2008) suggests that the crash risk for a vehicle on major urban arterial roads (speed limit 30 mph) would be reduced by 10% if a supportive system was installed or by around 54% if a limiting ISA system was fitted.

Collision avoidance systems with brake support

A number of motor vehicle manufacturers' have introduced collision avoidance systems with automatic brake support to minimise the damage caused by frontal collisions. When a vehicle equipped with one of these systems detects an impending collision it automatically applies the brakes to reduce the impact speed. Reduced impact speeds would have a significant positive effect on pedestrian related crash outcomes.

European vehicle manufacturer Volvo introduced a low speed collision avoidance system known as City safety in 2008, the system uses radar detectors and video cameras to detect the presence of pedestrians up to 150 m in front of the vehicle. The system was demonstrated at the 2008 International Motor Show in Sydney and is available as a standard feature on the Volvo XC60 model.



Volvo Motors City Safe System

Source: Source: www.volvomotors.com.au

Toyota Motor Corporation has recently developed a front-side pre-crash safety system for vehicles in the local Japanese market that includes frontal pedestrian detection. Other manufacturers including Ford, Honda, Nissan and Mercedes Benz have developed similar systems but few are available on the Australian market.

Shape shifting cars

In April 2009, New Scientist Magazine published an article on the potential for vehicles that can change their shape to better protect pedestrians after an impact.

Researchers from Cranfield University in the United Kingdom have developed an energy absorbing system that reduces the stiffness of a vehicle's windscreen, thereby reducing the

severity of head injuries suffered by pedestrians impacting with a vehicle's windscreen (New Scientist 2009)

Autoliv, a Swedish vehicle safety system manufacturer has developed two passive protection systems recently for pedestrians (Autoliv 2008). These pedestrian safety features were outlined in section 4.3 and more detail is provided below.

Active bonnet lift system

The Active Hood raises the vehicle's bonnet instantly when a pedestrian is hit. A sensor system placed in the vehicle's front bumper sends an electrical impulse to two small airbags which lift the rear part of the hood making the pedestrian's head contact a deformable and flexible surface instead of a hard and rigid one. The manufacture claims the sensor is so accurate that it can differentiate between a lamp post and a human leg.



With the Active Hood



Without the Active Hood

Autoliv Active Hood Pedestrian Protection System

Source: www.autoliv.com

Pedestrian Protection Airbag (PPA)

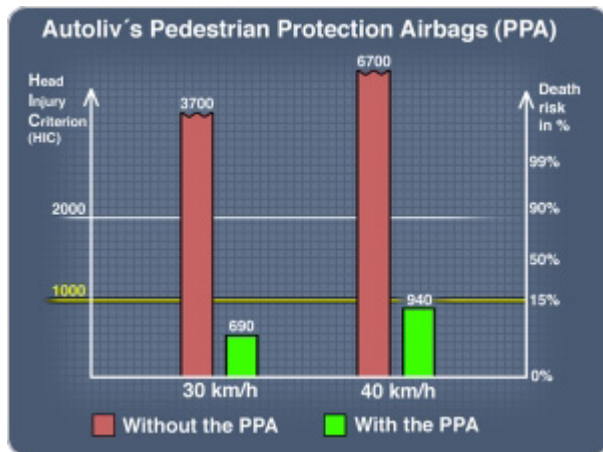
Autoliv has also developed a pedestrian air bag protection system. A pair of airbags, one at each windshield pillar. As vehicle hoods tend to become shorter with every new model change, the risk for pedestrians hitting the hard structures around the windshield increases, but this can be prevented by the PPA.



Autoliv Pedestrian Protection Airbag

Source: www.autoliv.com

The windshield itself is a deformable surface and this, in combination with a deformable hood and energy absorbing airbags at the side pillars, result in a combination that is both very efficient and comprehensive in terms of addressing the vehicle areas that are most dangerous for the pedestrian. The graph below whilst not independently evaluated indicates the potential effectiveness of the system although it can be assumed that this feature will be more effective at lower posted speed limits.



Autoliv Pedestrian Protection Airbag Effectiveness

Source: www.autoliv.com

Combined Active and Passive Systems (CAPS)

The combination of active and passive safety systems offer further potential to reduce the level and incidence road trauma to vehicle occupants as well as other road users. Combined Active and Passive Safety (CAPS) systems require a close network of active and passive safety systems with predictive driver assistance systems; German Company Bosh is currently working on the development of systems that can cross link ESP, hydraulic brake assist and the airbag control unit (Bosh 2009). In many cases, potential crash situations can be detected early by picking up excessive oversteering or understeering or by the onset of panic braking. ESP or hydraulic brake assist systems can also detect potential critical driving situations and in turn send a signal to a control unit which can initialise passive safety systems. For example, seat belts will be tightened to position driver and passengers optimally in their seats and minimise the risk of injury. These systems could also be used in the future to initialise pedestrian protection systems such as Autoliv's pedestrian protection airbag.

5.2 – Pedestrian Countdown Timers

Pedestrian Countdown Timers are typically used in conjunction with standard traffic or pedestrian signals to provide road users with an indication of how much time remains in a particular signal phase or to indicate how much time until the next phase. Countdown timers operate in various modes in a number of locations throughout the world including Copenhagen, Los Angeles, Singapore, Taipei, Istanbul, New York, France, The Netherlands and Ireland.

In late 2008, a report by the Office of Transport Safety Investigations (OTSI) into a bus crash resulting in serious injury to a pedestrian on 27 June 2007 in the Sydney CBD (OTSI Investigation Reference: 04370) recommended the RTA, in conjunction with the City of Sydney Council, conduct a trial of count down pedestrian signals at selected locations in the Sydney CBD to determine whether such equipment should be used more widely within the City.

The RTA is currently examining the potential for a trial of pedestrian countdown timers within the Sydney CBD. Only certain types of countdown timers are suitable for use in the SCATS adaptive traffic signal system including:

- Countdown to green walk (yellow phase only – approximately 6 seconds); and
- Countdown to end of Flashing Don't Walk Phase (i.e. Clearance)

The RTA has reviewed a wide range of research and various trials of pedestrian countdown timers and found limited and conflicting evidence regarding the pedestrian safety benefits provided by pedestrian countdown timers. The review of international literature is inconclusive in regard to the efficacy of pedestrian countdown timers.

However, the RTA is currently scoping a potential trial to ascertain their feasibility, effectiveness and cost. A trial may facilitate a better understanding of potential safety benefits (or disbenefits) in the context of their application in Sydney. Such a trial would involve a very detailed evaluation involving the use of sophisticated cameras and software to observe pedestrian behaviour (and compliance) prior to and during the trial.

5.3 – Observation of Pedestrian and Driver Behaviour

Observational studies of pedestrian and driver behaviour at different types of pedestrian facilities is a powerful tool used to gain an understanding of the potential causes and factors involved in pedestrian crashes and near misses. These studies use video and manual observations to observe factors such as the type of pedestrian facility, crossing location and age and gender of the pedestrian.

Monash University Accident Research Centre (MUARC) conducted an investigation of the road crossing behaviour of older pedestrians in 1995. This study found that older pedestrians:

- took twice as long to assess the traffic and cross the road than younger adults;
- spent more time looking at the ground on the approach to and while crossing the road;
- found difficulty in assessing the gap in traffic;
- were slow to react to approaching traffic; and
- failed to check and re-check for traffic prior to and whilst crossing the road.

The RTA sponsored a major observational study of elderly pedestrians undertaken in the late 1990s. This study unobtrusively observed and recorded the crossing behaviours of 2,172 randomly selected pedestrians. It also noted behaviours which are relevant to the safety of the pedestrian such as; whether they came from a hotel, age, gender, whether they had a walking aid, whether they crossed at a signalised intersection (if available), whether they look for cars prior to crossing and how long they take to cross etc.

The final report of this study (Job & Hatfield, 2006) highlighted:

- Impaired concentration due to distractions (e.g. walking with a friend or talking on a mobile phone);
- Pedestrians crossing away from designated crossing points;
- Preparedness for pedestrians to cross on signals other than the 'walk' phase; and
- Pedestrians exhibiting more care when crossing a main street than a side street;

Today there is sophisticated surveillance technology available to observe pedestrian behaviour and this new technology will be critical in the future observation of pedestrian behaviour.

Observational studies provide evidence of pedestrian characteristics for various pedestrian types (i.e. age and gender) and offer an effective tool to analyse locations with a pedestrian crash history. These studies can inform future strategies and interventions to improve pedestrian safety and assist to identify additional treatments needed to address a location with a pedestrian crash history.

PART 6 - IMPACT OF URBAN PLANNING AND URBAN DESIGN ON PEDESTRIAN SAFETY

Land use policies and the planning and management of the road system need to fully consider the needs of all road users.

Existing land use patterns such as strip shopping centres on major arterials do not support the objective to remove or minimise pedestrian – vehicle conflicts. To address safety deficiencies in existing areas, it is often necessary to retrofit traffic management treatments that seek to encourage safe behaviour by motorists and pedestrians in the context of the existing built environment.

The RTA is currently working on a revised update of its urban design policy for roads (*Beyond the Pavement*) which can be used as a guide in land use planning and road development. One of the key objectives of this policy is to help ensure road projects achieve accessibility and connectivity with focus on catering for pedestrian desire lines/paths and ensuring safe crossings as well as providing safe streets and places for people to use.

New developments such as growth centres and major redevelopments within established areas offer an opportunity for early planning to achieve the best possible access, traffic land-use suitability and road safety outcomes for communities.

Redevelopment in established suburbs

Major redevelopments within established areas must fully consider pedestrian needs in terms of volumes, desire lines or connections and ensuring the availability of safe crossing points in the vicinity of the redevelopment.

Pedestrian requirements need to be emphasised in planning guidelines and local and regional environmental plans and the adequacy of proposed pedestrian measures needs to be factored into the development assessment process. Local Traffic Committees and Road Safety Officers must be fully consulted in the planning phase.

Growth Centres

The RTA has recently produced a key document to provide road hierarchy, planning and urban design principles for the North-West and South-West growth centres in Sydney.

The “*Growth Centres road framework*” is included in [Appendix 4](#). This document sets out principles for developing the emerging major road networks in the growth centres. It provides guidance on road types and hierarchies in balance with land uses and seeks to ensure strong focus on transit oriented development.

The description of road hierarchies specifies the need to create infrastructure that avoids vehicle and pedestrians conflicts. Section 7.1 (RTA 2008, page 27) provides guidance on posted speed and road standard for different road types and specifies pedestrian crossing requirements for various road types. Section 7.3 (RTA 2008, page 30 and 31) outlines the design objectives and design principles to ensure pedestrian and bicycle amenity and safety and specifies the threshold for pedestrian crossing intervals.

PART 7 - EMERGING RISKS AND EXPOSURES FOR PEDESTRIAN SAFETY

There are a number of emerging risks which may act to increase the risk exposure for pedestrians. These issues are including for noting:

- Australia's ageing population – more pedestrians with deficits in their physical abilities and also in sensory, perceptual and cognitive abilities. Issues such as dementia also warrant consideration in developing strategies to improve safety for older pedestrians.
- Increased pedestrian activity.
- Increased bus activity in high pedestrian areas.
- Proliferation of mobility devices (e.g. motorised mobility scooters).
- Devices that cause distraction to pedestrians and drivers:
 - Mobile Phones (with increasing functionality – GPS, emails, play movies etc).
 - Ipods / MP3 players.

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