University of Southern Queensland
Faculty of Engineering and Surveying

The Effect of the 50km/h Implementation on Local Streets in Toowoomba

A dissertation submitted by

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ABSTRACT

The aim of this dissertation is to assess the impact of the implementation of the 50km/h on local streets in Toowoomba. Crash data was analysed to examine casualty crash rates on local streets both before and after the implementation and consider factors which may contribute to any findings. Maps were constructed displaying casualty crash sites in Toowoomba and speeding infringement data also studied. The implementation of the 50km/h speed limit has lowered casualty crash rates but not fatalities. There are several other factors such as intersection design and driver error which still contribute to the casualty crash rate in spite of the lower speed limit. The success in part of this implementation may have ramifications for further study of busier, arterial roads with higher casualty crash rates.

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I further certify that the work in original and has not bee previously submitted for assessment in any other course or institution, except where specifically stated.

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I would also like to thank my wife for assisting me through my University years.

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ABBREVIATIONS

The following abbreviations have been used throughout the text & list of references:

Km/h = Kilometres per hour

RUM code = Road User Movement Code

CHAPTER 1
INTRODUCTION

1.1 Outline of the Study

The first chapter presents an overview of the intentions of this study. (See Specification Appendix A)

The second chapter of this dissertation consists of a literature review of previous studies into road crash, crash types, crash casual factors and road hierarchies. Other background information discusses Toowoomba City with its boundaries, population and history. Information relevant to Toowoomba road crashes is also included.

The third chapter will explain how the project aims to achieve its results through refining raw crash data from the Toowoomba Regional Council and examining speed infringement data.

The fourth chapter discusses how these data sets were analysed, how crashes were plotted on maps and other factors that contribute to casualty crashes on local roads. Risk Assessment has been conducted (Appendix B) before embarking on the site investigations discussed in this chapter.

The fifth chapter will conclude with findings and recommendations of how this data may be transferred to arterial roads.

1.2 Introduction

Local, state and national governments are constantly striving for ways to lower number and severity of road crashes. The implementation of the 50km/h streets has been designed with this in mind. However, unless one closely examines the effectiveness of this strategy it is impossible to know whether this measure has achieved its goal. If indeed it has, then other areas may look at this implementation. However, if secondary problems are deemed to have occurred one must consider other measures to decrease road crashes with as few adverse effects as possible.

1.3 The Problem

Despite the best efforts of government bodies – including police enforcement and extensive marketing campaigns - lives are still being lost on Queensland roads. The extent to which this is occurring in Toowoomba local roads will be examined in Chapter 3. There is a limit to the resources that will be invested by government and private organisations into lowering the road toll. Therefore it is essential that the most cost effective strategies are chosen. It is imperative that this strategy is critically evaluated in order to ensure the most effective methods of reducing the Toowoomba road toll are being implemented.

1.4 Research Objectives

The aim of this research is to firstly identify and compare the number of road crashes which have occurred in local streets both before and after the implementation of the 50km/h speed limit.

To do this road crashes recorded in the Toowoomba Regional Council data will be examined to determine whether they occurred in local 50km/h streets or at intersections between local and other streets.

1.5 Conclusions: Chapter 1

The intentions of this dissertation are to critically evaluate the effectiveness of the implementations of the 50kmh speed limit in Toowoomba. This will be done through data analysis and by first examining literature to study the foundation laid by previous researchers.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter will review literature to establish the need for the implementation of the 50km/h speed limit on local streets in Toowoomba.

After giving an overview of Toowoomba with its history and roads it will discuss road crashes, their classification, causes and limitations on their reporting. The history of the implementation of the 50km/h speed limit on local streets will be discussed at a wider Queensland and local level. The effectiveness of this implementation in other areas will be considered along with alternative measures to lower the number of casualty crashes. A casualty crash is any road accident where people are injured or killed.

2.2 Overview of Toowoomba City

Toowoomba city is located atop the Great Dividing Range more than 700m above sea level and approximately 130kms west of Queensland's capital city Brisbane. Its latitude is 27 33'S 151 57'E. It has reputation as "The Garden City" with more than 240 public parks and gardens and more than 6,300 hectares of open space. (Toowoomba Now, 2008.)

Toowoomba has a population of approximately 96 226 and has experienced growth of between 1-2% each year since 2000. (See figure 2.1) (DLGSR 2007)

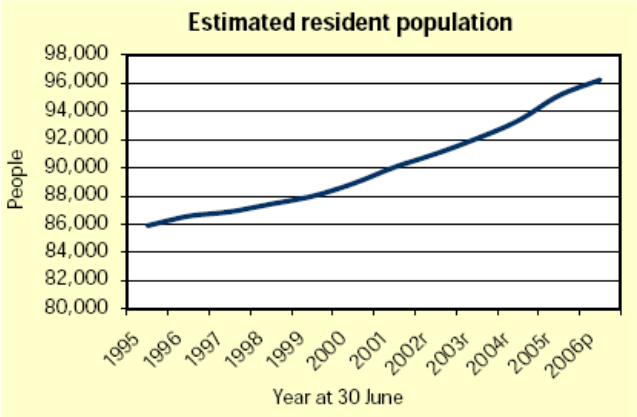


Figure 2.1 – Population growth in Toowoomba Source: DLGSR 2007

This makes Toowoomba Australia's second largest inland city, second only to the nation's capital Canberra.
There were 66242 motor vehicle registrations in Toowoomba as at March 2006 - 51 726 of which were passenger vehicles. (Toowoomba Now, 2008).

Toowoomba experiences four distinct seasons. It is notorious for its fog especially during Winter and fog streetlights line several of the major arterial roads.

2.2.1 Brief History of Toowoomba

This section is included to justify why many of Toowoomba roads are in their present locations.

The original Toowoomba settlement was called the Swamp in the Drayton area. (Ivan McDonald Architects, 2004). Originally the Drayton Swamp Agricultural area was bounded by what is now West Street, Bridge Street, and Stephen Street. It comprised 12 20 acre sections. As land speculation increased subdivisions did also and several residential estates were established. Boundary streets one square mile or longer framed a large square or rectangular grid with cardinal orientation.

The early surveyors applied this grid pattern somewhat haphazardly with little regard for the natural features of the land. There was no "master plan."

In 2008 Toowoomba City Council merged with other councils in surrounding shires to become Toowoomba Regional Council.

2.2.2 Roads in Toowoomba

The Warrego, New England and Newell Highway feed into the Toowoomba Region (Toowoomba Now 2008) and are the responsibility of the Queensland Department of Main Roads. Toowoomba Regional Council is responsible for some 93% of the total road length in Toowoomba, with State and Federal highways comprising 3.6% and 3.1% of the total road length respectively. (Dugdell, 2007).

Toowoomba's road network is largely designed on a grid pattern. Several major roads in Toowoomba are state and Federally controlled with Main Roads being responsible for these. However, the great majority of local streets are the responsibility of Toowoomba Regional Council.

Toowoomba is widely regarded as a transport hub for the Darling Downs and beyond (Maunsell, 1997).

There is limited public transport in Toowoomba. There are several bikeways though Toowoomba's crisp Winters and varying altitude can make this form of transport difficult. Therefore it can be assumed that motor vehicle traffic on these roads will continue to grow.

2.3 Road Crashes

The terms crash, collision and accident are used often interchangeably. For the purposes of this dissertation a road crash is defined by Austroads (2004) as follows –

A road crash is an apparently unpremeditated event which results in death or injury to a person or property damage and is attributable to the movement of a road vehicle on (including entering or leaving) a public road.

A casualty crash is a crash where people are injured or killed within 30 days, excluding death from another primary reason or deliberate intent, or a person not directly involved in the crash.

Crash frequency is the number of crash occurrences per year.

2.3.1 Crash classification

Toowoomba has a higher number of crashes than the state average but the severity is below average. (Dugdell, 2007).

Every reported crash that occurs is classified by type to allow further analysis. The Toowoomba Regional Council uses a system called the Coding of Road User

Movements or ‘RUM’ codes. These RUM codes use two digits and a letter to define the direction the vehicle was travelling. The full page of RUM codes is set out in Appendix A.

There is no blame attributed to drivers with the RUM system (Andreassen 1994).

2.3.2 Accident causation factors

The three main components in a traffic system are

- the human;
- the vehicle; and
- the road.

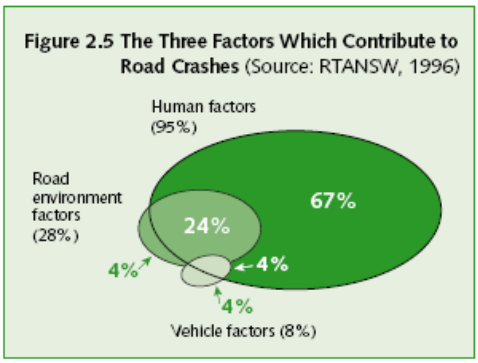


Figure 2.2 The three factors that contribute to road crashes

Source: Austroads 2004

A crash or accident may be considered as a 'failure' in the system. Indeed, the UK Department of Transport (1986) defines an accident as a 'rare, random, multifactor event always preceded by a situation in which one or more persons have failed to cope with their environment'. (Austroads, 2004)

Human error is often a major contributor to serious accidents. The “fatal four” of alcohol & drugs, failure to wear a seatbelt, fatigue and speed play a major part in accidents. Some statistics pertaining to these are outlined below.

- Approximately 30% of fatal crashes are influenced by alcohol and drug driving.

- Around 40 road user deaths each year are caused by fatigue. This is a difficult area to accurately measure statistically.
- Speed magnifies risk and increases severity of injury in accidents.
- Inexperience contributes to the road toll for young drivers.
- In-attention is the leading contributor to road crashes resulting in serious injury and increasingly for deaths. (Austroads 2004)

More information on the human factor in road crashes can be accessed from Cairney and Catchpole (1991).

Road environment causation factors are many. Some are briefly outlined below. For more information see Austroads (2004, p.62)

- Road, road surface and geometry
- Intersection
- Signs and markings
- Traffic signals
- Pedestrian and cyclists
- Lighting
- Parked vehicles
- Speed and the environment
- Roadside
- Visibility
- Evidence of problems

Vehicular safety issues are largely the responsibility of car manufacturers in their initial design and owners to ensure regular maintenance if performed. The Australian design rules go some way towards reducing risk in this area.

2.3.3. Limitations of reported crash data

Austroads, 1997 a minimum common dataset for reporting of crashes on Australian Roads proposes a national system of consistent road crash reporting.
Austroads, (2004) lists several factors which may limit the accuracy of crash data. These include

Systematic reporting bias – Accidents are not always recorded by different organizations in a consistent manner. Due to a number of factors including staff inexperience, non injury accidents are not always reported or not recorded in the database.

Random reporting bias –In addition to many non fatal accidents being under reported erroneous conclusions can be made from wrong interpretation of information. This is particularly evident when roadway factors and human factors are not precisely entered into the database in the first place.

Subjective bias. There are a range of answers to the question "What causes an accident?" Even when presented with similar information subjective elements come into play and different people can draw different conclusions.

Reporting errors. It is important to recognise the circumstances under which a police officer obtains information to complete an accident report. There will often be more pressing matters at an accident scene. The officer may not have local knowledge, so some data items may be inadequately or wrongly recorded. Accidents do not always fit 'standard' formats and there may not be the motivation to fill in the form.

Coding errors. These can occur throughout the process from filling out the accident report form to the data entry at the computer terminal. It is estimated that errors of this type are present in 5% of accident files (Ogden, 1996).

Location errors. A road may have different regional and local names which means accidents at one location may appear in two separate parts of the accident data base. Locations are often estimated.

Discontinuities over time. Abbreviations, definitions or interpretations of field data may be changed over time and can mean different things to different people.

Delays. Agencies responsible for data processing may not be sufficiently resourced: it may be many months before information is available for analysis. This means that countermeasure development may be responding to historical accident patterns which may be out of date.

Masked or hidden problems. It may be the case that a location is perceived as being so dangerous that people avoid using it.

2.4 50km/h streets

The following discusses the background to the 50km/h speed limit.

2.4.1 Road Hierarchies

A road hierarchy is defined as the grading of roads according to increasing or decreasing importance of their traffic-carrying or other function (Austroads 2004). Toowoomba Regional Council uses a 4 tier road hierarchy. Roads are classified as local collector, trunk collector, sub arterial or arterial. (Toowoomba Planning Scheme Online, 2008.) Urban arterial roads have a predominant function to carry traffic. They form the primary road network and link main districts of the urban area. Arterial roads that perform a secondary function are sometimes referred to as sub-arterial roads. Urban collector/distributor roads are local streets that have a greater role than others in connecting contained urban areas (e.g. residential areas, activity areas) to the arterial road system. Urban local roads are roads intended exclusively for access with no through traffic function. This paper considers both Urban collector roads and Urban local roads. Motorways and freeways that have the exclusive function to carry traffic within cities and to ensure the continuity of the national or regional primary road system are not evident in the Toowoomba Regional Council boundary. (Austroads, 2004).

2.4.2 Background to implementation on 50km/h streets

Before one can consider the effectiveness of the 50km/h speed limit, extensive background research must be done into its implementation. Most of the following information is drawn from Queensland Transport.

The 50km/h speed limit became effective throughout the entire state of Queensland from 1 February 2003. According to Queensland Transport the ruling is as follows - in built up areas drive no faster than 50km/h unless otherwise signed. The 50km/h speed limit will only apply to local streets. That is usually a street mainly used to provide direct access to homes and private properties.

Speed limits are decided after considering the following things –

- the number and configuration of traffic lanes
- density and type of development
- the amount of on-road parking
- access arrangements to properties
- the presence or otherwise of traffic signals
- the accident patterns that have occurred.

Local, 50km/h streets, are not normally signposted. There are some exceptions but as a general rule motorists must drive at 50kmh unless they see a sign telling them otherwise. The Queensland Police Service enforces this speed limit using radar and hand held laser devices. (Queensland Transport 2003b).

Previous to the 50km/h limit being introduced the speed limit in local streets was 60 km/h. According to Queensland Transport approximately 1/3 of all crashes resulting in injury occur in local streets. The aim is to not only to decrease the number of crashes but also the severity. Driving at a lower speed limit gives drivers shorter stopping distances and extra time to avoid collision.

The three aims of this move are

- save lives
- reduce serious injury and property damage
- make urban areas more liveable for local communities

A car travelling at 50km/h can stop 12 – 16 metres sooner than one travelling at 60km/h as illustrated in Figure 2.3

Figure 2.3 Stopping Distances

Source: Queensland Transport, 2003b.

2.4.3 Affect of lowering speed limit to 50km/h in other areas

Many local streets in Australia and overseas have lowered their speed limit to 50km/h. The following Table 2.1 from Monash University Accident Research Centre (2003) illustrates the findings after the trial implementation the 50km/h speed limit across Australian states and territories.

State/Territory	Impact on Crashes and Casualties	Impact on Speeds
New South Wales	A three-month trial of a 50 km/h urban speed limit in 26 local government areas commenced in October 1997; in June 1998 all local councils were invited to implement the limit, with all implementation costs to be met by the State Government. Networks of streets with limited access are posted with 50 km/h area signs, supplemented by repeater signs or pavement markings.	As at December 2002, 141 councils out of 171 (and two communities in the unincorporated area) had implemented the lower limit, covering more than 90% of the State's population.
Victoria	As a default limit by regulation.	Implemented on local streets throughout the State from January 2001.
Queensland	As a default limit by legislation. Signposting of 50 km/h areas is limited to perimeter and repeater signs.	Implemented on local streets by eleven local government areas in the south-east region of Queensland from 1 March 1999, covering 90% of the State's population. Will be extended to all of regional Queensland from February 2003.
South Australia	As a default limit by regulation.	Implemented on local streets throughout the State from 1 March 2003; existing 40 km/h local speed zones will not change.
Western Australia	As a default limit by regulation.	Implemented on local streets throughout the State from 1 December 2001.
Tasmania	As a default limit by regulation.	Implemented on non arterial roads in urban areas throughout the State from May 2002.
Australian Capital Territory	As a default limit by regulation for a two year trial period. Signs have been installed at the entry and exit of all 50 km/h areas.	Implemented on local streets in the ACT from 1 March 2001.

Table 2.1 Impact of 50km/h speed limit on Australian states and territories

In addition to the findings of other Australian states supporting evidence for the lower speed limit can be found internationally. (Monash University 2003)

In Europe and North America countries with an urban speed limit of 60km/h had a 30 per cent higher average death rate for pedestrians aged 25 – 64 years.

Within two years of implementation, 3 per cent of the annual French road toll was deemed to be prevented by the reduced 50 km/h speed limit.

The Norwegian Traffic Safety Handbook found that the average speed fell by 3.5-4 km/h and the number of fatal accidents was reduced by 45 per cent after Norway reduced its urban speed limit from 60 km/h to 50 km/h.

When the speed limit in Zurich was reduced from 60 km/h to 50 km/h, pedestrian collisions fell by 20 per cent and pedestrian deaths by 25 per cent.

In addition to this reduction in the number and severity of accidents there is a subsequent reduced cost to the community

2.5 Alternatives to lowering speed limit

The lowering of the speed limit to 50km/h has the potential to lower casualty crashes in Toowoomba. However, it can be difficult to control driver behaviour and reduce speeds on local streets solely through regulation and enforcement. There are alternatives measures that can be implemented to help reduce injuries and fatalities.

Pattison (2004b) lists the following as possible alternatives to lowering the speed limit in local areas.

Table 2.2 Alternatives to Lowering the Speed Limit. (Cameron et al, 2002)

Measure	**Description**
Road hump	Rounded raised area with dimensions in the order of a 4-metre radius and a 5 to 15 cm height.
Raised table	Long raised speed hump with a flat section in the middle and ramps on the ends; sometimes constructed with brick or other textured material on the flat section.
Chicane	A series of narrowings or curb extensions that alternate from one side of the street to the other forming S-shaped curves.
Roundabout	Raised circles, placed in intersections, around which traffic circulates.
Centre-line marking / flush kerbing	Painted markings in the centre of the road.
One- and two-lane slow points	Islands used to create an angle path for vehicles. The effect of angling the travel path slows vehicles down.
Intersection priority changes	Changes to an intersection priority, such as not allowing right turning traffic.
Channelisation	A raised island, islands or markings that force traffic in a particular direction, such as right-turn-only.
Speed cushions	A form of road hump, occupying part of the traffic lane in which it is installed, generally located in pairs.
'Mobile' speed humps	Temporary speed humps placed on the road at special events.

2.6Conclusions: Chapter 2

This Literature Review covered the City of Toowoomba, background of crash classification, causation factors and limitations of crash data. The rationale for the implementation of the 50km/h speed limit for local streets was also discussed along with alternatives to lowering the speed limit. With this foundation now laid data can be analysed specifically relevant to the effectiveness of 50km/h speed limit on local roads in Toowoomba.

Chapter 3 – RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describes the types of data required for analysis in this project. This chapter states the source of the data, how the data was collated and refined, as well as the methodology to analyse the data. As with the Monash University Evaluation of Victorian roads (Newstead et al 2002) hypothesis testing is evident in the analysis presented. No assumption is made that the introduction of the 50 km/h default speed limit will either decrease or increase crash frequency on the affected roads.

3.2 Data

The Toowoomba Regional Council, was contacted in May 2008 and crash data requested. This data was supplied by Greg Smith by way of a "data dump" from council's accident database into Microsoft Excel spreadsheet. (See Appendix B). The data details all reported accidents received from the Queensland Police Service (Toowoomba) for the Toowoomba city area dating back to the late 1980's. Also, provided from this organization was a map illustrating the streets of Toowoomba and their speed limits. (Appendix C). Queensland Transport was contacted in June 2008 requesting speed infringement data for local streets in Toowoomba. This data was supplied in a spreadsheet format. (Appendix D) It covered all speeding infringements in Toowoomba over the past five years. The relevant data was extracted analysed.

3.2.1 Crash Data

This data was very extensive with over 14000 entries since 1987. It needed some refining to obtain the relevant information. In addition to crash data provided there were also entries of each Give Way, Stop sign, roundabout and traffic light installation as well as modification etc. This information was removed from the data in an effort to grow closer to the relevant data concerning local streets. RUM codes and descriptions were used to determine which sites were accidents and which traffic control devices.

Appendix E shows a list of the Road User Movement (RUM) codes. Toowoomba City Council uses RUM codes to record road user movements during an accident.

3.2.2 Speed Infringement Data

This data was limited to only covering speed infringements from 2001. The data only had total annual speed infringement numbers with the corresponding infringement type. Appendix D shows the speed infringement data.

3.3 Methodology

This section explains the methods used in verifying the accuracy of the data and how the various data types will be analysed.

3.3.1 Crash Data

Using the Toowoomba City Speed Zone plan (Appendix C), accidents occurring on roads or intersections which were not classified as local were removed. However, if an accident occurred on an intersection between a local and non local road this information was retained. A local road constituted any road with a speed limit of 50km/h.

In order to reduce the possibility of human error all of these entries removed from the spreadsheet were proofread by another person.

After refining the spreadsheet to just the most relevant information the number of accidents occurring each year on local roads was graphed. In order to ensure this graph was read in context, the population growth of Toowoomba and the increase in registered motor vehicles were also taken into account. A population factor was calculated by dividing the 2007 population of Toowoomba by the corresponding population for other years. The graph also includes a factor for increase in registered motor vehicle ownership using appropriate data from the Australian Bureau of Statistics. (2006)

As one of the main aims of the reduced speed limit was to decrease serious injury and death these elements too have been considered. All roads that were not 50km/h or intersecting with a 50km/h street were removed. The crash data attained does not distinguish between minor or serious injury.

Four maps were constructed showing casualty crash. Two years were selected before the implementation of the 50km/h speed limit and two years after. The years selected previous to the implementation were 2001 and 2002. The years selected after the implementation were 2004 and 2007. 2004 was selected to show any immediate reduction following the extensive advertising campaign that accompanied the implementation. 2007 was selected as it was the most recent complete set of data. Each casualty crash occurring on a local street or an intersection with a local street was represented on the map with a dot. Only 50km/h streets with single carriageway were included.

3.3.2 Speed Infringement data

Senior Sergeant Bradley Clark of the Queensland Police Service – Toowoomba Traffic Branch provided codes for statistics regarding the number of annual speed infringements in 50km/h local streets. These codes were then sent to Queensland Transport statistics and data analysis department to obtain the relevant information. However, the exact location of the infringements could not be ascertained from Queensland Transport. Freedom of Information was contacted as an attempt to broaden the scope of the data however the information regarding exact location of infringements still could not be ascertained. Also, data on how many police radar traps were implemented on Toowoomba local roads could not be accessed. However, Queensland Police did state that speed cameras are not used on 50km/h streets. Radar traps are only used in response to supplied intelligence in 50km/h streets.

The speed infringement data (Appendix D) was graphed with the population growth of Toowoomba and the increase in registered motor vehicles taken into account. A population factor was calculated by dividing the 2007 population of Toowoomba by the corresponding population for other years. Data from the Australian Bureau of

Statistics was again used to include a factor for the increase in registered car ownership.

3.3.3 Factors Influencing the Accuracy of the Data

Several factors influencing the accuracy of the raw data need to be considered before implementing its use. The crash data from Toowoomba City Council is susceptible to double entries of accidents. Numerous data entries require extraction as it appears accidents at the same time, day and intersection have been duplicated by mistake.

Human errors also appear in leaving out vital information in the crash data from data entry personnel. Some accidents may only have one street defined as a location or have RUM code information missing. These data entries need to be assessed for usability and if deemed unusable extracted from the data.

As there is over 14000 crash data entry points it is inevitable that some data may be omitted by mistake. As all care must be taken to ensure a high level of data refinement a second person must check the omitted data.

3.4 Conclusions: Chapter 3

This chapter has described the types of data being analysed for this project. This chapter has explained the methodology to be used in the analysis of the data and the factors influencing the accuracy of the data.

CHAPTER 4

DATA ANALYSIS

4.1 Introduction

Having obtained the data it was necessary to manipulate it appropriately to achieve desired results. The following section discusses how what information could be drawn from the data after it was plotted and graphed.

4.2 Accidents Occurring on Local Streets

Figure 4.1 is a graph showing the number of accidents occurring on local streets in Toowoomba from 1987 to 2007. The overall trend is a growth in the number of accidents from 1987 until 2003. From 2005 there is a decline. The data for 2008 was omitted as it is not a full calendar year. Figure 4.2 shows this same data but takes into account population growth and increase in car ownership.

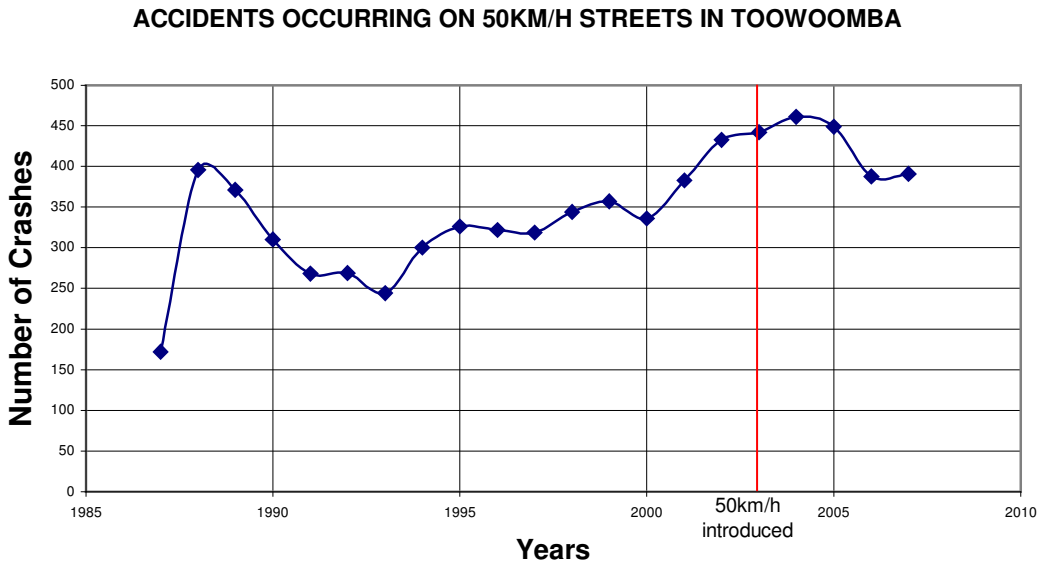


Figure 4.1 – Raw Data showing accidents occurring on 50km/h streets in Toowoomba.

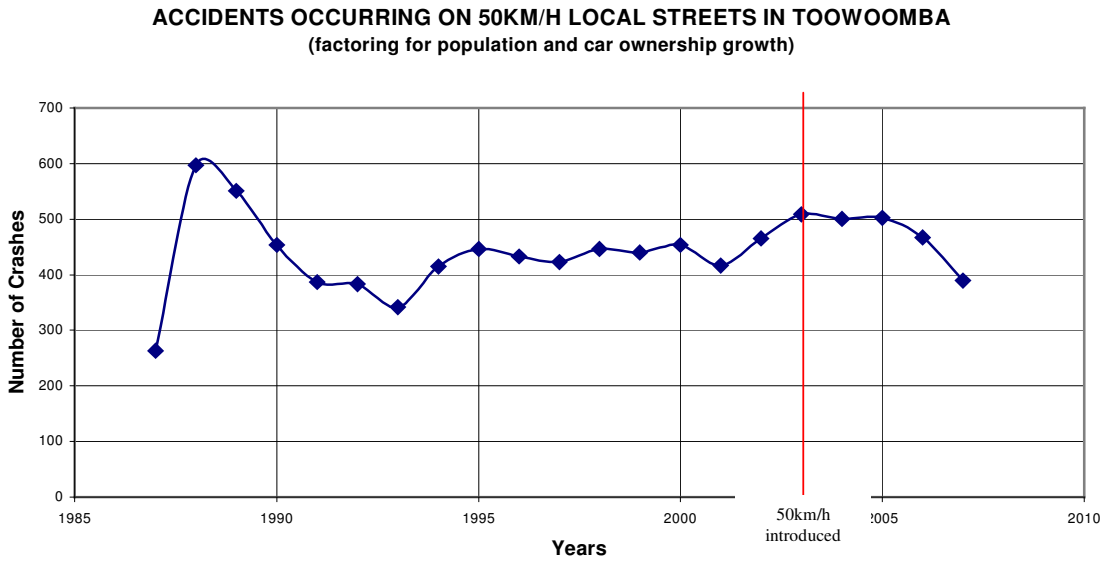
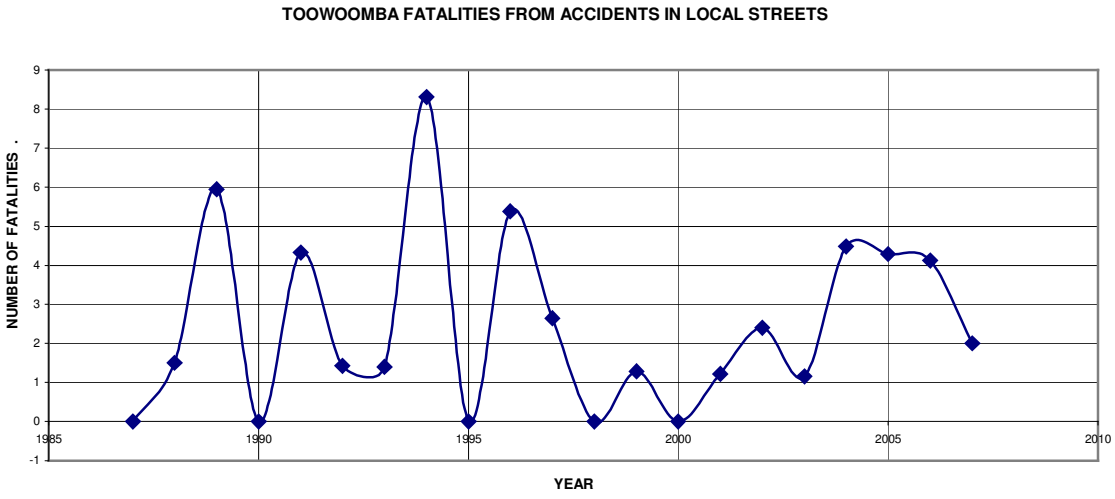


Figure 4.2 – Accidents including increase in population and car registration

4.3 Fatalities on Local streets

There is not a general downward trend when one examines the fatalities occurring on Toowoomba local streets, as seen in figure 4.3. This attracted interest considering the general downward trend in accident numbers. However, given that there is so few (under 10) fatalities a year on local 50km/h streets trends can be harder to establish.



4.3 Fatalities occurring on 50km/h local streets in Toowoomba

Road User Movement (RUM) Code	***Total***	Prior to Feb 2003	After Feb 2003
Pedestrian			
00	2	2	
01	1		1
02	5	4	1
04	1		1
Vehicles from Adjacent Directions			
10	8	5	3
Vehicles from Opposing directions			
20	2	2	
21	2		2
Vehicles from Same Direction			
30	2	1	1
Overtaking			
50	1	1	
On Path			
60	1	1	
Off Path, on Straight			
71	4	2	2
72	2	1	
73	2	1	1
74	1		1
75	3	2	1
Off Path on Curve			
81	1		1
Passengers and Miscellaneous			
91	1	1	

Table 4.2 Fatalities on Toowoomba local streets according to RUM code

In order to more closely examine this phenomenon fatalities were grouped according to their RUM code as shown in Table 4.2. The most commonly occurring RUM Code was 10 which is cross traffic. (See Appendix E) This has seen a decrease in the five years after the implementation compared to the 5 years before. It is worth noting that all of the RUM codes from 71 – 75 refer to probably single car accidents where cars have travelled off path on a straight section of road. These accidents are less likely to occur if a car was travelling at 50km/h. Therefore it suggests that even though the speed limit is 50km/h this may not be being adhered to.

4.4 Casualty crashes on local streets in Toowoomba

The total number of injuries occurring on local streets is shown below in Figure 4.4.

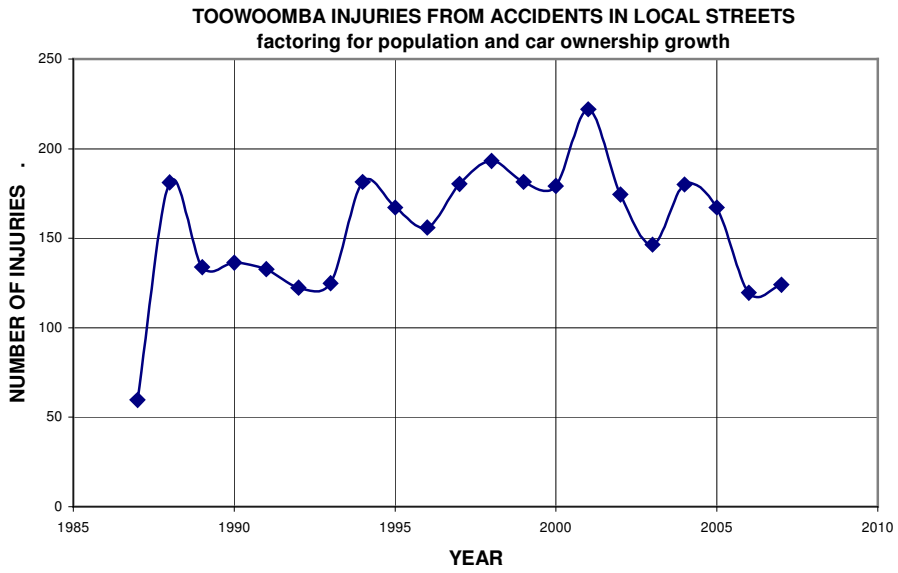


Figure 4.4 Casualty crashes in Toowoomba local streets factoring for car registration and population growth

Though there was some increase between 2003 and 2004 the overall trend is falling. The total number of accidents in the years 1999 – 2002 previous to the implementation of the 50km/h speed limit is 578 while the total number of accidents in years 2004 – 2007 are 557. This shows a decrease of 21 accidents or approximately 5 per year. While this is not a sharp decrease it is worth noting when one considers that there is a greater number of cars on the road.

4.5 Casualty crashes according to RUM codes

Data was also studied according to RUM codes to ascertain whether there was an increase or decrease in certain types of accidents. Again, when trying to compare whether there is an increase or decrease data was used from 1999 – 2002 inclusive and 2004 to 2007. 2003 was omitted due to the change occurring part way through the year. Data previous to 1999 was omitted as comparisons were done over an equal four year period of time. 2008 was also not included as it has not yet been a full year of data.

4.5.1 RUM Codes 00 – 09 PEDESTRIAN

There has been a decrease in the number of accidents involving pedestrians over the time period (Appendix F). Overall the decrease was 42%. The majority of fields decreased some degree. This is particularly relevant given that this is one of the major types of accidents targeted by the reduced speed limit. The majority of the marketing campaign focused on cars stopping in time to avoid hitting pedestrians. It is virtually impossible for an accident to occur with a pedestrian without injury or fatality occurring so this decrease is encouraging.

4.5.2 RUM Codes 10 – 19 VEHICLES FROM ADJACENT DIRECTIONS INTERSECTIONS ONLY

10 was the frequently occurring RUM code in accidents causing injury for every year. RUM code 10 refers to Cross Traffic accidents (See Appendix E).

In the site investigations undertaken it was noted that intersections between local streets are often not as clearly marked as those on arterial roads. Also, at times there is little warning that the driver is approaching an intersection until they are upon it. Rises and dips can be deceptive and prevent clear sight of upcoming intersections

Figure 4.5 Intersection where the Give Way sign on the left may be easily missed. Source: Google Maps (2008)

Also, there are greater chances of trees not being adequately pruned to clearly see all oncoming traffic.

Figure 4.6 Example of Trees reducing visibility on a local street.

Another possible factor is that many of these local street intersections are poorly lit and, especially in foggy Toowoomba conditions, can be difficult to make out.

The most obvious causation factor is driver error whether through inattention, fatigue or error in judgement.

The increase from 92 crashes in 2001 – 2004 to 96 crashes from 2004 – 2008 is marginal considering the increased number of cars on roads. However, it does suggest that lowering the speed limit on its own is not enough to significantly decrease the number of crashes occurring in this way. Thought the 50km/h speed limit can give other drivers extra time to react it will not eliminate all these other possible contributing factors for the high frequency of these crashes.

Rum CODE 13 referring to Right Near turns (Appendix E) also warrants discussion given its high occurrence. Again, there could be many contributing factors to this increase. Confusion over give way rules may be one as showed people are not as confident with this, especially on unguarded intersections. (Driving School 2001) Judgement errors are likely to be the other contributing factor with drivers thinking they have enough time to turn in front of oncoming traffic.

4.5.3 RUM Codes 20 – 29 Vehicles from opposing directions

Since the decreased 50km/h speed limit there has been a 21% drop in these types of accidents. Rum codes 20 – 29 occur infrequently with the exception of 21, referring to

right thru turns. RUM21 causing injury occurs on average 12 times a year between 2004 – 2007. There is a decrease of 21% on the four years previous to the 50km/h implementation. Reasons for these accidents could be similar to RUM Code 13 driver judgment errors, obstructions or lack of clear vision.

4.5.4 RUM CODES 30 – 39 Vehicles from the Same Direction

The number of accidents causing injury in this category have largely remained the same – a 1.9% increase overall. There are few isolated accidents causing in jury in each category.

RUM Code 30 saw a decrease of 25% but still had 24 crashes causing injury in the four year period. The lower speed limit should mean that drivers have increased reaction time to stop before hitting someone but road, car and weather conditions all play a part. (See Figure 4.7)

Figure 4.7
Toowoomba Fog

Code 32 was the 2nd most common accident type causing injury. With occurrences over the eight year period being examined. There was a consistently high number of crashes of this type occurring each year with an 18% growth since the lower speed limit was introduced.

4.5.5 RUM codes 40 – 49 Manoeuvring

There was a 21% decrease in injury causing accidents resulting from manoeuvring. The most common accident of this type was U turn. Drivers are often careless making U turns. (Driving School 2001) Local streets can often seem very quiet and drivers

can become complacent and unobservant. While the 50 km/h speed limit does give other drivers longer time to react this will not prevent all accidents of this nature.

Also, RUM code 47, emerging from a driveway, has an average of two crashes a year. Car parking is policed less on local roads and motorists Cars parked on the foot path or in the gutter can obstruct drivers view emerging from driveways. Though we do not know if these accidents are residents leaving their own homes this information could still be relevant. According to Monash University (2003) over half of all accidents happen within 8km of home. This study found that it may be a human fault or inattention and familiarity that causes the problems.

4.5.6 RUM Codes 50 – 59 Overtaking

The only accident type causing data in this category was code 53 overtake turning. There has been a decrease of 62% from eight to only three of these accidents occurring in the four years since the decreased speed limit.

4.5.7 RUM Codes 60 – 69 Accidents on Path

Accidents on Path had an overall decrease of 12 % from 17 to 15 in the four year period after the implementation. Overall accidents of this nature were farily rare with the most common being accidents occurring when drivers were double parked – RUM 61.

4.5.8 RUM Codes 70 – 79 Off Path On Straight

This category Off path on straight section of road has seen a decrease of 24% in accidents causing injury. However, as discussed in the fatality section this was the area with the most fatalities occurring.

RUM Code 72 – off carriageway to the right was the most commonly occurring with an increase of 9% which equates to an increase of 2 crashes over the four year periods being examined. There were 25 crashes causing injury of this nature over the 4 year period. This is particularly high given these are usually single car accidents occurring on a straight section of road. Speed often plays a part in these kind of accidents *****. There will always been drivers who regardless of the speed limit exceed it.

4.5.9 RUM Codes 80 – 89 Off Path On Curve

This category referring to drivers going off onto the path on a curve has seen a 27% decrease. Once again speed often plays a part in these accidents. If a driver was adhering to the 50km/h speed limit these accidents are unlikely to occur. It may not matter what the speed limit is set to some drivers will always speed and therefore have accidents causing injury. All of these accidents have rarely occurred in the time periods examined.

4.5.10 RUM Codes 90 – 99 Passengers and Miscellaneous

This passengers and miscellaneous category rarely features. The most common form of accident appearing here is Rum 90 falling in or from a vehicle. It would be difficult to see a connection between these accidents and the decreased speed limit.

4.6 Injury causing accidents according to location

Using an adaptation of the Toowoomba City Speed Zonal Plan, all the casualty and fatality accidents on local streets were marked. The maps were then closely studied for areas where several accidents seemed to occur in close proximity. This enables further study to establish other contributing factors in these areas. Site investigations were then conducted of areas of interest. Photos were taken of particular points of interest. Where it was difficult to take appropriate photos Google Maps (2008) has been used to represent the intersections.

There were no streets that had a particularly high number of casualty crashes that appeared on one map only. They all appeared over several years.

Site investigations were carried out on the following streets which demonstrated a higher number of casualty crashes.

- McGregor Street – near the intersection with Bridge Street 2001, 2002
- Hurstway Street – 2002, 2004
- Curzon Street between Crown and James Streets 2001, 2004, 2007
- Peachey Street – between Joyce Street and James Street 2001, 2002, 2004
- Mort Street between Rome Street and Bridge Street 2002, 2004, 2007
- Neil Street – between Russell and Margaret 2001, 2002, 2004, 2007.

4.6.1 James Street and local street intersections

There were several accidents occurring on local streets where they intersected with James Street. Site investigations were not conducted on each of these individual sites as it was deemed that the greatest contributing factors are more likely to be intersection management than the speed limit on the local street.

4.6.2 Russell Street

Russell, McGregor, Neil and Pechey Streets are signed 50km/h streets according to the Toowoomba City Speed Zonal Plan (Appendix C). This demonstrates that while still sharing some characteristics with local streets they are recognised at streets which have a traffic load greater than most local streets.

Site investigation at Russell Street revealed that, while it is a 50km/h street in some sections, in the areas where several accidents occurred it is a one way street with at least two lanes. It has three sets of traffic lights in this small section being examined between Victoria Street and Neil Street.

Figure 4.8 Corner of Russell and Neil Streets Source: Google Maps

In many ways it shares characteristics of a sub arterial road. This brings in a large number of factors which are not typical to local streets. Therefore, for the purposes of this discussion Russell Street has been disregarded.

4.6.3 Neil Street

A similar situation was found in Neil Street between Russell and Margaret Streets. While Neil Street does become a single lane carriageway between Perth and Herries Street previous to this it is similar to Russell Street – being one way with at least two lanes. In the areas where it show more characteristics of a local street there is not a higher than average casualty accident rate. One can effectively conclude that the 50km/h speed limit reduction introduced in 2003 has not hard a marked effect on accidents on both Russell and Neil street in the Toowoomba CBD.

4.6.4 Hurstway Court

Hurstway Court adjoins Ruthven Street and is one of two access points to the major Harvey Norman shopping complex. In 2007 traffic lights were installed at the other major entrance to this complex. Hurstway was also made a left turn only on Ruthven Street. This has resulted in a reduction of accidents on this street from eight in 2006, to three in 2007 and now one reported accident in 2008. There have been no reported accidents with an injury in 2007 or 2008 on Hurstway Court.

4.6.5 McGregor Street

McGregor Street runs alongside Captain Cook sporting grounds which in Winter in Toowoomba make it very busy on peak times such as Saturday mornings. Since 2001 additional parking has been installed and speed limits lowered during peak times. This has gone some way to decreasing accidents from seven in 2001 in future years to four accidents recorded in 2007.

Figure 4.9 McGregor St Source: Google Maps

4.6.6 Curzon Street

Curzon Street runs north-south, parallel to Mackenzie Street, towards the Eastern escarpment of the Toowoomba Range. A site investigation of the section of Curzon Street between Herries and Perth Streets revealed several possible contributing factors to the higher number of injury causing accidents on this local road.

Figure 4.10 Curzon Street

Curzon Street runs past St Vincents Hospital and while it is not the main access road with the main parking areas, it is extensively used. So it does have a fairly high traffic volume in comparison with other smaller local residential streets. Many roads form crossroads intersections with Curzon Street such as Ipwsich Street in Figure 4.5

Figure 4.11 Intersection of Curzon Street and Ipswich St.

There is no traffic lights on Curzon Street, all intersections are either Stop or Give Way signs. Curzon Street is divided by a traffic island. Motorists travelling west along Ipswich Street drive down a dip before meeting rather abruptly with the Curzon Street cross roads. Also, it is possible that drivers get distracted looking ahead along other roads that they do not realise there is an intersection with Curzon Street that requires them to yield.

4.6.7 Mort Street

A site examination of Mort Street was conducted to establish problem spots on this stretch of road. Mort Street is lined with large, established trees.

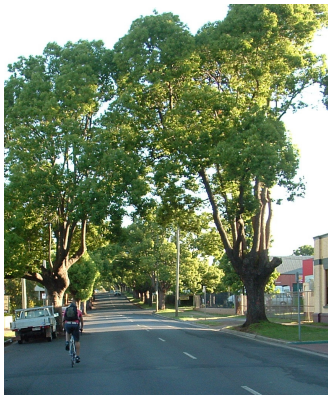


Figure 4.12 Tree lined Mort Street

Cars can park in between trees and in parks along both sides of the road in places. This can make it very difficult for drivers to establish a clear line of site when trying to cross or turn into Mort Street very difficult. Also, Mort Street is lined with businesses that have driveways that come out between the trees to the street. If a driver cannot clearly see oncoming traffic they are presented with the choice to edge out slowly or travel with speed and hope for the best. The latter choice would contribute to high accidents causing injury. In Mort Street there was increased risk of drivers not having clear line of sight due to trees, parked vehicles and vehicles coming out of business driveways. The 50km/h speed limit on Mort Street gives other drivers longer time to react but there are other factors making this a high risk areas.

4.6.8 Pechey Street

Pechey Street is the main access road between the CBD and Toowoomba Base Hospital. There has been a decreasing trend of accidents here since 2002 but it still has a largely number of casualty crashes than most streets. The highest number of accidents along Pechey Street occur at the traffic light intersection with James Street. However, some are also further along towards the hospital entrance.

4.13 Pechey Street outside Toowoomba Base Hospital

Site investigation revealed cars can park in metered parks on both sides of the road potentially making sight difficulty for traffic turning out of the hospital. Garden City Wholesalers is another large business on Pechey Street. Though not evident on the day the site investigation took place it is possible there would be a large number of trucks coming and going from this site. Also, ambulances and emergency vehicles frequent the hospital and could distract or alarm a less confident motorist.

4.7 Speed Infringement Data

The speeding infringement data obtained from the Queensland Police Force via Queensland Transport has limited conclusions that can be drawn from it.

Data was provided in table form for the sections where 50km/h limit was exceeded (Figure 4.8) The data has been left in table form as graphed it was misleading given that there we do not know how many tests were done and where they were done. The most common exceeded amount was >13 but <20km/h over the limit. However, it is alarming the number drivers exceeding the limit by greater than 30 or 40 km/h.

As there is no indication of how many radar tests are done on local streets it is impossible to work out what percentage of people are exceeding the 50km/h limit. Also, one cannot assume that the number of people speeding has increased in 2005 because it is possible there were a much greater number of speed traps conducted. What can be concluded from the data is that with that number of motorists exceeding the 50km/h limit, speed will still be a major factor in a large number of the accidents. Just because the limit has been lowered does not mean every driver is now adhering to it.

It may be necessary to consider other traffic calming measures such as chicanes or speed humps in conjunction with the lower speed limit in order to slow drivers down.

It is also possible that some of these infringement notices were issued in 50km/h sections of road that were not classed as local. Eg. Hospital zone on an arterial road

Table 4.3 Speed Infringement data 50km/h Toowoomba district

Code	Offence Description	2001	2002	2003	2004	2005	2006	2007	2008	Total
1701	EXCEED 50KM/H (LOWER DEFAULT SPEED LIMIT BUA) BY LESS THAN 15 KM/H	0	1	0	0	0	0	0	0	**1**
1702	EXCEED 50KM/H (LOWER DEFAULT SPEED LIMIT BUA)BY 15KM/H < 30KM/H	3	2	0	0	0	0	0	0	**5**
2522	TRACTOR W/- S/CANE TRAIL EXCEED 50KMH BY MORE THAN 30KMH NOT MORE 40K	0	0	0	0	0	0	1	0	**1**
2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH	0	0	45	104	225	176	160	35	**745**
2541	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 20KMH NOT MORE 30KMH	0	0	12	29	52	36	30	6	**165**
2542	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 30KMH NOT MORE 40KMH	0	0	1	8	6	6	3	4	**28**
2543	EXCEED 50KM/H (LOWER DEFAULT SPEED LIMIT BUA) BY MORE THAN 40KM/H	0	0	2	1	2	3	1	1	**10**
	TOTAL	**3**	**3**	**60**	**142**	**285**	**221**	**195**	**46**	**955**

Figure 4.8 Number of speed infringements issued by Queensland Police in 50km/h streets – Toowoomba Branch.

4.8 Maps

The maps in Appendix G show the location of casualty crashes that occurred in 2001, 2002, 2004, 2007. These were then used to create one more map that shows areas where they has been noticeable increase or decrease in the number of casualty crashes on local roads.

4.9 Conclusions: Chapter 4

Chapter Four has discussed the findings after the data was analysed. The results showed that there is some decrease in casualty accidents since the implementation of the 50km/h speed limit. However, other contributing factors still need to be eliminated in order to lower the casualty crash rate even further.

CHAPTER 5

CONCLUSIONS

5.1 Introduction

The aim of this chapter is to finalise the discussions of the previous sections. The scope of this paper will be examined and conclusions drawn on the effectiveness of the 50km/h speed limit on Toowoomba local streets.

5.2 Discussion

The number of casualty crashes on local roads in Toowoomba has decreased since the implementation of the 50km/h speed limit. This was shown by the decrease of accidents in the four year period after the implementation compared to the four year period prior. However, this paper has highlighted how there are several types of accidents, differentiated by their RUM code, which have increased since the implementation of the lower speed limit. Also, the paper highlighted several areas that have either remained the same or had an increased number of casualty crashes. In order to further reduce the number of casualty crashes many other factors need to be examined.

5.3 Further research and recommendations

There are many other factors that work in conjunction with speed to cause serious property damage, injury or death. In order to further reduce these incidents other issues need to be resolved such as -

- Poor lighting
- Unclear intersection signage
- Lack of warning signs of approaching intersection
- Obstructions to clear view
- Fatal four – speed, alcohol, fatigue, seatbelts
- Driver error – perhaps the most crucial

It would be worthwhile analysing the part each of the aforementioned factors plays in casualty crashes on local streets in Toowoomba. This would of course be dependant

on the information being made available to the researcher. Particularly relevant is examining speed to establish what percentage of people travelling in 50km/h zones are over the limit if this data could be made available. Also in which streets these speeding infringements are taking place.

Another area of further work could be to investigate the driver education and how secure motorists are with the road rules. Given that there were a number of casualty accidents due to u turns, double parking and other illegal acts it would be interesting to research whether these errors are made out of ignorance or complacency. It is possible that better driver education may assist here but there is a realisation that there are budget and other constraints. For example, roundabouts were not in place in Toowoomba when many drivers received their licences so there may be a lack of confidence in using them.

The final area of research would be to ascertain whether traffic calming devices such as slow points help or hinder the reduction of casualty crashes on local 50km/h roads. Do they become a place for "hoons" to test driving capabilities at speed or do they genuinely slow traffic?

While refining data to examine only accidents occurring on local roads it was observed that the majority of very serious accidents are occurring on the bigger, busier arterial roads. This is a large field that requires much further study.

5.4 Summary of Chapter 5

This chapter has discussed that - while a reduction in the number of casualty crashes has occurred on Toowoomba local roads since the implementation of the 50km/h speed zone – there is still more work to be done to achieve a higher level of safety. Further research into other accident causation factors, driver education and the effectiveness of other traffic slowing devices may assist in making decisions to further reduce accidents. However, perhaps the biggest difference to the overall safety of our roads can be achieved by examining our arterial roads

"*… although local roads make up a considerable amount of the road network, it is estimated that on average only 15% of journeys are spent on local roads. Secondly, around 15 to 20% of crashes occur on local roads. Therefore reducing the speed limit on such roads is only going to have small impact on the overall road safety situation. Enormous gains can still be obtained by lower speed limits on busier arterial roads where the bulk of crashes occur.*" (Woolley, 2005)

Appendix A University of Southern Queensland

Faculty of Engineering and Surveying

ENG4111/4112 Research Project
Project Specification

FOR: **Joshua Edward Allan GOODALL**

TOPIC: The 50kph speed limit in residential Toowoomba

SUPERVISOR: Trevor Drysdale

SPONSORSHIP: University of Southern Queensland

ENROLMENT: ENG 4111 – S1, X, 2008
ENG 4112 – S2, X, 2008

PROJECT AIM: This project will seek to determine the effectiveness of the introduction of the 50kph limit in Toowoomba by examination of road crash data and residential speed infringements.

PROGRAMME: **(Issue A, 19 March 2008)**

1. Research the background information relating to the introduction of the 50kph speed limit in Queensland.
2. Ascertain data from sources that relate to residential Toowoomba road crashes and speed infringements before and after the implementation of the 50kph speed limit.
3. Critically compare data sets prior to and after the 50kph speed limit implementation.
4. Produce maps of Toowoomba showing where road crashes and speed infringements happen both prior to and after the 50kph speed limit implementation.
5. Analyse the maps for any major differences between the data sets.
6. Complete site investigations of areas where road crashes and speed infringements have not been reduced.
7. Produce a map that shows where the implemented speed limit has reduced road crashes and speed infringements.

As time permits

8. Design traffic managing systems in accordance with local and state laws for areas that have high amounts of road crashes and speed infringements.

AGREED:

_____ (Student) _____ (Supervisor)

Date: ___ /___ / 2008 Date: ___ /___ / 2008

Examiner/Co-examiner:_____

Appendix B Risk Assessment.

Risk Assessment—Joshua Goodall
Affect of 150km/h speed limit on local streets in Toowoomba

Event— The dissertation is used real world scenarios

Consequences	Likelihood: Very likely	Likely	Unlikely	Highly Unlikely
Fatality	High Risk	High Risk	High Risk	Medium Risk
Major Injuries	High Risk	High Risk	Medium Risk	Medium Risk
Minor Injuries	High Risk	Medium Risk	Medium Risk	Low Risk
Negligible Injuries	Medium Risk	Medium Risk	Low Risk	Low Risk

Actions Taken to Reduce Risk:

- Ensure disclaimer is attached to the front of the dissertation
- Make sure disclaimer is written in simple English so no misinterpretation can occur

Risk Assessment—Joshua Goodall
Affect of 150km/h speed limit on local streets in Toowoomba

Event— Getting hit by a vehicle during site investigation

Consequences	Likelihood: Very likely	Likely	Unlikely	Highly Unlikely
Fatality	High Risk	High Risk	High Risk	Medium Risk
Major Injuries	High Risk	High Risk	Medium Risk	Medium Risk
Minor Injuries	High Risk	Medium Risk	Medium Risk	Low Risk
Negligible Injuries	Medium Risk	Medium Risk	Low Risk	Low Risk

Actions Taken to Reduce Risk:

- Wear high visibility clothing when taking photos at site investigations
- Go with another person who can look out
- Stay on footpath as much as possible
- Conduct investigations in full daylight at non peak travel times.
-

Risk Assessment—Joshua Goodall
Affect of 150km/h speed limit on local streets in Toowoomba

Event— RSI from typing the dissertation

Consequences	Likelihood: Very likely	Likely	Unlikely	Highly Unlikely
Fatality	High Risk	High Risk	High Risk	Medium Risk
Major Injuries	High Risk	High Risk	Medium Risk	Medium Risk
Minor Injuries	High Risk	Medium Risk	Medium Risk	Low Risk
Negligible Injuries	Medium Risk	Medium Risk	Low Risk	Low Risk

Actions Taken to Reduce Risk:

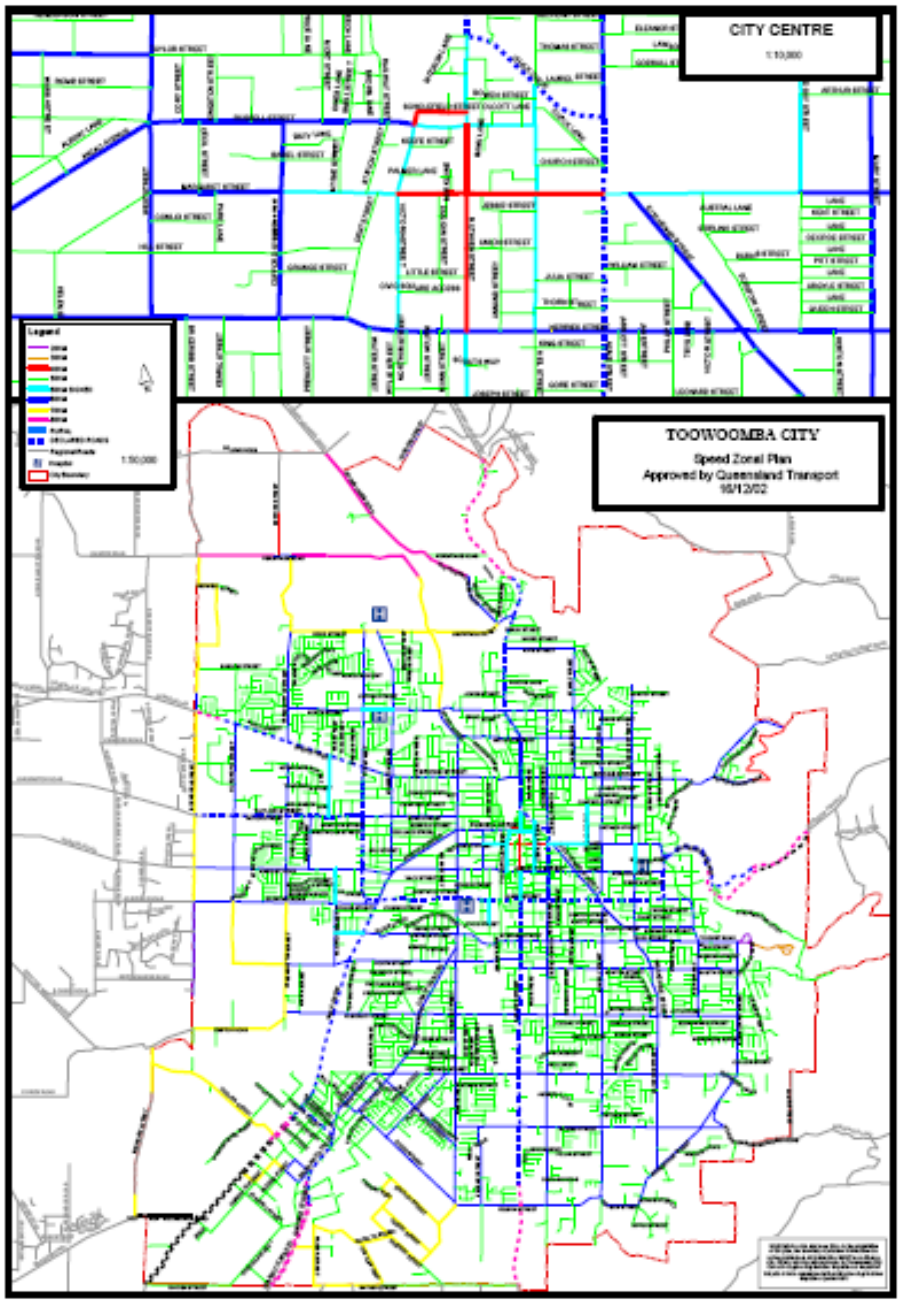
- Ensure constant breaks from typing
- Do hand exercises during breaks
- Ensure study area is set up correctly to limit irritations

Appendix C Sample Data Received from Toowoomba Regional Council

3/01/2001	21:35:00	JAMES ST	PECHEY ST	0	0	10W
3/01/2001	16:30:00	JAMES ST	100m W HELEN ST	0	1	32E
4/01/2001	18:00:00	JAMES ST	WEST ST	0	1	30N
4/01/2001	9:00:00	JAMES ST	12M W FIFTH	1	0	00W
5/01/2001	19:15:00	CAMPBELL ST	RUTHVEN ST	0	1	53S
9/01/2001	23:00:00	MORTON ST	RUTHVEN ST	0	0	31N
9/01/2001	18:50:00	PIERCE ST	RUTHVEN ST	0	1	10E
9/01/2001	22:30:00	BIRDWOOD ST	HENDERSON ST	0	0	75W
11/01/2001	18:10:00	CLIFFORD ST	GRANGE ST	0	0	10E
11/01/2001	13:00:00	BRIDGE ST	BROOK ST	0	0	32W
12/01/2001	12:55:00	STEPHEN ST	WEST ST	0	1	10W
12/01/2001	22:00:00	RUTHVEN ST	20m S MARGARET	0	0	60N
13/01/2001	14:00:00	RUTHVEN ST	40m N ALDERLEY	0	0	60N
13/01/2001	12:30:00	ALDERLEY ST	RUTHVEN ST	0	0	21W
14/01/2001	12:30:00	CAMPBELL ST	O/S NO 172	0	1	47N
14/01/2001	17:00:00	BRIDGE ST	RAFF ST	0	0	10S
16/01/2001	11:50:00	GLEESON CRES	100M N FLYNN	0	1	02N
16/01/2001	6:35:00	JAMES ST	100E E HELEN	0	1	71W
16/01/2001	21:10:00	KITCHENER ST	MARGARET ST	0	0	21E
16/01/2001	10:10:00	GEDDES ST	LONG ST	0	1	10S
17/01/2001	6:15:00	RUTHVEN ST	STENNER ST	0	0	21W
17/01/2001	16:15:00	VICTORIA ST	AT MILNE BAY	0	0	47E
18/01/2001	9:00:00	HERRIES ST	PHILLIP ST	0	1	10W
18/01/2001	18:00:00	CURZON ST	SINCLAIR ST	0	0	60E
19/01/2001	14:35:00	MANSFORD ST	RUTHVEN ST	0	1	32N
19/01/2001	10:42:00	PECHEY ST	200m S JAMES	0	0	60N
19/01/2001	12:50:00	FITZPATRICK ST	TARA ST	0	0	10N
19/01/2001	14:15:00	COONAN ST	MOONEY ST	0	0	83S
20/01/2001	3:45:00	ANZAC AVE	HURSLEY RD	0	0	81S
20/01/2001	13:05:00	CURZON ST	JAMES ST	0	0	32W
20/01/2001	1:30:00	HOLBERTON ST	50M S CAMPBELL	0	0	71S
23/01/2001	17:50:00	DALGLEISH ST	AT END	0	1	75E
25/01/2001	21:20:00	KITCHENER ST	MARGARET ST	0	0	13N
25/01/2001	14:55:00	JELLICOE ST	LINK ST	0	0	13N
26/01/2001	15:10:00	NORTH ST	100M E GREENWATTLE	0	1	71W
27/01/2001	0:50:00	RUTHVEN ST	20m N JAMES ST	0	0	35S
30/01/2001	3:00:00	HERRIES ST	MACKENZIE ST	0	0	71E
30/01/2001	2:00:00	ALAYNE CT	RACHEL ST	0	0	85S
30/01/2001	18:30:00	NORTH ST	RUTHVEN ST	0	0	21W
30/01/2001	15:30:00	LONG ST	RUTHVEN ST	0	0	21E
30/01/2001	12:10:00	MARGARET ST	E OF PARK LN	0	0	43W
31/01/2001	10:15:00	TAYLOR ST	WYALLA ST	0	0	13N
31/01/2001	14:50:00	RUTHVEN ST	STEPHEN ST	0	0	30N
1/02/2001	16:25:00	AUBIGNY ST	HUME ST	0	0	32N

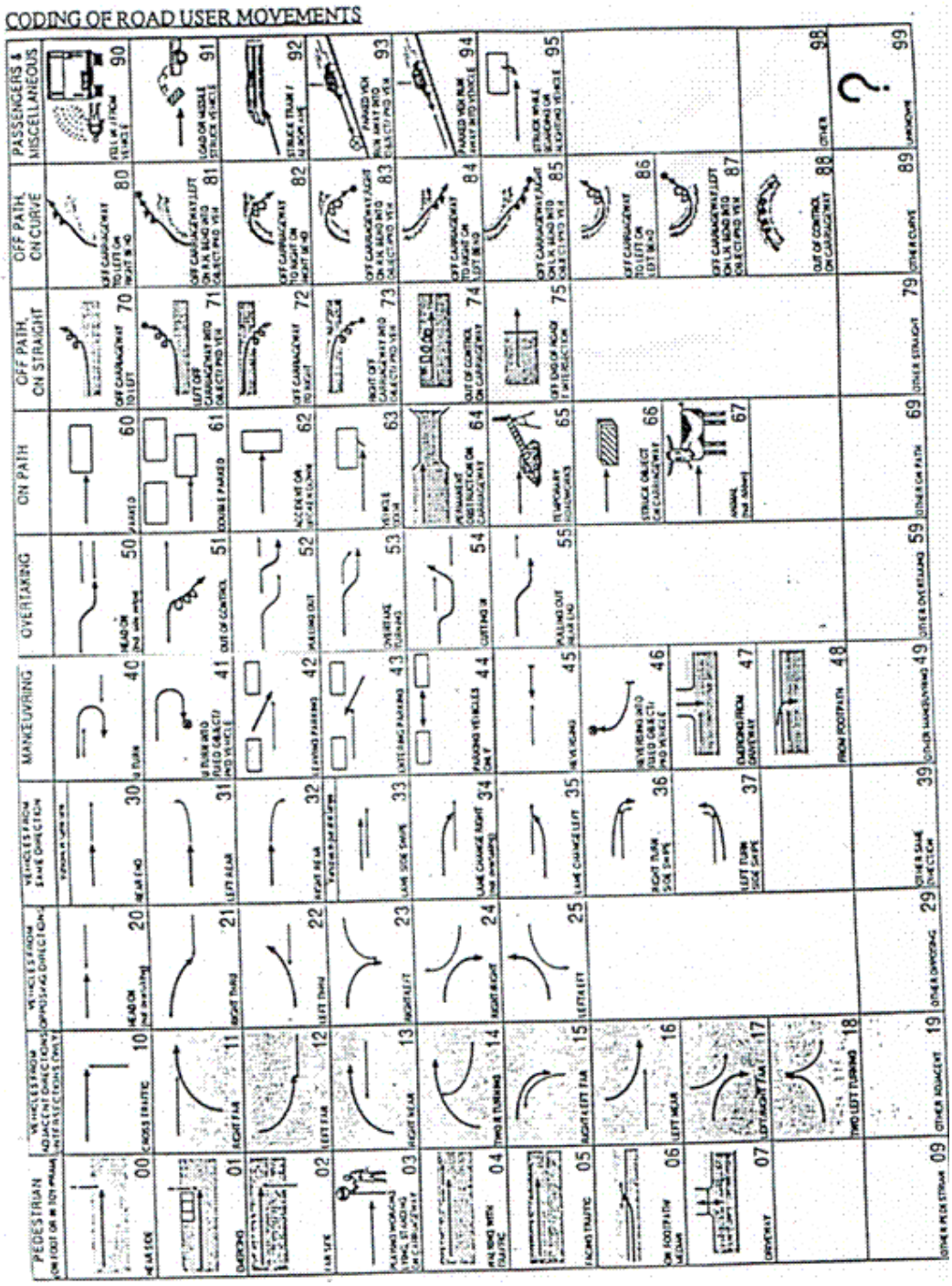
AT INTERSECTION CROSS TRAFFIC   SOUTHBOUND - WESTBOUND
ON PATH HIT PARKED VEHICLE NORTHBOUND
ON PATH HIT PARKED VEHICLE NORTHBOUND
VEHICLES FROM OPPOSING DIRECTIONS RIGHT-TURN FROM E - STR FROM W
EMERGING FROM DRIVEWAY ONTO WESTBOUND CARRIAGEWAY
AT INTERSECTION CROSS TRAFFIC   SOUTHBOUND - EASTBOUND
PEDESTRIAN far side westbound
STRAIGHT OFF CARRIAGEWAY TO LEFT INTO OBJECT/PARKED VEH WESTBOUND
VEHICLES FROM OPPOSING DIRECTIONS RIGHT-TURN FROM W - STR FROM E
AT INTERSECTION CROSS TRAFFIC   SOUTHBOUND - EASTBOUND
VEHICLES FROM OPPOSING DIRECTIONS RIGHT-TURN FROM E - STR FROM W
EMERGING FROM DRIVEWAY ONTO NORTHBOUND CARRIAGEWAY
AT INTERSECTION CROSS TRAFFIC   SOUTHBOUND - WESTBOUND
ON PATH HIT PARKED VEHICLE EASTBOUND
VEHICLES FROM SAME DIRECTION REAR END FRONT VEH TURNING RT S-E
ON PATH HIT PARKED VEHICLE NORTHBOUND
AT INTERSECTION CROSS TRAFFIC   NORTHBOUND - WESTBOUND
CURVE OFF C'WAY, RIGHT ON R.H.BEND INTO OBJECT/PKD VEH WESTBOUND
CURVE OFF C'WAY, LEFT ON R.H.BEND INTO OBJECT/PKD VEH WESTBOUND
VEHICLES FROM SAME DIRECTION REAR END FRONT VEH TURNING RT E-N
STRAIGHT OFF CARRIAGEWAY TO LEFT INTO OBJECT/PARKED VEH SOUTHBOUND
STRAIGHT OFF END OF ROAD/TEE INTERSECTION EASTBOUND
AT INTERSECTION RIGHT NEAR TURNING FROM S TO E
AT INTERSECTION RIGHT NEAR TURNING FROM S TO E
STRAIGHT OFF CARRIAGEWAY TO LEFT INTO OBJECT/PARKED VEH WESTBOUND
VEHICLES FROM SAME DIRECTION LANE CHANGE LEFT SOUTHBOUND
STRAIGHT OFF CARRIAGEWAY TO LEFT INTO OBJECT/PARKED VEH EASTBOUND
CURVE OFF C'WAY, RIGHT ON L.H.BEND INTO OBJECT/PKD VEH EASTBOUND
VEHICLES FROM OPPOSING DIRECTIONS RIGHT-TURN FROM E - STR FROM W
VEHICLES FROM OPPOSING DIRECTIONS RIGHT-TURN FROM W - STR FROM E
ENTERING PARKING COLLISION WITH WESTBOUND VEHICLE
AT INTERSECTION RIGHT NEAR TURNING FROM S TO E
VEHICLES FROM SAME DIRECTION REAR END NORTHBOUND
VEHICLES FROM SAME DIRECTION REAR END FRONT VEH TURNING RT S-E

Appendix D - Toowoomba City Speed Zonal Plan



Appendix E - Sample Speed Infringement Data Received from Qld Tranpsort

QPS District	QPS Station Name	Code	Offence Description
TOOWOOMBA	CROWS NEST	2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH
TOOWOOMBA	DRAYTON	2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH
TOOWOOMBA	DRAYTON	2541	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 20KMH NOT MORE 30KMH
TOOWOOMBA	GATTON	2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH
TOOWOOMBA	GATTON	2541	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 20KMH NOT MORE 30KMH
TOOWOOMBA	GATTON	2543	EXCEED 50KM/H (LOWER DEFAULT SPEED LIMIT BUA) BY MORE THAN 40KM/H
TOOWOOMBA	HELIDON	2541	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 20KMH NOT MORE 30KMH
TOOWOOMBA	LAIDLEY	2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH
TOOWOOMBA	OAKEY	2522	TRACTOR W/- S/CANE TRAIL EXCEED 50KMH BY MORE THAN 30KMH NOT MORE 40K
TOOWOOMBA	OAKEY	2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH
TOOWOOMBA	PITTSWORTH	2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH
TOOWOOMBA	PITTSWORTH	2541	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 20KMH NOT MORE 30KMH
TOOWOOMBA	TOOWOOMBA	1702	EXCEED 50KM/H (LOWER DEFAULT SPEED LIMIT BUA)BY 15KM/H < 30KM/H
TOOWOOMBA	TOOWOOMBA	2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH
TOOWOOMBA	TOOWOOMBA	2541	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 20KMH NOT MORE 30KMH
TOOWOOMBA	TOOWOOMBA	2542	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 30KMH NOT MORE 40KMH
TOOWOOMBA	TOOWOOMBA TACTICAL BRANCH	2541	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 20KMH NOT MORE 30KMH
TOOWOOMBA	TRAFFIC BRANCH TOOWOOMBA	1701	EXCEED 50KM/H (LOWER DEFAULT SPEED LIMIT BUA) BY LESS THAN 15 KM/H
TOOWOOMBA	TRAFFIC BRANCH TOOWOOMBA	1702	EXCEED 50KM/H (LOWER DEFAULT SPEED LIMIT BUA)BY 15KM/H < 30KM/H
TOOWOOMBA	TRAFFIC BRANCH TOOWOOMBA	2540	EXCEED 50KMH (LOW DEFAULT SPD LT BUA)BY AT LEAST 13KMH NOT MORE 20KMH
TOOWOOMBA	TRAFFIC BRANCH TOOWOOMBA	2541	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 20KMH NOT MORE 30KMH
TOOWOOMBA	TRAFFIC BRANCH TOOWOOMBA	2542	EXCEED 50KMH(LOW DEFAULT SPD LT BUA)BY MORE THAN 30KMH NOT MORE 40KMH
TOOWOOMBA	TRAFFIC BRANCH TOOWOOMBA	2543	EXCEED 50KM/H (LOWER DEFAULT SPEED LIMIT BUA) BY MORE THAN 40KM/H



Appendix F

Coding of RUM

Appendix G Rumcode analysis	1997	1998		1999	2000	2001	2002	Total 1999 - 2002
Pedestrian								**50**
00	2	8		9	3	3	1	**16**
01	2				2	5	1	**8**
02	4	4		2	6	6	5	**19**
03		1						**0**
04					1			**1**
05						1		**1**
06				1	1			**2**
07	1	1		1				**1**
09		1				1	1	**2**
Vehicles from Adjacent Directions								**127**
10	24	32		24	25	25	18	**92**
11	2	1		3	1	1	2	**7**
13	4	10		2	2	10	7	**21**
14					1	2		**3**
15							1	**1**
16	1				2			**3**
Vehicles from Opposing Directions								**70**
20	2	1		3		1		**4**
21	20	14		18	13	19	14	**64**
23						1		**1**
24						1		**1**
29	1							**0**
Vehicles from Same Direction								**105**
30	6	5		11	3	12	6	**32**
31	2	3			2	1	7	**10**
32	9	9		11	6	19	13	**49**
33		1		1	1	1	1	**4**
34		1		1		3		**4**
35	1						1	**1**
36					1	2		**3**
37	1	1				1		**1**
38				1				**1**
39								**0**
Manoeuvring								**23**
40	1	1		1	1	3	2	**7**
41		1						**0**
42		1			1	2	1	**4**
45	1			1				**1**
47	2	1		1	2	3	2	**8**
48	1					1	2	**3**
Overtaking								**8**
53	1	1		3	2	3		**8**
On Path								**17**
60							1	**1**
61	1	3		5	4	1	1	**11**
65		1		1	2		1	**4**
66				1				**1**
68								**0**
Off Path On Straight								**45**
71						1		**1**
72	4	5		2	9	5	7	**23**
73							1	**1**
74	3	4		4	1	6	2	**13**
75	1			1		1		**2**
76	2	1			1	3	1	**5**
Off Path on Curve								**11**

Off Path on Curve								**11**
82		2		1		1	2	**4**
83				1	1			**2**
84					1	1		**2**
85								**0**
86	2	2						**0**
88		2		2				**2**
89	1						1	**1**
Passengers and Miscellaneous								**5**
90	1	2			1	1	1	**3**
92						1		**1**
93		1				1		**1**

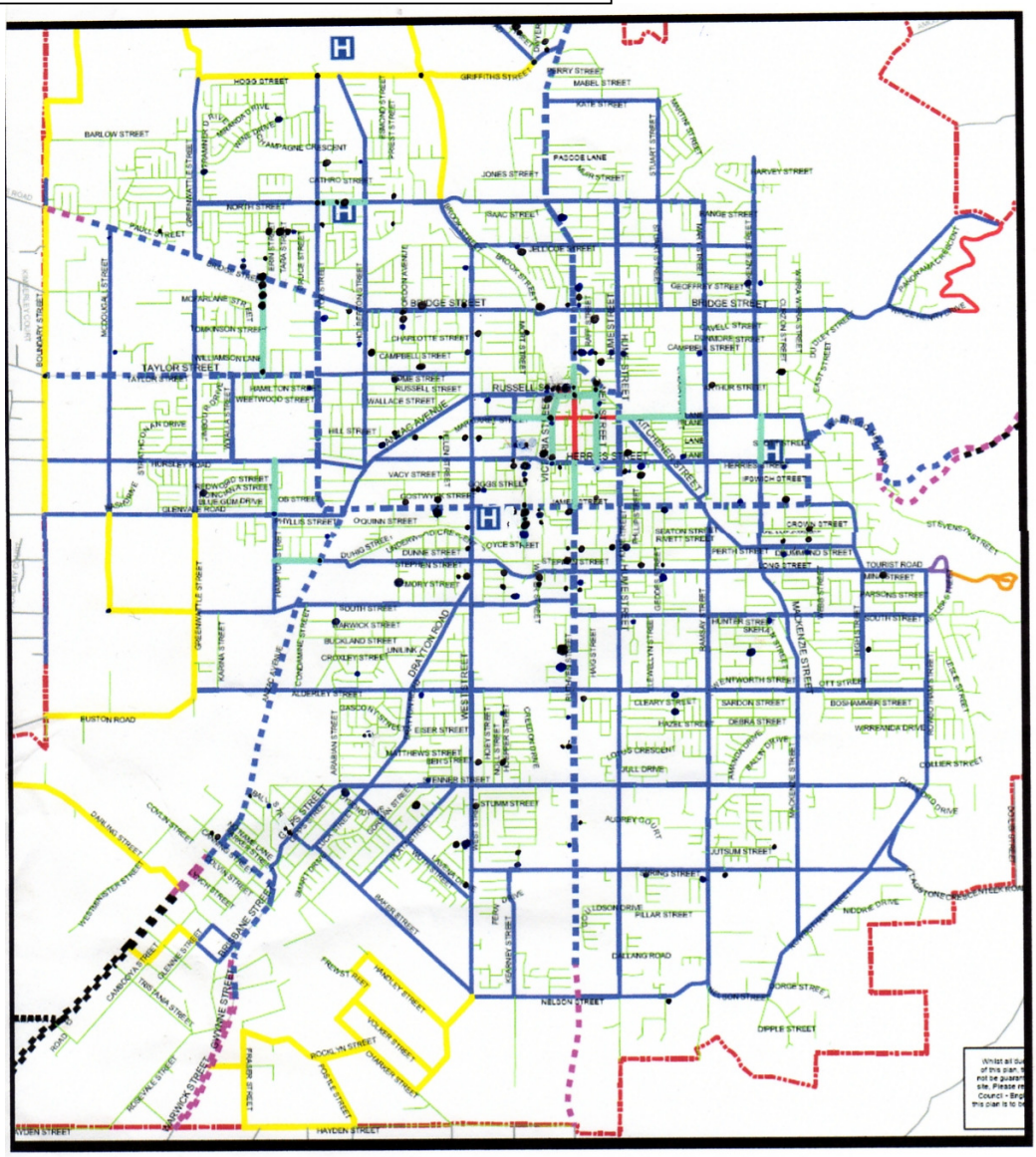
Rumcode Analysis Page 3

2004	2005	2006	2007	Total 2004 - 2007	Percentage Increase or Decrease
				29	-42.0
4	2	0	6	12	-25.0
2	2	1	2	7	-12.5
1	1	2		4	-78.9
				0	0.0
2				2	100.0
				0	-100.0
				0	-100.0
			1	1	0.0
	1	1	1	3	50.0
				137	7.9
25	23	19	29	96	4.3
1		3	2	6	-14.3
10	5	11	8	34	61.9
				0	-100.0
	1			1	0.0
2	1			3	0.0
				55	-21.4
3			1	4	0.0
10	15	14	11	50	-21.9
				0	-100.0
				0	-100.0
		1		1	100.0
				107	1.9
5	5	6	8	24	-25.0
4	4	4		12	20.0
18	14	13	13	58	18.4
3				3	-25.0
	1	1		2	-50.0
				0	-100.0
2	1		2	5	66.7
1	1			2	100.0
				0	-100.0
			1	1	100.0
				18	-21.7
2	2	3	2	9	28.6
				0	0.0
		1		1	-75.0
				0	-100.0
1	4	2	1	8	0.0
				0	-100.0
				3	-62.5
1	2			3	-62.5
				15	-11.8

				0	**-100.0**
2	3		3	**8**	**-27.3**
1	2	1	2	**6**	**50.0**
				0	**-100.0**
		1		**1**	**100.0**
				34	**-24.4**
				0	**-100.0**
4	9	7	5	**25**	**8.7**
				0	**-100.0**
1		2	2	**5**	**-61.5**
				0	**-100.0**
1	1	1	1	**4**	**-20.0**
				8	**-27.3**
1				**1**	**-75.0**
1				**1**	**-50.0**
	1			**1**	**-50.0**
		1		**1**	**100.0**
				0	**100.0**
1	1			**2**	**0.0**
			2	**2**	**100.0**
				8	**60.0**
3	3	1		**7**	**133.3**
				0	**-100.0**
			1	**1**	**0.0**

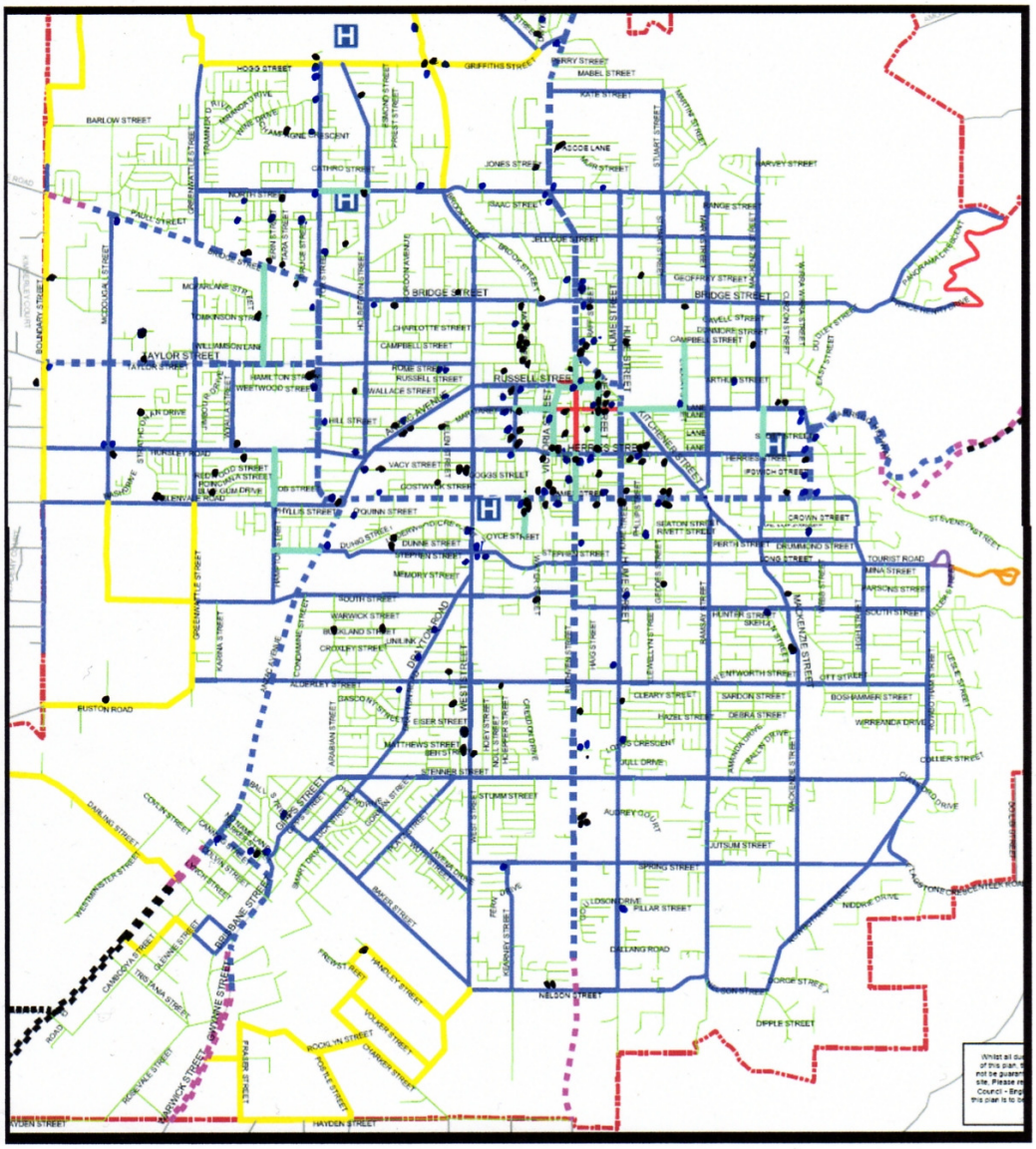
RUM code analysis Page 4

Appendix H Maps.



Road Crashes on Toowoomba Roads 2001

- Indicates an area where an accident occurred on a local road or local road intersection with no injuries or fatalities.
- Indicates an area where an accident occurred on a local road or local road intersection causing injury.
- Indicates an area where a fatal accident occurred on a local road or local road intersection.

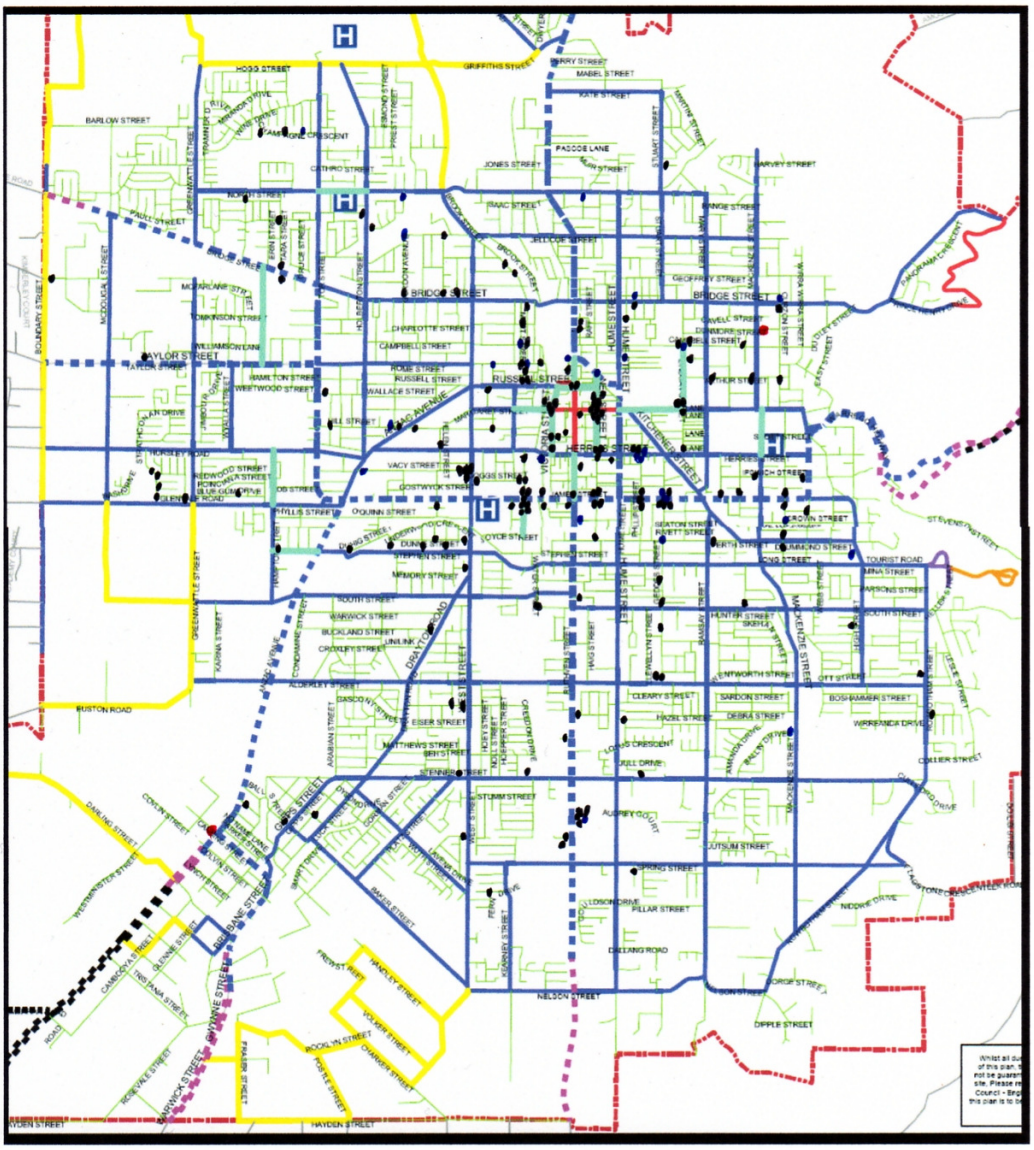


Road Crashes on Toowoomba Roads 2002

Indicates an area where an accident occurred on a local road or local road intersection with no injuries or fatalities.

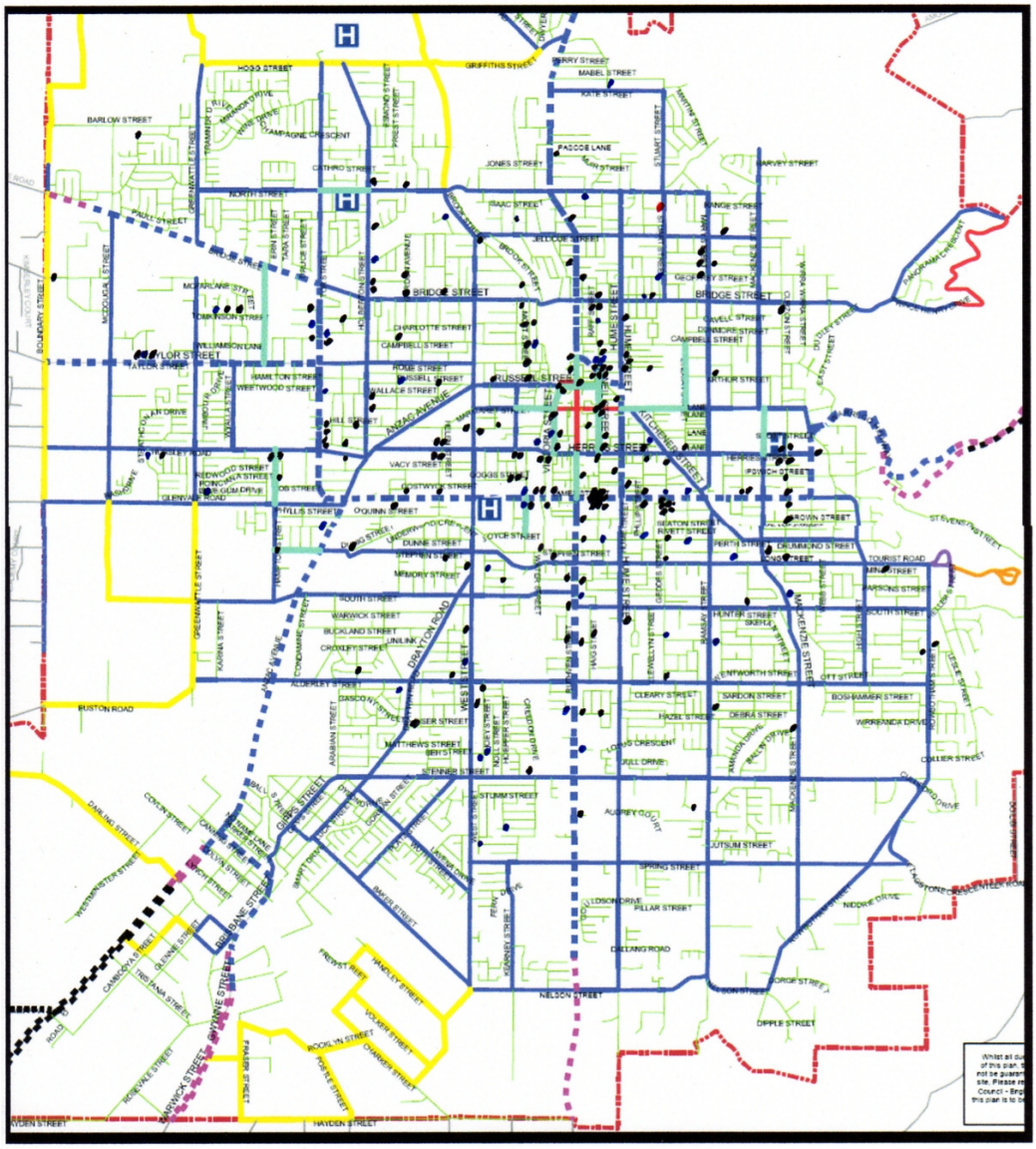
Indicates an area where an accident occurred on a local road or local road intersection causing injury.

Indicates an area where a fatal accident occurred on a local road or local road intersection.



Road Crashes on Toowoomba Roads 2004

- Indicates an area where an accident occurred on a local road or local road intersection with no injuries or fatalities.
- Indicates an area where an accident occurred on a local road or local road intersection causing injury.
- Indicates an area where a fatal accident occurred on a local road or local road intersection.

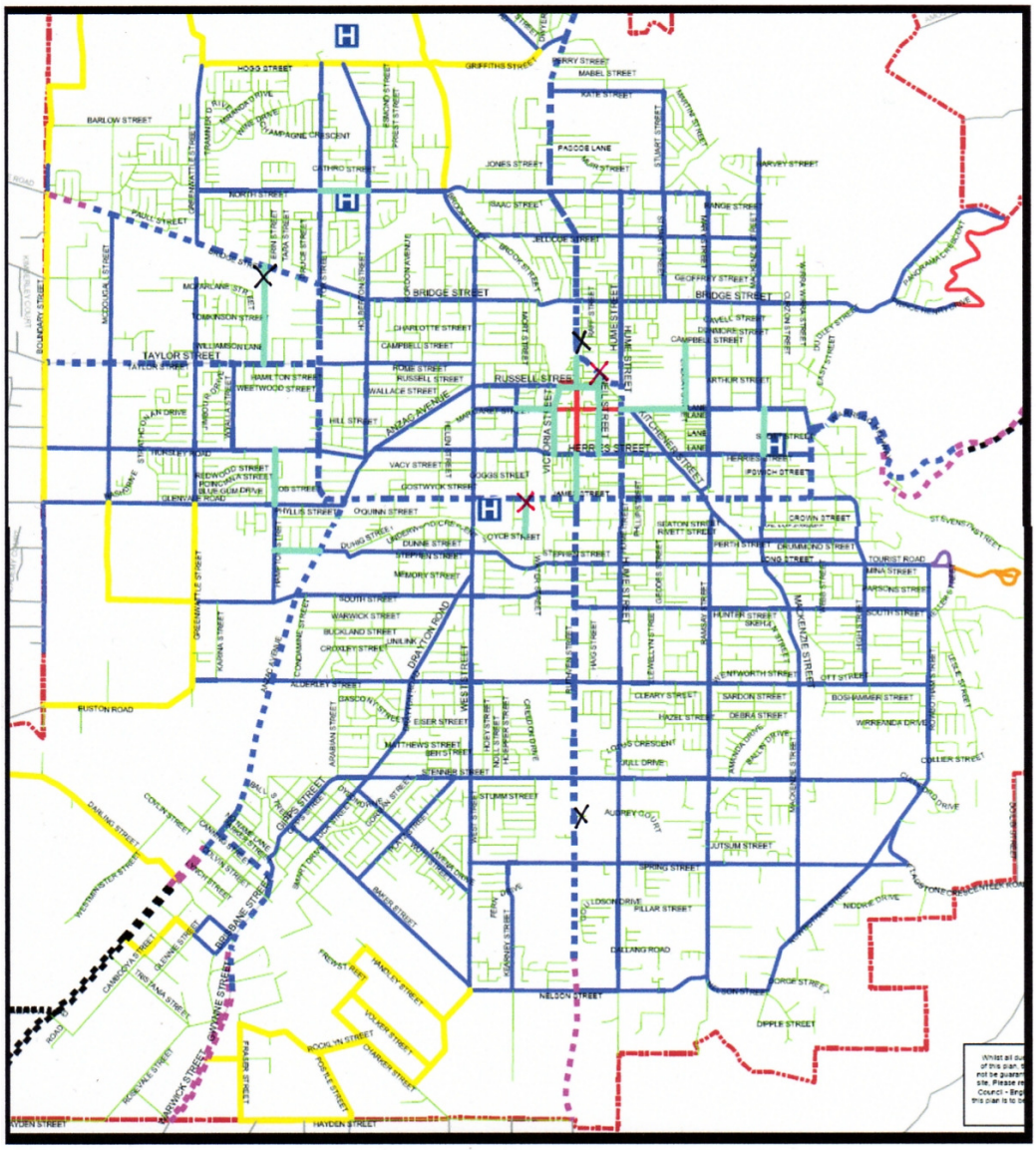


Road Crashes on Toowoomba Roads 2007

Indicates an area where an accident occurred on a local road or local road intersection with no injuries or fatalities.

Indicates an area where an accident occurred on a local road or local road intersection causing injury.

Indicates an area where a fatal accident occurred on a local road or local road intersection.



Areas of increased and decreased casualty crashes on Toowoomba 50km/h local streets

☒ Indicates an area where casualty crashes have increased since implementation of 50km/h speed limit.

☒ Indicates an area where Indicates an area where casualty crashes have decreased since implementation of 50km/h speed limit.

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