University of Southern Queensland
Faculty of Engineering and Surveying

Pedestrian Characteristics and Control for the Toowoomba City Centre Master Plan Area

A dissertation submitted by

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Abstract

An understanding of pedestrian characteristics is an essential role in delivering safe and effective control measures within urban environments. An appreciation of the volume and direction of pedestrian movement also provides insight into the areas of commercial and social activity and enables greater success in the planning and implementation of community infrastructure.

The aim of this study is to provide an assessment of the movement and behavioural characteristics of pedestrians within the Central Business District of Toowoomba in response to the preparation of a Master Plan for the city centre. The study provides an analysis of existing pedestrian control measures within the study area through survey of pedestrian activity at key locations along routes identified for greater pedestrian focus. The study also provides an assessment of existing car parking within the study area and recommendations for consideration in the implementation of the Master Plan.

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ENG4111 Research Project Part 1 & ENG4112 Research Project Part 2

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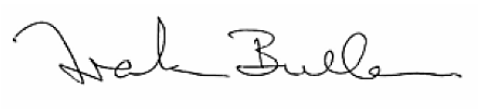

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Certification

I certify that the ideas, designs and experimental work, results, analyses and conclusions set out in this dissertation are entirely my own effort, except where otherwise indicated and acknowledged.

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

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Signature

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Date

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I would like to thank my project supervisors Professor Ron Ayers of the University of Southern Queensland and Mr David Brown of the Toowoomba Regional Council for their advice in relation to the preparation of this study.

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Abbreviations

ABS	Australian Bureau of Statistics
AS/NZS	Australian Standard / New Zealand Standard
CBD	Central Business District
GFA	Gross Floor Area
HCM 2000	Highway Capacity Manual, 2000
km	Kilometre
LOS	Level of Service
m	Metre
m/s	Metres per Second
min	Minute
p	People
sec	Second
SEQ	South East Queensland
TCCMP	Toowoomba City Centre Master Plan
TRC	Toowoomba Regional Council
WHS	Workplace Health and Safety

Chapter 1 Introduction

1.1 Outline

This research aims to investigate and identify the influence of pedestrian characteristics on the design and location of pedestrian control devices within the Toowoomba City Centre Master Plan area.

1.2 Overview of Toowoomba City

Toowoomba is a regional city located in south-east Queensland approximately 120 km west of the city of Brisbane, the state's capital. The city is located as a regional centre and services the wider Darling Downs region as a major gateway to the Southwest portion of the state. The large rural and regional catchment surrounding Toowoomba combined with the city's proximity to the state's capital and coastal areas have led to the city serving as a major linkage between the regional Southwest and the metropolitan centres of the Southeast. This has further led to the formation of the city's unique mixture and notable union of rural and urban characteristics.

In light of the city's location and broad regional base, the importance and ability of the city to sustain the needs of a growing population are paramount in maintaining both a prosperous and attractive city and a regional base for the surrounds. Toowoomba currently has approximately 100,000 residents within its statistical boundaries, and services a regional population approaching 250,000. The city also sees an annual tourism influx in the order of 1 million people. Due in part to the economic drivers of south-east and south-west Queensland, these populations are expected to grow significantly over the next 30 years. For this reason it is important that Toowoomba's city centre is geared to service the needs of a growing population and changes in population density.

1.3 Background of the TCCMP

The Toowoomba City Centre Master Plan is an endeavour of the Toowoomba Regional Council to revitalise the central business district and provide a framework for the future growth of the city. The master plan area broadly encompasses residential and commercial uses within the existing central business district area, expanding to include fringe areas to the immediate CBD. The master plan document makes provision for pedestrian friendly routes and green spaces within this area in recognition of the need to provide a socially engaging environment for the community.

The Toowoomba City Centre Master Plan document was released in May of 2010 after two years of consultation and planning with key stakeholders. Commissioning of the master plan is considered to be a milestone for the growth of the city. The implementation of the master plan includes short to long term actions ranging in scope from immediate recommendations to long-term projects over the 20 year life of the plan. The actions contained within the master plan will be subject to regular review, based on community, commercial and financial trends. While the master plan has been initiated by local government, full implementation of the plan requires the involvement of not only community and commercial interests, but also contribution from state and federal government. In this light, it is important that the goals of the master plan achieve social and economic outcomes that most benefit the community.

The ability to provide efficient and socially engaging pedestrian facilities within city centre precincts is an important component of the planning process, and has a general effect on the city as a whole. Active and vital centres encourage community interaction and offer a more personal interface to retail and commercial enterprise. This has the ability to increase both the social and consumer capital in the city. Understanding of pedestrian movement characteristics and control devices within a CBD area is therefore an important aspect of good planning and design.

This research therefore aims to provide an analysis of the existing pedestrian control devices within the master plan area in an effort to determine what measures may be

implemented. Research on similar city environments is also considered in order to provide a broader understanding of established pedestrian networks, and the lessons learnt by past example. It is intended that this research will aid in the future planning of the pedestrian control measures and ancillary design of the pedestrian networks within the Toowoomba City Centre Master Plan area.

1.4 The Study Area

Due to the extended scope of the Toowoomba city centre master plan area, this research focuses on a sub-area located to cover what could be traditionally described as the heart of the city. The area chosen as the 'Study Area' centres on the Ruthven Street and Margaret Street intersection and expands to include the proposed East-West pedestrian 'Green Spine' linkage between the East Creek corridor at Queens Park and West Creek to the west of Victoria Street. The study area also includes the north-south section of Ruthven Street between Herries Street and Russell Street. This area is considered to encompass the major extent of the central business district and covers the main areas identified for pedestrianisation in the master plan.

The pedestrianisation of Margaret Street and the proposed 'Green Spine' linkage forms the main component of the analysis conducted within the study area. The 'Green Spine' is anticipated to be a pedestrianised form linking the major open space area of Queens Park to the major retail centre of Grand Central through the centre of the city. This route along Margaret Street encompasses the major intersections of Hume Street, Neil Street, Ruthven Street and Victoria Street. The route also crosses the major West Creek drainage corridor and rail corridor located between Victoria Street and the Grand Central shopping centre.

Ruthven Street has been included within the study area in order to analyse pedestrian activity in the north-south direction, including the main intersections at Herries Street, Margaret Street and Russell Street.

All of the streets identified within the study area currently convey traffic volumes consistent with any central business district area of a major city. Ruthven Street and Margaret Street are identified as Truck Collector streets. Herries Street is classified as a Sub Arterial Road, and Hume Street is an Arterial Road declared main road under the jurisdiction of the Department of Transport and Main Roads that provides the main north-south bypass around the city centre linking James Street in the south to Chalk Drive to the north. The particular intersections identified within the study area are examining greater detail in Chapter 4 - *Pedestrian Crossings*. The study area extends to include a wider portion of the total master plan area in consideration of parking requirements. These areas are showing greater detail in Chapter 8 – *Car Parking Analysis*.

Figure 1.1 shows the area covered by the Toowoomba city centre master plan, followed by Figure 1.2 which shows the study area as a portion of the total TCCMP area. The major pedestrian linkages and areas identified for pedestrianisation are Margaret Street between Queens Park and the Grand Central shopping centre and Ruthven Street between Herries Street and Russell Street.

Figure 1.1 – Toowoomba City Centre Master Plan Area

Figure 1.2 – The Study Area

Margaret Street - East-West Green Spine (linking Queens Park at the right of page to the west creek corridor to the left).

- 1 – Intersection of Victoria Street and Margaret Street
- 2 – Intersection of Ruthven Street and Margaret Street
- 3 – Intersection of Neil Street and Margaret Street
- 4 – Intersection of Hume Street and Margaret Street

Ruthven Street - North-South

- 5 – Intersection of Ruthven Street and Russel Street
- 6 – Intersection of Ruthven Street and Herries Street

1.5 Objectives

The aim of this research is to provide useful data and analysis of existing pedestrian control devices within the study area and to provide a meaningful investigation into the transformation of these pedestrian controls throughout the implementation of the master plan. Investigation into the influence of pedestrian characteristics on methods of pedestrian control will be undertaken in an effort to provide guidance on the suitability of existing control devices and also measures that may be adopted.

The following objectives are outlined in achieving this aim:

- Background literature from Australia and overseas will be researched to determine common characteristics of good pedestrian control measures in city environments. This will be undertaken in order to understand the fundamental approaches to pedestrian network and control devices adopted in other similar locations.

- Provide an assessment of the existing pedestrian control devices within the defined study area of the Toowoomba City Centre Master Plan. This will be carried out in order to gain an understanding of the types of measures used at various locations.

- Quantify pedestrian movements and behavioural characteristics by undertaking surveys at key locations within the study area. The survey locations will be limited to intersections and crossings on major pedestrian routes in order to provide broad characteristics.

- Quantify relationships between pedestrian movement/behaviour and the design, type and location of existing control devices by analysing the survey data. The data collected will identify the suitability of existing control devices and provide input into future design.

- Devise and recommend improvements to the pedestrian network within the study area based on survey data of pedestrian characteristics.

- Investigate and propose methods to improve the safety and interaction between pedestrian and vehicles within the study area.

- Provide an assessment of parking demand and supply within the study area and adjacent precincts and propose improvements to the location and design of adequate, accessible and pedestrian friendly car parking facilities.

- Propose methods of improving the location and design of pedestrian control and it's ancillaries in the short and long-term within the context of the master plan.

1.6 Summary

The aim of this dissertation is to provide an assessment of pedestrian characteristics associated with the existing pedestrian control devices within the Toowoomba City Centre Master Plan and use this data to propose recommendations on improving the pedestrian network over the life of the plan. While this document is intended for a specific study area it may aid in background research for similar city environments.

The following section presents a review of available literature and technical detail associated with the influence of pedestrian characteristics on the design of pedestrian control devices relevant to the study area. Background studies on parking and a comparison of Toowoomba's parking conditions in relation to other Southeast Queensland centres is also provided. This is then followed by an evaluation of the project, assessment of the major pedestrian crossings within the study area, results from the pedestrian surveys, analysis of these results and analysis of car parking within the study area. Recommendations for improvements to the pedestrian and car parking facilities are provided in conclusion.

Chapter 2 Literature Review

2.1 Introduction

The area of pedestrian control and the design of pedestrian control measures have been subject to a considerable field of investigation and literature. This literature review will attempt to summarise and present the current state of understanding of the methods by which control measures are chosen and the influence that pedestrian characteristics have on their design. This chapter will also attempt to familiarize the reader with the common body of knowledge on the effects of good pedestrian planning on social outcomes and the current standards for the design of safe pedestrian facilities within the road network.

2.2 Sustainable Design and Social Response

Sustainability has become an important criteria in the planning and design for all forms of construction, whether it be for the construction of private or public infrastructure. Awareness of the need for sustainability from project conception to completion has increased to the extent that it has become a requirement for many forms of development.

The term sustainability encompasses a wide ranging set of principals centred on the aim of minimising social, economic and environmental cost. Riddell (2004) quotes the Brundtland Report (1987) prepared for the World Commission on Environment and Development, in giving a definition of sustainability comprising three goals:

- *'To ensure that all societies' needs are met.*
- *To ensure that all members of societies' have their needs met;* and
- *To ensure that all development and conversation is sustainable over time in a social, economic and environmental sense.'*

Riddell (2004) continues in defining the context of sustainable development in that:

> *'...there arises a moral challenge to retain an ethical focus, along with a practical challenge to assess and resolve all manner of unacceptable risk.'*

There is therefore, a moral and ethical obligation of producing sustainability in the design of public infrastructure to ensure that the community's needs are met over time and into the future. Planning for the future will reduce the possibility that today's solutions do not become tomorrow's problems in much the same way that yesterday's solutions have in many senses become today's.

The social implications of poorly implemented public infrastructure have the ability to present long lasting effects. This can be seen most evidently where public realms such as open space and pedestrian networks are mismanaged or poorly designed or planned. The preparation of the Toowoomba City centre master plan, stemming from the Toowoomba Towards 2050 project has envisaged sustainable design. The background Toowoomba City Centre Sustainability Report carried out by URBIS (2010), sets a framework for the processes and outcomes required in order to achieve sustainable progress for the master plan area.

In the context of this research, URBIS reports that:

> *'Sustainability, like any other development outcome, should be built into the project process from inception and subject to a rigorous assessment of goal setting, measurement and accountability.'*

The case studies presented by URBIS in their Report also highlight the value of sustainable design principals in the planning of pedestrian mobility within city environments.

2.3 Demographics

In order to undertake a complete assessment of the pedestrian characteristics within the study area it is important to consider the general demographics and social data available for the population of the city. Information on age groups, gender, employment and household composition all give an indication of pedestrian characteristics and needs within the study area and can be used to assess data obtained through survey against background data.

From the 2006 census data obtained from the Australian Bureau of Statistics the total population of the statistical region, i.e. the 4350 postcode area, was 99,483. Of this total population gender characteristics show proportions of 47.9 per cent male and 52.1 per cent female (Australian Bureau of Statistics, 2006). Based on national percentages 49.4 per cent male and 50.6 per cent female, Toowoomba exhibits higher percentage of female residents.

In terms of defining the city by age groups, the 2006 census data reveals that the greatest population by age is the 25 to 54 year age group with 38.1 per cent of the total population. This is followed by the 15 to 24 year age group at 16.1 per cent, the 65 years and over age group at 14.5 per cent, the 5 to 14 year old age group at 14.2 per cent, the 55 to 64 year age group at 10.4 per cent and the under 4 year age group at 6.7 per cent (Australian Bureau of Statistics, 2006).

Figures from the 2006 census are expected to have increased in the four years since the census was undertaken. The next census will be undertaking 2011. Based on information from the South East Queensland Regional Plan, southeast Queensland is Australia's fastest-growing region with the population expected to grow from 2.8 million to 4.4 million in the period from 2006 to 2031 (South East Queensland regional plan, 2009). In this period the number of additional dwellings is forecast to increase by 31,000 from the 45,538 dwellings within the Toowoomba statistical district in 2006. This equates to an increase in the Toowoomba regional population of 80,000 people over the 2006 to 2031 period.

2.4 Design Criteria

Physical control devices for pedestrians are required to achieve relevant accepted standards for design and implementation. These standards are imposed in order to provide consistency in design and some degree of certainty in overall functionality and safety. Standards generally offer varying degrees of flexibility where appropriate, in consideration of the varying environments to which they are applied.

The standards to which pedestrian control devices and associated traffic control measures are designed in Australia are the Manual of Uniform Traffic Control Devices. The manual was an implementation of the Department of Main Roads and has become an Australian Standard, that being Australian Standard AS1742. Of this Standard several parts are relevant to the design of pedestrian control measures, the most relevant of which being Part 10 – *Pedestrian Control and Protection*. This part of the Manual gives design criteria for various forms of pedestrian control.

It is not intended to give an in depth assessment of the control measures contained within the Manual within this review as the scope involved is prohibitive, however a more detailed assessment of the existing pedestrian control devices within the study area against the relevant standards will be given in Chapter 4 – *Pedestrian Crossings*. The Manual, and in particular Part 10, are intended to provide a structure of purpose and safety for all road users.

Another Australian Standard that will be included in this research will be Australian Standard AS1428.4.1:2009 - *Design for Access and Mobility - part 4.1 – Means to assist the orientation of people with vision impairment – Tactile ground surface indicators*, AS1428.4.1:2009. This standard is relevant in assessing the safety of pedestrian facilities for those with disabilities and vision impairment. The Standard states:

> *'Approximately 330 000 Australians are blind or vision-impaired and many more have some reduction in the effectiveness of their sight, the majority of whom are over the age of 65 years. The ageing of Australia's population is expected to see the number of people with vision impairment double in 25 years.'*

The importance of this Standard in the application of pedestrian control is evident given the number of people with disability or vision impairment, and the number of people to which this relates is expected to increase significantly.

2.5 Accident Statistics and Pedestrian Safety

The pedestrian realm, by its nature is often shared with other forms of transportation and carries with it an inherent level of risk. Depending on the nature of the shared environment, the pedestrian may be required to share their immediate surroundings with vehicles, trains, trams, cyclists and other pedestrians. Accidents involving pedestrians are inevitable in any real world environment.

Published data on road accident statistics in Queensland indicate that in 2009, 12.1 per cent of road fatalities were attributed to pedestrian. This is a 33.3 per cent increase over 2008 figures (Queensland Government – 2009 Queensland Road Toll in Review). Based upon data from the three year period between 2007 and 2009, the average percentage of road fatalities attributed to pedestrian is 11 per cent of all fatalities. These figures reinforce the importance of pedestrian safety.

Howarth and Gunn, as edited by Chapman, Wade and Foot (1982) present three types of attempts to reduce pedestrian accident rates:

> *'Ergonomic and engineering measures to improve the physical environment...Legal measures to provide rules governing the interaction of pedestrians and traffic... and penalties for infringement to ensure that the rules are obeyed.'*

Legislation and enforcement measures have been in place for some time in order to prohibit pedestrian manoeuvres that would increase the likelihood of accident. The adoption of engineering standards has also been widely implemented in western society, however there will always remain the inherent risk of injury or fatality to pedestrians in road environments.

The influence of pedestrian behaviour on accidents depends upon many factors, including the road environment itself, the weather, the perceived level of danger and the age or demographic of the pedestrian. Age is a particularly important factor in the accident rate amongst pedestrians. The approach to road crossing for that of children and the elderly is different to that of those in the middle age group. Firth, as edited by Chapman, Wade and Foot (1982) argues that:

> *'...the likelihood of a facility being used was affected by traffic volume and the distance a pedestrian had to walk in order to reach the crossing.'*

In addition to the nature of the pedestrian to wish for the shortest route to a destination, the design of the crossing device also has a psychological effect on the willingness of pedestrians to use such facilities. Limiting a pedestrian's choice through poor placement of control devices may lead to complacency or inattentiveness through misdirection.

2.6 Level of Service

One measure of the effectiveness of pedestrian facilities, in particular pedestrian footpaths in high traffic areas is the level of service provided at any given point along the pedestrian route. The footpath areas adjacent to intersections and pedestrian crossings are a case where the level of service provided to pedestrians can be measured. The level of service at any given point is a measure of the ability of pedestrians to behave naturally to their surroundings taking into account the physical and environmental attributes of their chosen route. Factors which affect a pedestrian's ability to negotiate their chosen path, such as physical obstructions and other pedestrians have an inherent effect on the level of service provided.

The level of service provided to pedestrians is an important consideration in the design of pedestrian controls and is affected by a pedestrian's interaction with other pedestrians and cyclists, physical barriers, low visibility and the design of handicapped accessible ramps and street furniture. The need to make walkways a

safe and comfortable environment is important in promoting walking (Journal of the Eastern Asia Society for Transportation Studies, 2005) and the provision of adequate level of service is a measure of pedestrian safety and comfort.
Perhaps the greatest measure of level of service in highly trafficked areas is the level of congestion encountered by pedestrian within their natural travel path. As a typical traffic engineering expression, congestion is defined as the point where the capacity of the road is exceeded by the number of vehicles or pedestrians in the traffic stream.

Austroads 2010 defines congestion as:

> *'The maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of a lane or roadway during a specified time period under given roadway, geometric, traffic, environmental, and control conditions; usually expressed as vehicles per hour, passenger cars per hour, or persons per hour*.'

The capacity of a pedestrians travel path is therefore considered to be governed by the potential for physical interaction within the pedestrians chosen travel path under the conditions present at any given time.

Measurement of the level of service and quality of facilities for pedestrians has been considered in depth for cases of high pedestrian traffic throughout the world, based on physical and environmental factors at the areas of study. The most notable and widely used method for determining physical level of service for pedestrians is the system put forward in the Highway Capacity Manual (2000) developed by the American Transportation Research Board.

The Highway Capacity Manual (2000) establishes six distinct ranges (A through F) in order to define the physical level of service for pedestrians within a chosen study area. The level of service categories are ranked based on the attributes of the space available to each pedestrian, the flow rate of pedestrians per minute per metre unit width of travel path and pedestrian speed. The methodology proposes that a greater amount of personal space and ability to travel at natural speeds, combined with lower

flow rates lead to a reduction in the possibility of conflict and results in a higher level of service.
Conversely, higher flow rates and lack of freedom of movement inherently lead to greater potential for conflict and a lower physical level of service within the pedestrian route.

The level of service categories established in the Highway capacity manual (2000) and the physical attributes associated with each category range are illustrated in the following table. Typical conflicts associated with each level of service category provide an indication of the effect that decreasing levels of service have on pedestrian freedom of movement.

LOS	SPACE (m^2/p)	FLOW RATE (p/min/m)	SPEED (m/s)	CONFLICTS
A	> 5.6	≤16	>1.30	Pedestrians move in desired paths, walking speeds are freely selected and conflicts between pedestrians unlikely
B	>3.7 - 5.6	>16 – 23	>1.27 – 1.30	There is enough space to select walking speeds, bypass other pedestrians and to avoid crossing conflicts. Pedestrians begin to be aware of other pedestrians and to respond to the presence when selecting a walking path
C	>2.2 - 3.7	>22 – 33	>1.22 – 1.27	Space is sufficient for normal walking speeds, and for bypassing other pedestrians in primary unidirectional streams. Reverse-direction or crossing movements can cause my conflicts, and speeds and flow are lower
D	>1.4 – 2.2	>33 - 49	>1.14 – 1.22	Freedom to select individual walking speeds and to bypass other pedestrians is restricted. Crossing or reverse flow movements face a high probability of conflict, requiring frequent changes in speed and position
E	>0.75 – 1.4	>49 - 75	>0.75 – 1.14	Virtually all pedestrians restrict their normal walking speed, frequently adjust their gait. At the lower range, forward movement is possible only by shuffling. Space is not sufficient for passing slower pedestrians
F	≤0.75	variable	≤0.75	All walking speeds are severely restricted, and forward progress is only made by shuffling. There is frequent, unavoidable contact with other pedestrians

Table 2.1- Level of Service, Highway Capacity Manual (Transportation Research Board, 2000)

2.7 Pedestrian Focus within the CBD

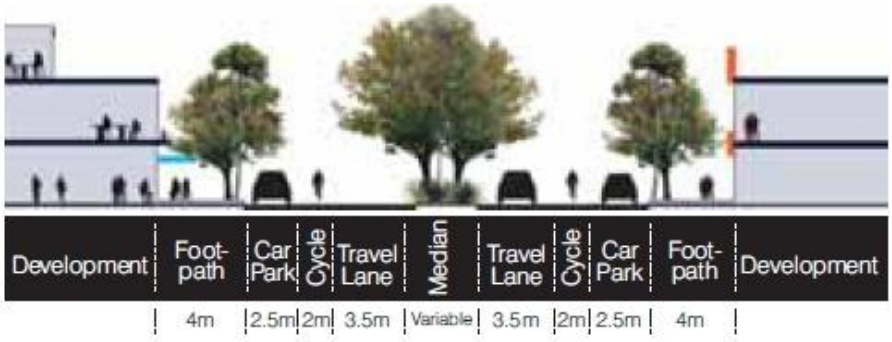
The Toowoomba City Centre Master Plan proposes augmentation and modification to the existing city streets located within the study area. These modifications generally consist of the provision of Boulevard treatments and beautification within the confines of existing road reserves. Changes proposed to the major pedestrian routes considered in this study are shown in in the following Figures.

Figure 2.1 shows an indicative plan of the proposed augmentation of streets within the study area. This includes provision of Boulevard treatments and landscaping to enhance the pedestrian aspect of the street arrangements.

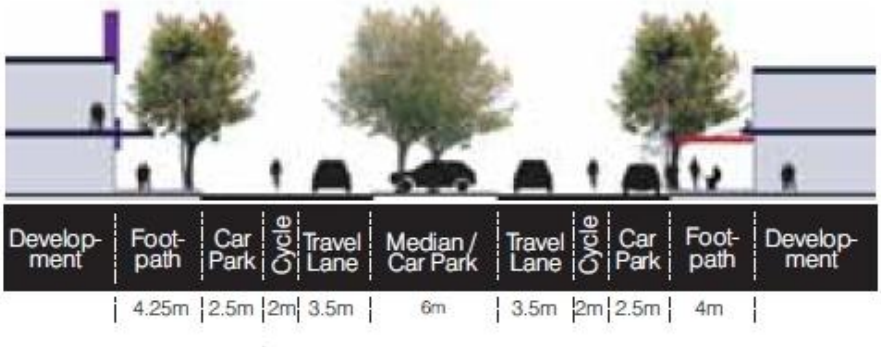
Figure 2.1- Indicative Plan of Margaret Street and Ruthven Street (TCCMP, 2010)

Figure 2.2 shows indicative Cross sections of the proposed Margaret Street 'Green Spine' and Ruthven Street 'Main Street' treatments. The 'Green Spine' proposal includes the provision of existing footpath widths and modification of the existing road to include kerb side parallel parking, dedicated cycle lanes in each direction, 3.5 metre traffic lanes in each direction and the removal of existing 90 degree central parking with a landscaped median.

The 'Main Street' proposal for Ruthven Street consists of a similar arrangement which includes the provision of dedicated bicycle lanes, however includes the retention of central parking within the landscaped median.



Indicative Cross Section - Margaret Street 'Green Spine'



Indicative Cross Section - Ruthven Street 'Main Street'

Figure 2.2- Indicative Cross sections Margaret Street and Ruthven Street (TCCMP, 2010)

2.9 Summary

Review of relevant literature associated with pedestrian networks and the influence that pedestrians have on the design of control devices has been carried out in order to provide a background for the following investigation. Additional investigation and analysis has been undertaken in the following chapters to determine the characteristics of the existing pedestrian network and control devices within the study area in order to assess and recommend improvement measures through the fulfilment of the Toowoomba City Centre Master Plan.

Chapter 3 Project Evaluation

3.1 Consequential Effects and Ethics

The investigation and data provided as part of this research is intended as an assessment of the existing pedestrian control measures within the study area of the Toowoomba City Centre Master Plan. As this research includes recommendations for the improvement of these networks, it is anticipated that this material may be used in the planning or design of the pedestrian network within the city centre. The consistency and accuracy of the data provided as part of this investigation work is therefore a significant objective in providing a useful study.

The nature of pedestrian facilities is such that they are typically located within road reserves or areas where personal safety can become a factor in their design. This means that any input into their planning or design is required to consider both the immediate safety of the pedestrian and also the safety or danger to vehicles. Financially and environmentally sustainable practices are also a necessary responsibility, and the importance of these requirements will be a principal point of consideration throughout the course of this investigation.

The ethical responsibility of providing accurate data and consistent recommendations is also a necessary intent throughout the course of this study. The presentation of reasonable and unbiased research is an ethical standard required to be met for any engineering study and is of particular importance within the scope of this investigation. As this material may be used for planning and design of pedestrian control devices within the study area, public safety and sustainability requirements will need to be considered when making recommendations into the type, location or changes to existing pedestrian facilities. This will need to be considered for the lifespan of the master plan.

It is endeavoured that all recommendations proposed throughout the course of this research will be made to 'best practice' standards and the consequential effects of providing usable data and recommendations for the pedestrian network within the master plan will be beneficial. The provision of inaccurate data or biased investigation would not be ethical in this context and would be un-beneficial in that perceptions may be altered by misleading data. Misrepresentation may also put at risk public safety and economic or environmental sustainability.

3.2 Project Methodology

In addition to researching the influence of pedestrian characteristics on the design and location of pedestrian control devices, the objectives of this investigation require that meaningful data on pedestrian activity within the study area be obtained. A large part of this investigation therefore consists of survey and analysis of the existing pedestrian control devices within the defined study area.

Methodologies for completing this project work relate closely to the objectives specified in Section 1.5 - *Objectives* of this report. For the purpose of describing the relevant methods of carrying out the project, the project methodologies are divided into survey work and analysis.

The survey work carried out at key locations within the study area consists of the following:

- Define the key pedestrian routes and control devices within the study area.

- Characterise the type of pedestrian control devices and any limitations that may result from the use.

- Carry out pedestrian surveys at these locations, including pedestrian counts, direction, movement, and other pedestrian characteristics such as visual or mobility impairment and demographic trends.

- Observe the relevant signal timing at signal crossings and average waiting time and walking time for pedestrians.

- Observe pedestrian behaviour at points of interest, including illegal manoeuvres, jaywalking and behaviour in relation to vehicles.

- Observe vehicle behaviour in relation to pedestrians.

The extent of survey work to be carried out was dependent upon the relevant survey node chosen within the study area. The key consideration in the amount of data collected at each survey point was to ensure that a statistically significant data set was obtained, and that the information acquired was of use during analysis. Surveys at each location on weekdays, Saturdays and Sundays provided a basis for the results.

Once the survey work was conducted and the necessary data had been acquired, it was necessary to assess the information for completeness and consistency. The data was then analysed at each survey point in order to quantify the pedestrian movements and characteristics of the pedestrians at each control device. The information obtained from the analysis included volume, direction, composition, and other characteristic data.

Use of the information obtained in the initial survey of the control devices, combined with the data analysed from the survey information was then used to assess the appropriateness of the existing control measures and to allow for an investigation into methods of improvement. From the survey results and analysis methods for the improvement of pedestrian/vehicle interaction and safety were able to be obtained, taking into account the survey data and relevant crossing characteristics at each location.

A detailed survey methodology relating to the pedestrian survey and analysis is provided in Section 6.2 – *Survey Methodology*.

Investigation of parking demand and supply requires that data be collected on the usage of existing parking facilities within the survey area and an analysis of the pedestrian routes and proximity of parking to end-of-trip facilities. Data from the Toowoomba Regional Council and relevant parking studies was used in order to assess the patronage of existing vehicle parking areas within the study area.

Data was also obtained on the cost and the location of the existing on street and off street parking facilities within the central business district. A comparison of the cost of parking of other Southeast Queensland centres is also made in determining measures of parking regulation within the study area. The data obtained in section 2.8 – *Parking Studies and Statistics* will be investigated in Chapter 7 - C*ar Parking Analysis* with further recommendations given in Chapter 8 - *Recommendations and Conclusions.*

3.3 Risk Assessment

The Risk Management Code of Practice 2007 prepared by Workplace Health and Safety Queensland and the Department of Justice and Attorney Law includes a Code of Practice for risk management. The code also includes 3 supplements associated with hazard identification, risk assessment and risk control, implementation, monitor and review.

The Code specifies five steps for risk management. They are:

1. Identify Hazard,
2. Assess and Prioritise risks,
3. Decide on control measures including hierarchy of control,
4. Implement control measures; and
5. Monitor and review.

These steps are inter-related and awareness should be given throughout the course of activity to all of the steps of risk management.

As the survey work associated with this project consists of taking data in the road environment where the potential for hazards were presented, it was required that a risk assessment be undertaken.

The tables in Appendix B – *Risk Assessment* present an evaluation of the potential risks associated with this body of work. This assessment was considered as a 'living document' and was updated throughout the course of the investigation and survey work. The type of register used is a Form A3 from the Control, Implement, Monitor and Review (Supplement 3) of the Risk Management Code of Practice 2007.

Chapter 4 Pedestrian Crossings

4.1 Introduction

This chapter will provide an assessment of the existing intersections and pedestrian crossings within the study area. As defined in Section 1.4 - *The Study Area*, the intersections chosen for evaluation are located along the major pedestrian routes identified within the Toowoomba City Centre Master Plan area, that being the major east-west 'Green Spine' identified for Margaret Street and the north-south "Main Street' treatment identified for Ruthven Street.

Assessment of the major intersections along the two routes identified for greater pedestrianisation will give an understanding of the intersection and crossing design for assessment of the pedestrian survey and analysis. It will also give a basis for recommendations on improving pedestrian interaction.

4.2 Intersections and Crossings within the Study Area

The major intersections identified along the 'Green Spine' and 'Main Street' pedestrian routes within the study area are as follows:

Margaret Street 'Green Spine'

- 1 – Intersection of Victoria Street and Margaret Street
- 2 – Intersection of Ruthven Street and Margaret Street
- 3 – Intersection of Neil Street and Margaret Street
- 4 – Intersection of Hume Street and Margaret Street

Ruthven Street 'Main Street'

- 5 – Intersection of Ruthven Street and Russel Street
- 6 – Intersection of Ruthven Street and Herries Street

The locations of these intersections within the study area are shown in Section 1.4 – *The Study Area*.

4.2.1 Intersection of Victoria Street and Margaret Street

Figure 4.1- Intersection of Victoria and Margaret Street (Toowoomba Regional Council, 2010)

The intersection of Victoria and Margaret Street forms a busy pedestrian linkage between the immediate central business district and the major retail shopping facilities of Grand Central, located to the west of West Creek. West Creek and a major rail line are located immediately to the west of the intersection.

Pedestrian movements at this location are facilitated in all perpendicular directions by time separation at the intersection with an average total pedestrian crossing phase of 20 seconds. Signalised pedestrian crossing facilities are also provided at the rail crossing. A zebra crossing is provided to the east of the rail corridor as a linkage to Grand Central across Dent Street.

The pedestrian linkage between Victoria Street and the western side of the rail crossing is covered with the provision of decking and street furniture over the West Creek crossing. Public transport facilities are provided to the east of the intersection fronting the Garden Town shopping centre shown at the bottom left of figure 4.1.

4.2.2 Intersection of Ruthven Street and Margaret Street

Figure 4.2- Intersection of Ruthven and Margaret Street (Toowoomba Regional Council, 2010)

The intersection of Ruthven Street and Margaret Street is considered to be the central point of the central business district. The intersection also forms the crossing of the two major pedestrian routes identified within the study area.

Pedestrian movements at the intersection are characterised by a single pedestrian crossing phase to allow for crossing in all directions, including diagonal crossing through the centre of the intersection. Due to the extended distance of the diagonal crossing, the total pedestrian crossing phase has been extended to a total period of 30 seconds with an initial green phase of 8 seconds.

This intersection, as is the case for all chosen intersections, has a 40 kilometre per hour speed environment. Both Ruthven Street and Margaret Street are characterised by two lanes of traffic entering the intersection merge into a single lane through the intersection.

4.2.3 Intersection of Neil Street and Margaret Street

Figure 4.3- Intersection of Neil and Margaret Street (Toowoomba Regional Council, 2010)

Neil Street is a one-way street in the southbound direction between Russell Street to the north and Herries Street to the south. Traffic movement along Margaret Street is limited to a single through lane in the east and west directions and dedicated turning lanes onto Neil Street.

Pedestrian crossing at the intersection of Neil Street and Margaret Street is controlled by a single time separated phase of 22 seconds in each of the perpendicular directions.

4.2.4 Intersection of Hume Street and Margaret Street

Figure 4.4- Intersection of Hume and Margaret Street (Toowoomba Regional Council, 2010)

The intersection of Hume Street and Margaret Street carries multiple lanes of traffic in each direction. Hume Street is a declared Arterial Road under the control of the Department of Transport and Main Roads and provides the north-south bypass of the New England Highway around the city centre between James Street and Chalk Drive. Ruthven Street forms the New England Highway to the south and north of the study area.

Time separated pedestrian crossings are available in all perpendicular directions at the intersection. The pedestrian clearance phase is a total of 27 seconds with an initial green signal of 6 seconds. Corner refuges are provided at the northeast and southwest corners of the intersection in order to provide protection to pedestrians from the vehicles slip lanes located at these points. Pedestrians crossing to the northeast corner are provided with a zebra crossing at the corner of Queen's Park. Pedestrians crossing the slip lane the south-west corner are required to give way to traffic.

4.2.5 Intersection of Ruthven Street and Herries Street

Figure 4.5- Intersection of Russell and Ruthven Street (Toowoomba Regional Council, 2010)

The intersection of Ruthven Street and Herries Street consists of time separated pedestrian crossings in the north-south and east-west directions at each leg of the intersection. Traffic lanes entering intersection consists of three lanes and dedicated right and left turn lanes. The speed environment in the north-south direction along Ruthven Street decreases from 50 kilometres per hour to 40 kilometres per hour through the intersection.

The intersection has a total pedestrian clearance phase of 25 seconds. Both dedicated, and on road bike facilities are present along the northbound and southbound directions of Ruthven Street.

4.2.6 Intersection of Ruthven Street and Russell Street

Figure 4.6- Intersection of Herries and Ruthven Street (Toowoomba Regional Council, 2010)

Ruthven Street traffic at this intersection consists of vehicle movements in the north and south directions and dedicated turning lanes onto Russell Street to the east. Russell Street is a one-way street consisting of two through lanes and turning lanes onto Ruthven Street in the north and south directions. Dedicated on road bicycle lanes are also provided will stop

The north-south and east-west crossings at each leg of the Ruthven Street and Russell Street intersection have a total pedestrian clearance phase of 20 seconds.

4.2.7 Pedestrian Crossings

In addition to the pedestrian crossings identified at the major intersections within the study area, several dedicated pedestrian crossing facilities are present along the length of the Margaret Street 'Green Spine' and Ruthven Street 'Main Street' routes. The most notable of these pedestrian crossings are the crossings requiring pedestrians to give way to vehicle traffic. These crossings generally consist of an alternate pavement treatment at grade with the road alignment, in combination with a median pedestrian refuge and signage notifying that pedestrians must give way to vehicles.

Within the study area the pedestrian give way crossings are located as follows:

- Margaret Street between Victoria Street and Ruthven Street near the entrance to the Gardentown shopping centre.
- Margaret Street between Neil Street and Hume Street.
- Ruthven Street, immediately to the south of Little Street.
- Ruthven Street, mid-block between Little Street and Margaret Street.
- Ruthven Street, mid-block between Margaret Street and Russell Street.

While the 40 kilometre per hour low speed traffic environments and acceptable site distance at these locations provide adequate opportunity for safe pedestrian/vehicle interaction, an element of doubt is introduced as to right of way when pedestrians negotiate the crossings. Observation of pedestrians at these locations shows a tendency towards confusion and hesitancy in a proportion of pedestrians. This confusion is reinforced by the tendency for some vehicles to stop in the moving traffic stream in order to allow pedestrians to cross.

During congested traffic periods vehicles were also observed to move slowly, limiting the ability for pedestrians to cross without hurrying. Pedestrians were observed to ignore these crossing points in favour of finding an adequate opening in traffic in order to cross to the median, typically between parked vehicles, and continue this behaviour for the opposing traffic stream in order to make their way to the opposite footpath.

Chapter 5 Pedestrian Surveys

5.1 Introduction

This section provides an overview of the pedestrian surveys undertaken at the identified intersections within the study area. This includes a description of the methodology used to define the pedestrian surveys, including the physical execution of the pedestrian counts, behavioural study, and pedestrian questionnaire.

A summary of the survey data and results obtained from the survey work is also included in this section to provide a summary of the data included in the appendices.

5.2 Survey Methodology

The major component of the pedestrian survey work included the physical counting of movements in each direction of travel at the relevant pedestrian crossings and intersections. This data was obtained by observing pedestrian movement from a location adjacent to the survey point. For the case of the surveys conducted at intersections this meant that surveys were conducted from a location in proximity to the various parts of travel, typically facing in the northern direction in order to provide a consistent viewpoint across all of the relevant intersections and to ensure consistency in reporting.

The pedestrian counts were taken in 15 minute intervals for the duration of each survey. This time interval was chosen in order to provide a means of assessing peak pedestrian activity in greater accuracy and in order to provide a useful series of data when comparing peak pedestrian volumes between intersections. Recording pedestrian counts in a short time interval also has the effect of reducing errors and enabling errors to be identified. The use of a 15 minute interval is a typically accepted means of conducting and reporting pedestrian counts, and is considered to provide the most suitable period for establishing data in each travel direction.

Due to the location of the Ruthven Street and Margaret Street at the intersection of the two major pedestrian routes identified within the study area, it was decided conduct the pedestrian survey this location for the full period between 7:30 AM and 5:30 PM. In order to gain data on the difference between pedestrian activities throughout the week, full daily surveys were undertaken during a weekday, Saturday and Sunday. Thursday was chosen for the weekday counts in order to gauge pedestrian activity during late-night shopping in the evening period. The duration of the Thursday count was extended to 7:00 PM in order to obtain data during this period. The inclusion of Saturday and Sunday surveys was intended in order to gauge pedestrian activity on the weekend.

Pedestrian counts at the other intersections identified within the study area were conducted over a 1 hour duration during the 11:30 AM to 12:30 PM peak period of pedestrian activity identified at the Ruthven and Margaret Street intersection. These counts were again conducted in 15 minute intervals to enable comparison of pedestrian movements and volumes throughout the study area. Thursday, Saturday and Sunday counts were conducted at these locations.

In addition to collecting data on pedestrian volumes in each direction, data was obtained on pedestrian composition for the duration of the pedestrian surveys. The pedestrian characteristics observed included gender, age, mobility or vision impairment and illegal movements carried out at the relevant crossing. These characteristics were included in order to provide useful data in the analysis of the crossings design as well as to gain an insight into pedestrian attitudes within the CBD. Illegal movements were recorded by age and gender as well as the direction of travel during the relevant time interval.

In order to gauge the public's perception of the pedestrian routes and crossings within the survey area, and in order to gauge the proposed reforms to the pedestrian environments within the CBD, a pedestrian questionnaire was used during the study period when not conducting the pedestrian count surveys. Pedestrians were chosen at random for the interviews and asked a series of questions relating to the pedestrian environment. A total of 30 interviews were conducted.

The questions asked during the interview were based on a modified form of the Main Roads pedestrian safety and accessibility audit tools 2006. A summary of the survey data relating to the pedestrian questionnaires is included in Section 5.4 - *Pedestrian Questionnaire*, and a copy of the questionnaire is included as Appendix C - *Sample Pedestrian Questionnaire.*

5.3 Survey Data

Data obtained from the pedestrian survey is included in this section as a summary of the material provided in Appendix D and E which include the pedestrian volume counts at the intersections identified within the study area.

The pedestrian counts are shown as volumes in each of the available directions of movement at the intersection. As each of the intersections are aligned generally in the north-south and east-west directions, the direction of movements for each of the intersections include northbound and southbound counts and eastbound and westbound counts on each side of the street and also the riding of turning movements at each corner of intersection. Each of these counts is grouped into the major direction of travel in order for total pedestrian volumes in each direction to be calculated.

The intersection of Margaret Street and Ruthven Street consists of a complex arrangement of available pedestrian movement directions. Pedestrians at this intersection are able to cross on each side of the intersection in the north-south and east-west directions, through 90 degrees to the adjoining street and also diagonally through the intersection. Crossing in the north-south, east-west and diagonal directions is controlled through actuation buttons and crossing signals. The availability of diagonal crossing at this intersection means that there are total of 20 defined directions of travel at this intersection.

The remaining intersections chosen within the study area do not allow for diagonal movement. There are a total of 16 directions of movement available to pedestrians at these intersections.

Table 5.1 shows a summary of the total one-hour peak pedestrian movements in each direction for the Thursday, Saturday and Sunday surveys at each of the intersections excluding the major intersection of Margaret Street and Ruthven Street.

Day																
Margaret and Victoria Street																
Thur.	22	33	20	48	35	43	52	30	38	294	37	51	40	340	23	63
Sat	20	40	14	40	31	45	44	24	52	274	36	35	53	299	23	44
Sun	10	15	9	20	9	14	12	8	9	98	14	15	10	92	5	16
Margaret and Neil Street																
Thur.	7	15	12	9	22	10	23	6	52	22	6	10	88	91	36	5
Sat	7	20	15	11	27	9	18	19	60	27	14	15	90	80	29	19
Sun	4	12	1	3	5	2	1	1	15	17	6	3	12	19	4	3
Margaret and Hume Street																
Thur.	2	4	3	1	9	5	5	4	22	30	2	0	23	33	10	5
Sat	4	6	4	0	5	4	4	2	24	27	4	1	20	16	9	3
Sun	4	3	1	0	3	0	1	1	7	2	4	0	3	2	2	1
Ruthven and Herries Street																
Thur.	33	29	19	20	38	11	4	3	7	9	4	36	35	8	18	3
Sat	9	5	6	5	11	6	4	2	4	4	4	5	4	3	3	2
Sun	6	3	1	2	0	2	1	6	7	5	3	1	1	3	2	3
Ruthven and Russell Street																
Thur.	36	29	9	25	23	26	19	12	12	5	6	9	6	9	4	8
Sat	35	11	5	13	12	23	28	5	12	9	4	6	2	6	6	18
Sun	7	12	5	4	3	12	2	5	3	7	2	1	2	3	2	3

Table 5.1 – Intersection Pedestrian Counts (1 Hour Peak) Excluding Margaret and Ruthven Street

The total number of pedestrian movements in the major north-south and east-west directions at each of these intersections can be seen in Figure 6.5 and Figure 6.6. The pedestrian counts in each of the available directions of travel at the Margaret Street and Ruthven Street are shown in Figure 6.2

Data obtained on pedestrian composition at the Margaret Street and Ruthven Street intersection during the Thursday count including gender, age, vision and mobility impairment and illegal movements are as follows.

Characteristic	Number of Movements	Proportion of Total (%)
Gender		
Male	3193	49%
Female	3323	51%
Age		
Under 16	391	6%
17 to 65	4040	62%
Over 65	2085	32%
Impairment		
Mobility Impairment	9	
Vision impairment	2	
Total	11	0.17% of Total Pedestrians

Table 5.2- Pedestrian Characteristics of Gender, Age and Impairment

	Number of Movements	Proportion of Total (%)
Illegal movements		
Under 16	34	21%
17 to 65	116	71%
Over 65	14	8%
Total	164	2.50% of Total Pedestrians

Table 5.3- Pedestrian Characteristics of Illegal Movements

5.4 Pedestrian Questionnaire

The interview questions asked during the pedestrian questionnaire surveys were designed to gauge individual perception of the pedestrian environment, reason for the walking trip and opinion on the measures proposed in the Toowoomba City Centre Master Plan. A Sample pedestrian questionnaire is included as Appendix C - *Sample Pedestrian Questionnaire.*

The results of the pedestrian interviews taken from 30 random individuals are summarised in the following tables. Pedestrians were chosen in order to obtain an even cross-section of age and gender.

	Travelling to work	Travelling from work	Health benefits	Shopping	Recreation	Other
Gender						
Male	7	4	0	3	0	0
Female	4	6	0	5	1	0
Age						
Under 16	1	0	0	2	0	0
17 to 65	8	10	0	2	0	0
Over 65	2	0	0	4	1	0
Total	11	10	0	8	1	0
Proportion (%)	36.7%	33.3%	0%	26.7%	3.3%	0%

Table 5.4 - Purpose of Walking Trip by Gender and Age

	Proportion (%)
Place of Origin	
Local	81%
Frequency of Use (Local Users)	
< Once / Week	25%
> Once / Week	75%
Visitor	18%
Overseas	1%

Table 5.5 – Place of Origin

	Safe	Convenient	Adequate Standard	Adequate Design	Pleasant Environment
Gender					
Male	86%	64%	79%	86%	93%
Female	81%	75%	75%	88%	94%
Age					
Under 16[1]	33%	67%	100%	100%	67%
17 to 65	90%	70%	75%	85%	95%
Over 65	71%	71%	86%	86%	85%
Total (No.)	25	21	23	26	28
Proportion (%)	83%	70%	77%	87%	94%

[1] Only 3 persons in the under 16 age group were interviewed

Table 5.6 – Perception of the Pedestrian Environment

Pedestrianisation of the City Centre	Proportion (%)
In Favour	56%
Not in Favour	19%
Undecided	25%

Table 5.7 – Opinion of Pedestrianisation of the CBD

5.5 Summary

The pedestrian survey data provided in this section provides a representation of the pedestrian characteristics at the key locations identified within the study area. The data collected on pedestrian volume, directions of travel, demographics and illegal movements provide an indication of the pedestrian activity within the city centre. The survey data also provides an insight into the perception of pedestrians as users of the road network within the study area.

The analysis of the data collected from the survey work is contained within the next chapter, Chapter 6 - *Survey Analysis.*

Chapter 6 Survey Analysis

6.1 Introduction

This chapter provides an analysis of the survey results and investigations into pedestrian activity within the study area.

The first section includes an analysis of the volume and direction of pedestrian movement at the selected pedestrian crossings and provides a representation of pedestrian activity along the major pedestrian routes of Margaret Street and Ruthven Street. Based on pedestrian activity at the major intersections, the second section of this chapter provides an investigation of the Level of Service for pedestrians.

The remaining sections of this chapter provide an analysis of pedestrian characteristics, including walking speeds, demographic trends and illegal movements carried out within the study area.

6.2 Pedestrian Volume and Direction

As noted in Section 5.2 - *Survey Methodology*, pedestrian volume and direction counts were conducted for Thursday, Saturday and Sunday periods at each of the identified intersections in order to gauge pedestrian activity at the major points within the study area and to gauge the differences in weekday and weekend volumes.

Surveys at the primary intersection of Margaret Street and Ruthven Street were conducted for the full days of Thursday, Saturday and Sunday in order to provide an indication of the daily pedestrian activity within the city centre. Surveys at the secondary intersections of Margaret Street and Victoria Street, Margaret Street and Neil Street, Margaret Street and Hume Street, Ruthven Street and Herries Street, and Ruthven Street and Russell Street were carried out for the one-hour peak between

11:30 AM and 12:30 PM, in order to give a comparison of the pedestrian activity in the North South and East West directions through the study area.

Based on the survey data obtained from the pedestrian volume and direction counts at each intersection, trends have been identified in relation to pedestrian activity over the study periods. Pedestrian volume and direction trends have also been found along the two major east-west and north-south pedestrian routes of Margaret Street and Ruthven Street.

In order to provide an overall indication of the daily pedestrian activity within the city centre an assessment of the full day surveys at the Margaret Street and Ruthven Street intersection will firstly be considered, followed by an analysis of the pedestrian activity at each secondary intersection along the 'Green Spine' and 'Main Street' pedestrian routes identified within the Toowoomba City Centre Master Plan.

6.2.1 Intersection of Ruthven Street and Margaret Street

The pedestrian volume and direction data obtained at the Margaret Street and Ruthven Street intersection is contained within Appendix E - *Intersection Data Sheets (Ruthven/Margaret).*

The means of data collection allows for analysis of pedestrian volume and direction for the peak activity period and a full day period. Categorising pedestrian volume by each direction of travel also enables an assessment of the level of pedestrian activity along each of the major pedestrian routes. This provides a means of assessing the level of service provided to pedestrians at each leg of intersection as well as providing overall trends in pedestrian movement.

In order to provide an indication of the overall pedestrian activity within the city centre, the full day pedestrian surveys have been used to provide the trends in activity for the typical daily period from 7:30 AM to 5:30 PM.

Figure 6.1 shows a comparison of the total daily pedestrian activity at the Ruthven Street and Margaret Street intersection for the Thursday, Saturday and Sunday pedestrian surveys. The Thursday count provides an extended assessment of pedestrian movement until 6:30 PM in order to provide an indication of pedestrian activity during the evening period of late night shopping.

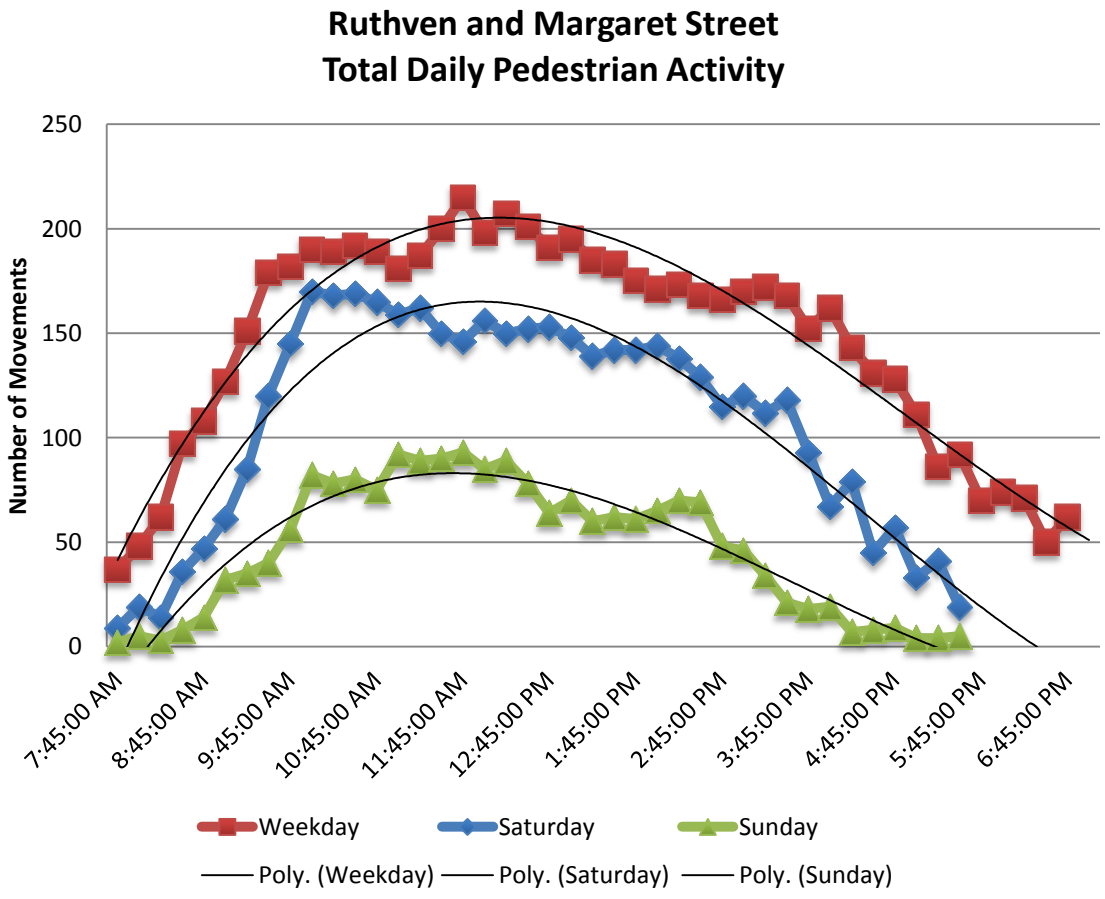


Figure 6.1 – Ruthven and Margaret Street Daily Pedestrian Activity

It can be seen from figure 6.1 that weekday pedestrian activity is higher than Saturday and Sunday. Pedestrian movements in the order of 220 pedestrians per hour occur at this intersection within the peak period between 11:30 AM and 12:30 PM. The Saturday peak is approximately 170 movements per hour and the Sunday peak is approximately 100 movements per hour.

Based on the trends shown for each of the Thursday, Saturday and Sunday surveys it can be seen that pedestrian activity builds gradually through the morning period to a peak just prior to midday and subsides at a steady rate through the afternoon. This trend appears to be consistent across each of the daily surveys.

The number of pedestrian movement shown after 5:30 PM on Thursday indicates a continual decline of pedestrian activity during a late-night shopping period. There does however appear to be a slight flattening out of the general decline in pedestrian numbers from that in the late afternoon. While pedestrian activity in this period is declining, pedestrian numbers between 5:30 PM and 6:30 PM are in the order of, and only slightly less than peak pedestrian numbers on Sunday.

In order to further provide an indication of the total pedestrian activity at the city centre, the total number of pedestrian movements for the Thursday survey have been calculated based on the total number of pedestrian movements in each of the 20 directions of movement at the Ruthven Street and Margaret Street intersection for the full 11 hour survey period.

The total number of daily pedestrian movements in each of the principal North, South, East and West directions were able to be calculated from the total number of pedestrian movements for each direction of travel. The number of pedestrian trips in each principal direction was calculated by adding the number of pedestrian movements in each of the contributing direction of movement.

For the case of calculating the total number of pedestrians travelling in the westerly direction, the number of pedestrians turning towards the west and half of the number of pedestrians crossing the intersection in the north-west and south-west directions were added to the number of westerly movements on each side of the street. It was chosen to divide the diagonal movements equally based on observation during the survey. Approximately 50 per cent of pedestrians were observed to move in either principal direction when exiting the intersection.

The total number of pedestrians moving in each of the principal directions at the Ruthven Street and Margaret Street intersection for the Thursday survey is shown in Figure 6.2.

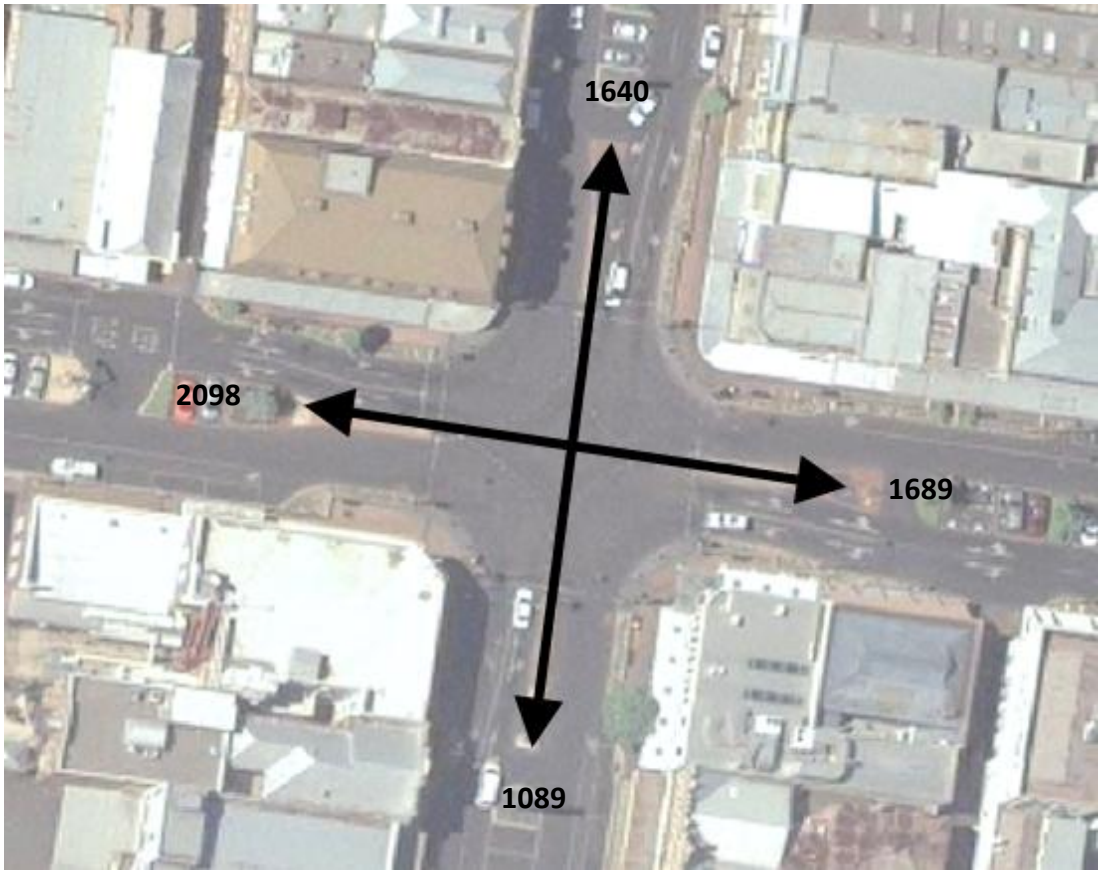


Figure 6.2 – Ruthven and Margaret Street Total Daily Pedestrian Activity

It can be seen from the total number of daily pedestrian movements in each of the principal directions that a total number of 6516 pedestrians used the intersection during the survey. It can also be seen that the east and west principal directions along Margaret Street convey the highest number of total pedestrian users for the given day. The least number of pedestrians at the intersection travel in a southerly direction towards Herries Street.

The largest numbers of pedestrians were observed to travel in a westerly direction towards Victoria Street, with 2098 pedestrian movements per day. This is equal to 32.2% of the total pedestrian activity at the intersection.

The one-hour peak pedestrian activity at the Ruthven Street and Margaret Street intersection has also been assessed in order to provide a means of calculating the level of service to pedestrians in each leg of intersection in Section 6.3. The one-hour peak data also provides a description of the peak pedestrian movement at the midday period in relation to the other intersections within the study area.

The number of movements in each of the pedestrian travel paths is shown in Figure 6.3. It can be seen from this data that the number of pedestrians moving in the east and west directions are generally the highest with the exception of the northwest corner which carries a significantly higher number of pedestrians than the turning movements at the northeast, southeast and southwest corners of the intersection. The number of pedestrians crossing at diagonals is higher than expected given the length of the movement through the centre of intersection.

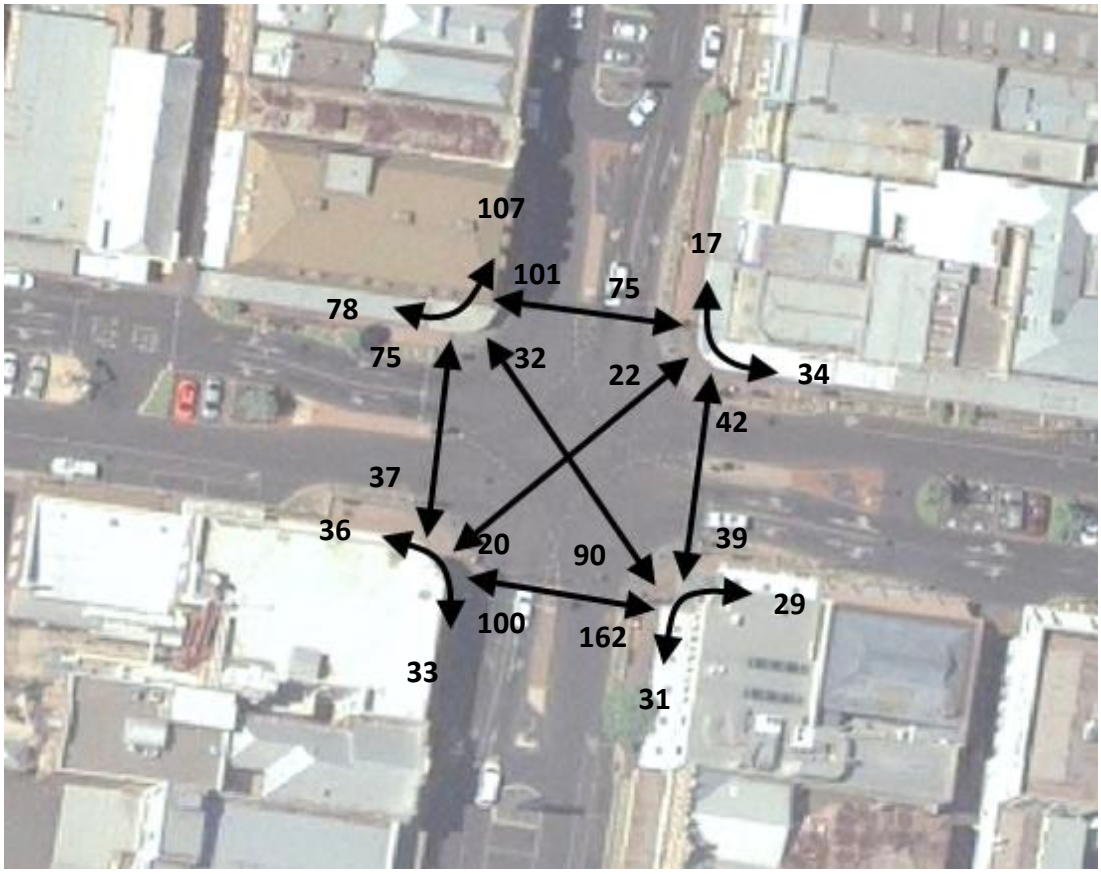


Figure 6.3 – Ruthven and Margaret Street Pedestrian Activity 1 hr Peak

6.2.2 Ruthven Street and Margaret Street Pedestrian Routes

The data obtained from the peak one-hour surveys at the secondary intersections within the study area will now be considered in order to provide an overview of the pedestrian activity along the major pedestrian routes identified within the study area. This analysis will be used to gauge the pedestrian use of the 'Green Spine' and 'Main Street' treatments proposed in the Toowoomba City Centre Master Plan.

The one-hour peak data collected at the Victoria Street, Ruthven Street, Neil Street and Hume Street intersections along the Margaret Street 'Green Spine' pedestrian route are shown in Figure 6.4. The pedestrian activity shown is based on the total number of pedestrian movements during the 11:30 AM to 12:30 PM peak at each intersection for the Thursday, Saturday and Sunday pedestrian surveys.

The one-hour peak data collected along the Ruthven Street "Main Street' route, at the intersections of Herries Street, Margaret Street and Russell Street for the Thursday, Saturday and Sunday pedestrian surveys are shown in Figure 6.5.

Data used for the comparison of pedestrian activity at each intersection is contained within Appendix D - *Intersection Datasheets,* and Appendix E - *intersection datasheets (Ruthven/Margaret).* Pedestrian counts for all of the directions of travel are added to show the total one-hour peak pedestrian activity at the relevant intersection.

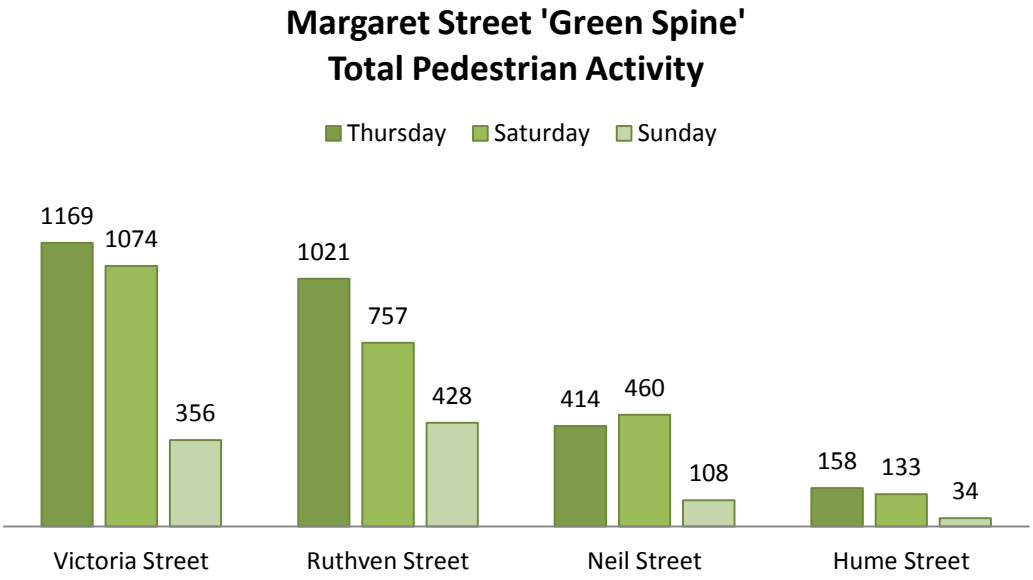


Figure 6.4 – Margaret Street 'Green Spine' Pedestrian Activity

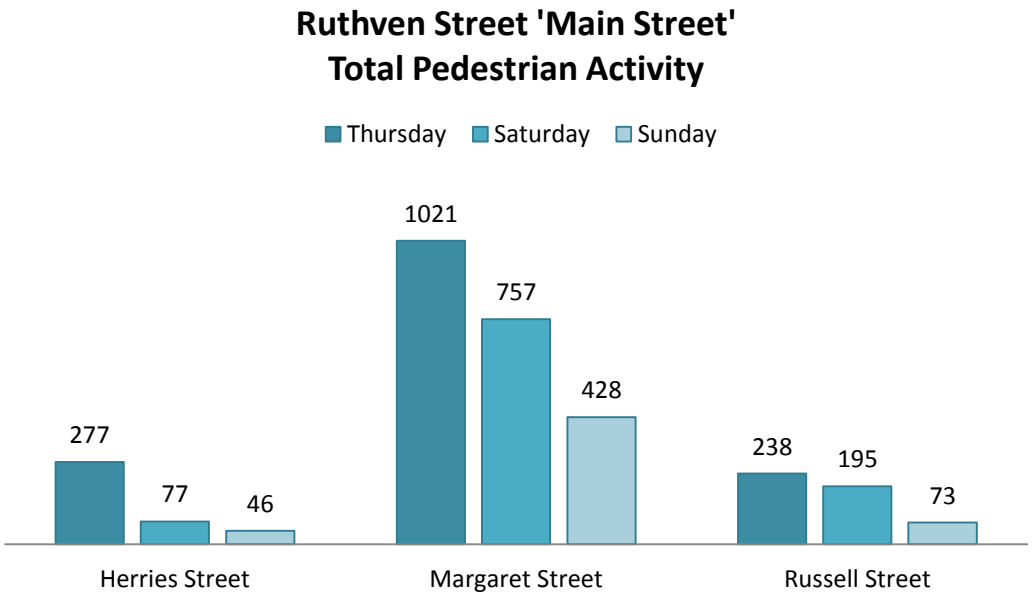


Figure 6.5 – Ruthven Street Main Street' Pedestrian Activity

For the case of the Margaret Street ‘Green Spine’ route it can be seen that the intersection of Victoria Street and the intersection of Ruthven Street carry significantly higher pedestrian volumes than the intersection of Neil Street and Hume Street to the east. This may be due to the location of the Grand Central and Gardentown shopping centres and the location of public transport infrastructure between Ruthven Street and Victoria Street. As for the pedestrian activity along Margaret Street, it can be seen that the majority of pedestrian activity along the Ruthven Street ‘Main Street’ pedestrian route is centred on the Ruthven Street and Margaret Street intersection.

The decreasing trends between Thursday, Saturday and Sunday pedestrian activity initially shown in the analysis of the Ruthven Street and Margaret Street intersection are also represented at the secondary intersections along both pedestrian routes within the study area. The only exception to this is apparent at the intersection of Margaret Street and Neil Street which shows a higher pedestrian activity on Saturday of 460 pedestrians as opposed to 414 pedestrians on Thursday.

It can be seen for the intersections on the Margaret Street ‘Green Spine’ route that the Victoria Street intersection carries the highest volume of pedestrians based on the Thursday surveys at a total one-hour peak of 1169 pedestrians. The Ruthven Street intersection has slightly less pedestrian activity at 1021 pedestrians during the one-hour peak. It can be seen that there is a decreasing trend in the number of pedestrians from west to east along the Margaret Street route.

Along the Ruthven Street route, pedestrian activity centres on the intersection of Margaret Street, with much lower pedestrian activity at Herries Street to the south and Russell Street to the north. Pedestrian activity at these locations is approximately one quarter of the activity at Margaret Street.

A complete representation of the pedestrian movements along the Margaret Street ’Green Spine’ and the Ruthven Street ‘Main Street’ are shown in Figure 6.6 and Figure 6.7 for the one-hour peak Thursday surveys.

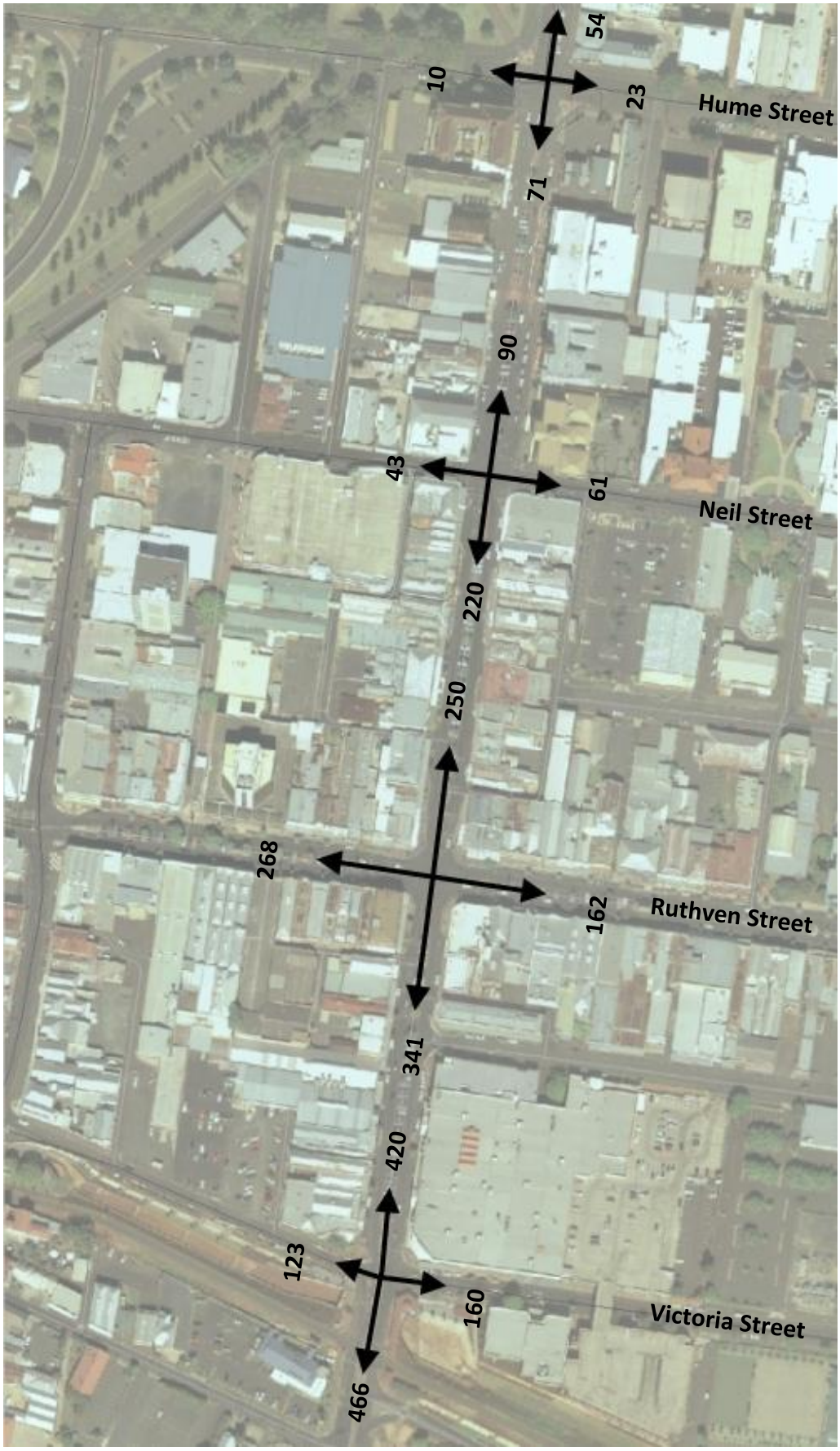


Figure 6.6 – Margaret Street 'Green Spine' Pedestrian Movement 1 hr Peak

Figure 6.7 – Ruthven Street 'Main Street' Pedestrian Movement 1 hr Peak

6.3 Walking Speed

Pedestrian walking speeds were observed separately from the volume and directions surveys conducted at intersections within the study area. Walking speeds were observed at the intersection of Victoria Street and Margaret Street. As walking speeds are a factor in determining the physical level of service, observations were taken at this intersection due to the large volume of pedestrian activity, and the higher likelihood of interrupted travel.

Table 6.1 provides the average walking speeds observed for pedestrians based on age group. The walking speeds were calculated as the average time taken for each pedestrian to pass two defined points along a section of footpath between Victoria Street and the railway crossing for a sample of 10 pedestrians per age group.

	Average Walking Speed (m/s)
Age	
Under 16	1.4
17 to 65	1.3
Over 65	1.0
Total Average	1.23

Table 6.1 – Pedestrian Walking Speeds

The average walking speed is shown to decline by age group in the range of 1 m/s to 1.4 m/s. The average walking speed calculated from all observations was 1.23 m/s. These figures are based on a continuation of movement and do not consider start-up times or acceleration and standing start as would be the case for pedestrians crossing the signalised intersections.

6.4 Level of Service within the Study Area

In order to determine the level of service for pedestrians at a given point within the pedestrians travel path, the footpath environment and the average walking speeds for pedestrians determined in Section 6.3 - *Walking Speed* were assessed against the level of service attributes specified by the Highway Capacity Manual (2000) summarised in section 2.6 – *Level of Service.*

In order to assess the level of service for pedestrians within the study area, it was decided to begin the analysis with the most heavily trafficked pedestrian footpath. Based on the data in appendix E - *Intersection Data Sheets* and the pedestrian activity shown in Figure 6.4 the intersection that carries the most pedestrian traffic is the intersection of Margaret Street and Victoria Street. At this intersection, the most heavily trafficked section of footpath is the southern section of Margaret Street between the intersection and the railway crossing. This section of footpath showed a total pedestrian volume of 794 movements in the east and west directions.

The next most heavily trafficked footpaths are located at the northwest corner of the Ruthven Street and Margaret Street intersection. The northern side of Margaret Street immediately to the west of the intersection carries a total peak hourly pedestrian volume of 372 movements in the east and west directions, followed by the western side of Ruthven Street immediately to the north of intersection with a total hourly peak of 328 pedestrian movements past this point.

In order to carry out a full assessment of the level of service at these points, the space available to pedestrians and the effective width of the footpaths were also assessed. The effective width of the available travel path takes into account the location of street furniture, signage and other infrastructure along the general path of travel. The level of service calculated at each of these points is shown in Table 6.2.

Location	**Number of Pedestrian (p/min)**	**SPACE (m^2/p)**	**Effective Width (m)**	**FLOW RATE (p/min/m)**	**SPEED (m/s)**	**LOS**
Margaret St South Between Victoria St and Rail Crossing	13.23	> 5.6	3.6	3.67	1.23[1]	A
Margaret St North West of Ruthven St	6.20	> 5.6	2.7	2.30	1.23[1]	A
Ruthven St West North of Margaret St	5.47	> 5.6	2.9	1.89	1.23[1]	A

[1]Average natural walking speed found in Table 6.1

Table 6.2 – Level of Service within the Study Area

It can be seen from table 6.2, that the level of service provided at the most heavily trafficked areas identified within the study area achieve a Level of Service category A. The number of pedestrians per minute was calculated using the peak one-hour movements past each of the locations identified. The space attributed to each pedestrian was given by observation. During the surveys it was considered that in excess of 5.6 square metres of personal space was available to pedestrians at any given time. Although the walking speeds do not meet the 1.3 metre per second target identified by the Highway Capacity Manual (2000) it is considered that the speed criteria for Level of Service A is achieved at these points given the average natural walking speed of pedestrians within the study area.

6.5 Demographics

The demographic data obtained during the Ruthven Street and Margaret Street pedestrian surveys included the total pedestrian movements carried out by age, gender and mobility and vision impairment. This data can be compared with census data from the local area to analyse the demographic trends within the study area.

The total number of male and female pedestrians observed during the Thursday surveys at the Ruthven Street and Margaret Street intersection is shown in Table 5.2. Based on the survey, a total of 3193 males (49%) and 3323 females (51%) used the intersection during the study period. These figures suggest that gender within the study area is more evenly balanced than the figures provided in the census data, which indicate a 47.9 per cent proportion of males and 52.1 per cent of females within the statistical area. The total proportion of male and female pedestrians is shown in Figure 6.8.

Data obtained from the pedestrian questionnaire indicates that the main reason for both male and female pedestrian movement at the Ruthven Street and Margaret Street intersection are the purposes of travelling to and from work and for the purpose of shopping. A high proportion of both male and female participants in the pedestrian interviews indicated that the area provided adequate safety and convenience for the purposes of their trip. A very high percentage of both male and female participants also indicated that the area provided a pleasant environment in which to walk.

Based on the proportion of pedestrians by age shown in table 5.2, the largest group is the 17 to 65-year-old category at 62 per cent of all pedestrians, followed by the over 65 category at 32 per cent and the under 16 category at 6 per cent. The census data shows a correlation in the 17 to 65-year-old category, but a lower proportion of the over 65 category. This may be due to the fact that the survey was carried out on a school day and the total proportion of those under 16 is a reflection of the fact that no large schools are located in proximity to the intersection. The comparison of the survey of age groups against the census data is shown in Table 6.1. The total proportion of pedestrians by age is shown in Figure 6.8.

Information gathered in the pedestrian questionnaire suggests that the 17 to 64-year-old category considers the area to be the safest and most pleasant walking environment.

	Survey Data	Census Data
Age		
Under 16	6%	20.9%
17 to 65	62%	64.6%
Over 65	32%	14.5%

Table 6.3 – Comparison of Pedestrian Age to Census Data

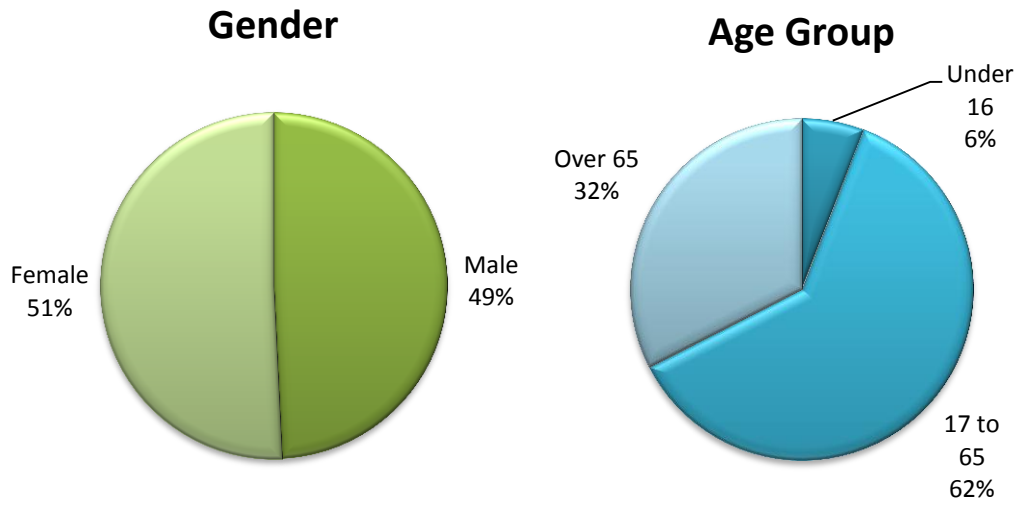


Figure 6.8 – Pedestrian Gender and Age

Based on the place of origin data obtained from the pedestrian interviews, 81% of pedestrian travel within the study area can be attributed to local residents, with visitors to the city making up the remaining 19%. Of the local pedestrians, 75% acknowledged frequent pedestrian use within the CBD. This may be attributed to the large proportion of trips to and from work.

6.6 Illegal Movements

The number of illegal movements carried out by age and by gender is shown in Table 5.3. For the purpose of this study the term' illegal movement' includes crossing outside of the relevant crossing phase, crossing the streets within proximity to the intersection and the use of bicycles on the footpath and when crossing the intersection. It also includes movements where the pedestrian begins crossing mid phase.

The data obtained shows that the total proportion of illegal movements during the Thursday survey at the Ruthven Street and Margaret Street intersection is 2.5 per cent of all pedestrian movements.

When considering the proportion of illegal movements carried out by age, a majority were carried out by the 17 to 65-year-old age group. It is important to consider however that this age group makes up 62 per cent of the total pedestrian activity at the intersection. When considering the number of illegal movements carried out as a proportion of the age group, the number of illegal movements carried out by the under 16 age group would be higher by comparison. Figure 6.9 shows the proportion of illegal movements carried out by age group.

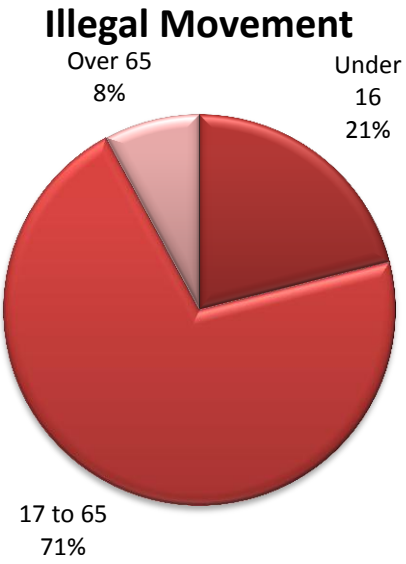


Figure 6.9 – Illegal Movements by Age

The time of day was also observed to have an effect on the number of illegal movements carried out by pedestrians at the intersection. Figure 6.10 shows the number of illegal movements as a proportion of total movements throughout the day. It can be seen that trend of higher illegal movement activity is present in the early morning and late afternoon. Illegal movements were shown to peak between 7:30 AM and 8:30 AM at a total proportion of 12 per cent of pedestrian movements.

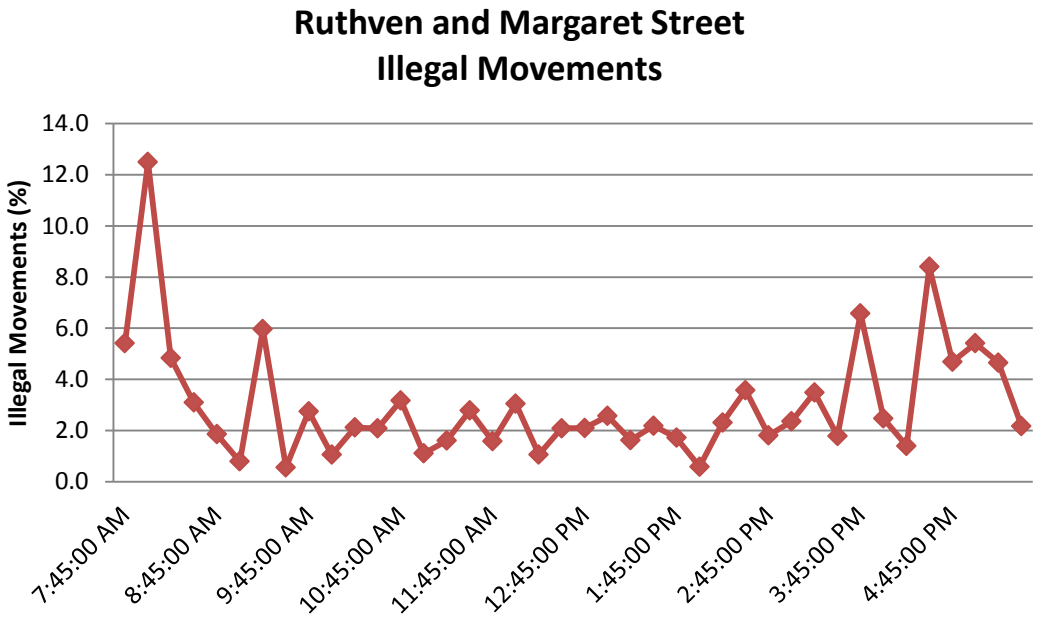


Figure 6.10 – Ruthven and Margaret Street Illegal Movement

The high proportion of illegal movements in the early morning and late afternoon is considered to be a reflection of risk. The lower volumes of vehicle traffic observed in the early morning may indicate to the pedestrian that the time required to wait for the pedestrian phase is unnecessarily long or not relevant. There is also less chance of being observed by other pedestrians or motorists at this time. The rise in illegal movement in the late afternoon may be due in part to a lack of patience with long cycle times at the intersection.

6.7 Summary

The pedestrian activity shown in Figure 6.6 for the Margaret Street 'Green Spine' pedestrian route is shown to be centred on the eastern half of the CBD, with the majority of pedestrian activity at the intersection of Victoria Street and the intersection of Ruthven Street. A general decline in pedestrian activity is shown from west to east along the approximately 720 metres of the pedestrian route between West Creek and Queens Park.

Pedestrian activity in the north-south direction along the 630 metre Ruthven Street 'Main Street' pedestrian route shown in Figure 6.7 shows pedestrian activity centred at the intersection of Margaret Street with significantly lower activity at the Herries Street and Russell Street intersections to the South and North.

Daily pedestrian volumes at the Ruthven Street and Margaret Street intersection show a definite trend in pedestrian activity, building through the morning to a total peak of 220 movements per hour in the period between 11:30 AM and 12:30 PM. Pedestrian activity declined steadily throughout the afternoon. The highest pedestrian activity occurs on a weekday with lower volumes experienced on Saturday and Sunday.

The Level of Service provided to pedestrians at the highest trafficked areas to the west of Victoria Street and at the Northwest corner of the Ruthven Street and Margaret Street intersection is category A. This is the highest category available and shows that pedestrian movement is generally unrestricted by conflict.

Demographic trends are typically consistent with census data with a slightly higher proportion of over 65 and lower proportion of under 16-year-old pedestrians on weekdays. The 17 to 65-year-old age group made up approximately 62 per cent of pedestrians during the study period.

Illegal movements consist of approximately 2.5 per cent of the total pedestrian activity within the study area. There is also a general trend towards higher illegal pedestrian activity in the early morning and late afternoon.

Chapter 7 Car Parking Analysis

7.1 Introduction

This section provides an investigation into the availability of on-street and off-street car parking within the Central Business District and surrounding precincts. A comparison of the location and cost of parking within the Central Business District area will be made, together with an assessment of the supply and demand of on-street and off-street parking.

7.2 Parking Study and Statistics

Prior to amalgamation, the Toowoomba Regional Council, formerly the Toowoomba City Council, adopted the Toowoomba CBD car parking study undertaken by Adam Pekol Consulting as a basis for the short and long-term car parking strategy for the city. This car parking strategy was adopted by Council in 2004 and provided an assessment of existing on and off street parking facilities within the CBD together with possible strategies and considerations for future planning.

The goals identified by Council in response to the study in light of the parking conditions at the time were to ensure that CBD development complied with the parking requirements and parking rates set forth in the Toowoomba Planning Scheme 2003 and to ensure that an appropriate combination of short, medium and long-term parking spaces were provided within the CBD in the form of both on and off street facilities.

The location of the major off-street parking facilities located within the city centre is shown in Figure 7.1. The regulated parking fees and time limits for on-street and off-street car parking are shown in Table 7.1. A comparison of the parking fees adopted in Toowoomba against the applicable fees or other south-east Queensland cities are shown in Table 7.2.

Public Parking

1. Grand Central Shopping Centre (~2,000 spaces)
2. Gardentown Shopping Centre (~750 spaces)
3. AMart / Market Plaza Shopping (~160 spaces)
4. Hooper Centre Shopping

Private Parking

1. Bus Interchange (302 spaces)
2. Chalk Drive Car Park (107 spaces)
3. Herries/Water Street Car Park (
4. Central Car Park (143 spaces)
5. Duggan Street Car Park (187 spaces)
6. Annand Street Car Park (166 spaces)
7. Council Staff Car Park

Figure 7.1- Major Off-Street Private and Public Parking Locations

Location	Time	Cost
On - Street		
1P (1 Hour parking)	7:30am-8:30am Mon-Fri 9:30am-11:30am Sat	$1.00/hr
2P (2 Hour Parking)	7:30am-8:30am Mon-Fri 9:30am-11:30am Sat	$1.00/hr
Off - Street		
Bus Interchange	8am-6pm Mon-Sat	$1.00/hr capped at $7.00/day
	6pm-12am Mon-Sat	$1.00/hr capped at $2.50/evening
	7:30am-8:30am Mon-Fri	$5.00/day early bird
Chalk Drive South	7:30am-8:30am Mon-Fri 9:30am-11:30am Sat	$0.60/hr capped at $2.50/day
Clifford Street	7:30am-8:30am Mon-Fri 9:30am-11:30am Sat	$0.40/hr capped at $1.50/day
Herries/water	7:30am-8:30am Mon-Fri 9:30am-11:30am Sat	$0.40/hr capped at $1.50/day
Central, Duggan and Annand Street	7:30am-8:30am Mon-Fri 9:30am-11:30am Sat	$0.80/hr capped at $5.00/day 3P $0.80/hr capped at $2.40

Table 7.1- Toowoomba Regional Council 2010-2011 Parking Fees

Location	Short Term (<4 hours)	Long Term(>4 hours)
On - Street		
Brisbane[1]	$2.50/hr (7am-7pm Mon-Fri)	$1.50/hr capped at $8.00/day
Ipswich[2]	$0.80/hr	$0.80/hr
Gold Coast[3]	$1.30/hr (9am-7pm Mod-Sat)	$1.30/hr (9am-7pm Mod-Sat)
Off - Street		
Brisbane	$2.50/hr (7am-7pm Mon-Fri)	$1.50/hr capped at $8.00
Gold Coast[3]	$0.70/hr $22.00/wk $78.00/mth	$0.70/hr $22.00/wk $78.00/mth

[1]Brisbane area surrounding CBD defined as Zone 2 Brisbane City Council Regulated Parking
[2]No defined time periods
[3]Based on off street parking facilities at Southport

Table 7.2- Comparative Parking Fees

In order to understand the increasing demand for parking within the CBD, it is first necessary to examine the private parking generated by new development within the area. A majority of the city centre falls within the Regional Centre Zone of the Toowoomba Planning Scheme 2003. Car parking rates for the office and retail commercial uses present within the city centre are approximated as follows:

- Office – 1 space per 20 m² GFA
- Retail - 1 space per 40 m² GFA

These figures are expected to increase under the implementation of the future Toowoomba Regional Council planning scheme proposed to be implemented in 2011- 2012.

Background work for the Toowoomba City Centre Master Plan conducted by URBIS shows the projected commercial and retail floor spaces within the city centre area over the Master Plan timeframe. These forecast Gross Floor Areas are shown in Table 7.3.

Land Use	**Current**	**Forecast**		
	2009	***2016***	***2021***	***2031***
Commercial/Office	**m^2**	**m^2**	**m^2**	**m^2**
-Medium	82,400	91,900	99,600	114,200
-High	82,400	95,500	105,700	126,000
Retail				
-Medium	217,000	241,000-246,000	262,000-275,000	304,000-334,000
-High	217,000	249,000-255,000	277,000-291,000	335,000-369,000

Table 7.3-Toowoomba city centre floor space summary (URBIS)

These figures show an increase in commercial and office uses of 75,400 m² of Gross Floor Area, and 269,000 m² of Gross Floor Area over a 20 year period between 2009 and 2031. Based on the car parking rates of the Toowoomba Planning Scheme 2003, the number of additional development driven car parking spaces required to be provided on-site is in excess of 10,000 for the forecast period.

7.3 Additional On-Street and Off-Street Parking

In order to provide additional public parking for the expected growth of the central business district, additional on-street and off-street parking facilities will be required based on existing parking stress within the CBD. The investigation conducted by Adam Pekol Consulting in 2002 showed a demonstrated shortfall in parking supply within the city centre. The report found that all of the streets within the CBD core area were either at 100 per cent of capacity or within the range of 90 per cent to 100 per cent capacity. It is expected that within the time since the study was conducted that demand for on-street and off-street parking would have further increased above the available parking supply.

The proposed augmentation of enhanced pedestrian facilities along the Margaret Street 'Green Spine' will further add to the shortfall of parking within the CBD. The removal of median parking as proposed on the indicative cross sections shown in Figure 2.2 will lead to a reduction of 58 on-street car parking spaces between Victoria Street and Hume Street.

Due to fact that on-street parking is already provided along a majority of the streets within the Central Business District area, it is considered that the provision of additional off-street parking facilities will be required to service the growing demand for parking within the CBD. This will either require land to be acquired for the purpose of providing additional car parks, or the construction of multilevel car parks at existing parking locations.

7.4 Summary

Due to the existing shortfall of parking supply within the city centre and the changes proposed to provide a more pedestrian orientated Central Business District, additional off-street parking facilities will be required at locations within close proximity to the centre of the city. Options available for the provision of additional off-street parking include the acquisition of land at strategic locations and the consideration of expanding existing off-street car parks to multilevel facilities. The cost comparison between the acquisition of new land and the construction of multilevel parking structures will be a key consideration in the methods adopted to satisfy the growing demand for parking within the city centre.

Due to the impact of the ‘pedestrianisation’ proposed by the Toowoomba City Centre Master Plan and the associated removal of existing on street parking spaces required to achieve the indicative road cross sections and treatments, the provision of additional parking facilities will be required prior to their implementation.

Chapter 8 Recommendations and Conclusions

8.1 Recommendations

This section provides recommendations on measures to improve the pedestrian and car parking facilities within the Toowoomba city centre in response to the preparation of the Toowoomba City Centre Master Plan.

For the case of pedestrian control, the scope of recommendations is limited to the major east-west and north-south pedestrian routes of the Margaret Street 'Green Spine' and the Ruthven Street 'Main Street' defined within the study area. Recommendations on car parking cover the wider city centre area and existing off-street parking facilities located within the Central Business District of the city.

8.1.1 Pedestrian Control Measures within the Study Area

Recommendations provided on measures to improve pedestrian facilities and control within the study area are based on the survey work, investigation and analysis contained in Chapter 4 - *Pedestrian Crossings*, Chapter 5 - *Pedestrian Surveys* and Chapter 6 -*Survey Analysis* and also a review of the literature available on pedestrian characteristics.

The major areas requiring attention in terms of providing a pedestrian friendly environment within the study area are the number of pedestrian crossings on the two major routes of travel along Margaret Street between West Creek and Queens Park and along Ruthven Street between Herries Street and Russell Street. These two routes are considerable in length, with large distances between dedicated crossings. The section of Ruthven Street, between Herries and Margaret Street presents a long travel distance without any dedicated mid-block crossing.

The provision of pedestrian give-way crossings as a means of combating the excessive distance between dedicated pedestrian crossing facilities is not considered to be an effective or sustainable means of allowing cross street pedestrian movement. Based on observation, pedestrians are more likely to cross between cars parked in the median parking areas. This is considered to promote hazardous pedestrian activity. Additional dedicated pedestrian crossing facilities are recommended at locations midblock to allow for safer and more convenient pedestrian movement from one side of the street to the other.

Pedestrian activity at the key intersections along the major pedestrian routes is currently given low priority in relation to vehicle traffic. In order to provide a more pedestrian friendly environment through the implementation of the Toowoomba City Centre Master Plan, reducing the delay at intersections, particularly the delay at the Ruthven Street and Margaret Street intersection, will provide a more pleasant pedestrian experience. Increasing the length and the frequency of the pedestrian phase is recommended to achieve this. Redirection of vehicle traffic around the city centre by the provision of the Outer Circulating Road will also aid in reducing currently saturated vehicle volumes.

Providing a more attractive pedestrian route between the major pedestrian attractions of the shopping centres either side of West Creek and continuing further to the east will be vital in establishing a pedestrian friendly environment. This will also help to encourage pedestrian activity through the centre of the city. In order to continue greater pedestrian activity to the east, the pedestrian crossing facilities at Neil Street and Hume Street should also be revised to provide greater connection to Queen's Park.

8.1.2 Car Parking within the Central Business District

In order to provide sufficient car parking supply for the growing demand within the city centre, measures are required to increase the number off-street car parks and maintain the number of on-street car parks available within the CBD. The demand generated by additional development within the city centre is also required to be managed such that sufficient car parking spaces are available to the general public and those shopping within the CBD.

The most viable measures to increase the number of off-street car parking spaces within the city centre are the provision of additional Car Park facilities and the augmentation of existing street level Car Park facilities with multiple levels. The cost-benefit of each of these options will depend upon the availability of new land within the CBD and the level of cost associated with constructing multilevel facilities. Investigation is recommended into the cost-benefit of each of these options in order to provide strategically located off-street parking within the city centre.

Rationalisation of the parking fees for on-street and off-street regulated car parking spaces is also recommended. Revision of the parking fees should be undertaken to greater manage parking within the city centre and to increase revenue for the use of providing additional parking facilities. Increasing parking fees may also have the effect of reducing vehicle dependence, and increase the use of public transport and walking trips for those who would otherwise use long-term parking. Provision of greater public transport infrastructure would also reduce dependence on vehicles.

In order to ensure that sufficient on-street and off-street parking is available for those visiting and shopping within the CBD, revision of the parking rates required for new development within the city centre should also be revised to ensure that they adequately cater for private parking.

8.2 Further Work

Based on the extent of changes proposed by the Toowoomba City Centre Master Plan, additional research would be beneficial in the following areas:

- Further investigation of illegal pedestrian movements at crossings within an expanded study area, including further analysis of the pedestrian give-way crossings located along the heavily trafficked sections of Ruthven Street and Margaret Street.

- Expansion of the study of pedestrian activity to include the surrounding road network within the Toowoomba City Centre Master Plan area.

- Investigation into the means of reducing the dependency on vehicles, especially single occupant trips into the CBD.

- An analysis of the Bicycle and public transport facilities within the city centre in light of the increased pedestrianisation associated with the Master Plan and greater focus on removing vehicles from the CBD.

- Cost-benefit analysis of the construction of multilevel car parking facilities within the city centre against the acquisition of land for additional off-street parking facilities.

8.3 Conclusion

The research undertaken through this project has endeavoured to quantify the movement and behavioural characteristics of pedestrians within the study area and to assess the control measures and parking facilities within the inner city.

The investigation and analysis of pedestrian characteristics and movement has identified definitive trends in the volume and composition of pedestrian activity within the city centre and provides an indication of pedestrian movement along the major pedestrian routes of the Margaret Street 'Green Spine' and the Ruthven Street 'Main Street' identified as future 'pedestrian streets' within the Toowoomba City Centre Master Plan. Based on the pedestrian activity surveyed at the key intersections within the study area, the study has also provided an assessment of the characteristics and function of the pedestrian crossing and control devices within the city centre.

The car parking analysis shows that the existing car parking facilities within the city centre are operating at capacity and the provision of further off-street car parking will be required in order to satisfy parking demand generated by a growing Central Business District.

It is hoped that the research and analysis of the pedestrian activity and inner city car parking contained within this study is of benefit in the planning and design of pedestrian and parking facilities within the city centre through the implementation of the Toowoomba City Centre Master Plan.

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Appendices

Appendix A – Project Specification

University of Southern Queensland

FACULTY OF ENGINEERING AND SURVEYING

ENG4111/4112 Research Project
PROJECT SPECIFICATION

FOR: **Neil Davies**

TOPIC: Pedestrian Characteristics and Control for the Toowoomba City Centre Master Plan Area

SUPERVISORS: Professor Ron Ayers – USQ
David Brown - TRC

PROJECT AIM: To investigate and identify the influence of pedestrian characteristics on the design and location of pedestrian control devices for the Toowoomba City Centre Master Plan Area.

PROGRAMME: **(Issue B, 23 March 2010)**

1. Research background literature from Australia and overseas on pedestrian characteristics and control in city environments, considering particularly:

   a. Pedestrian movements and behavioural characteristics;
   b. Planning, design and effectiveness of pedestrian control devices;
   c. Vehicle-pedestrian interaction strategies; and
   d. Safety and security issues for pedestrian areas.

2. Define the study area for this project and determine the existing data for this area in regard to pedestrian characteristics and control devices.

3. Undertake surveys at key locations within the study area to quantify pedestrian movements and behavioural characteristics, and existing pedestrian control devices.

4. Analyse the data to quantify relationships between pedestrian movement /behaviour and the design, type and location of existing control devices and facilities within the study area.

5. Devise improvements to pedestrian linking / routing within the study area.

6. Investigate methods to improve pedestrian / vehicle interaction and safety throughout the study area.

7. Investigate parking demand and supply within the study area and adjacent precincts and propose improvements for the location of adequate accessible, pedestrian friendly car parking facilities.

8. Propose methods to improve existing facilities, location and design of pedestrian control in the short and long term.

9. Present the final results in the required oral and written formats.

AGREED: _____ (Student) _____ (Supervisor)

Date: / / 2010 Date: / / 2010

Examiner/Co-examiner:_____

Appendix B – Risk Assessment

Form A3: Hazard and associated risk register

Form completed by: Neil Davies **Sign:** 

Date form completed: 22 May 2010

Ref #	Hazard	Associated Risk	Risk Rating	Control Measures	Control Measure Implemented?		Review Date
					Yes	No	
1	Poor Lighting	Trip due to poor visibility	L	Perform survey in fine conditions	Yes		4/10/2010
2	Slippery Pavement	Slip potential during survey	L	Wear safety boots	Yes		4/10/2010
		Twisted joints / laceration bone fractures / breaks		Watch footing	Yes		4/10/2010
3	pedestrian / cyclist interference	fall or trip due to other pedestrian actions	L	Stand clear of pedestrian paths / Locate away from queuing areas	Yes		4/10/2010
4	Vehicles	Collision / hit by vehicle	H	Stand clear of roadway and vehicles	Yes		4/10/2010
		Reversed into by vehicle obscure vision or steal motorist attention from the road		Do not attract undue attention	Yes		4/10/2010
				Observe road rules	Yes		4/10/2010

Risk priority chart (risk score and statement)

LIKELIHOOD How likely is it to happen?	CONSEQUENCES: How severely it hurts someone (if it happens)?				
	Insignificant (no injuries)	Minor (first aid treatment, spillage contained at site)	Moderate (medical treatment; spillage contained but with outside help)	Major (extensive injuries, loss of production)	Catastrophic (death, toxic release of chemicals)
Almost certain - expected in most circumstances	3 H	3 H	4 A	4 A	4 A
Likely – will probably occur in most circumstances	2 M	3 H	3 H	4 A	4 A
Possible – might occur at some time	1 L	2 M	3 H	4 A	4 A
Unlikely – could occur at some time	1 L	1 L	2 M	3 H	4 A
Rare - may occur, only in exceptional circumstances	1 L	1 L	2 M	3 H	3 H

Risk score and statement

Score and statement	Action
4 A: Acute	ACT NOW – Urgent - do something about the risks immediately. Requires immediate attention.
3 H: High	Highest management decision is required urgently.
2 M: Moderate	Follow management instructions.
1 L: Low	OK for now. Record and review if any equipment/ people/ materials/ work methods or procedures change.

Appendix C – Sample Pedestrian Questionnaire

Pedestrian Questionnaire

(Modified from the Main roads Pedestrian safety and Accessibility Audit Tools 2006)

Hello, my name is XXXX and I am from XXXX. I am doing a pedestrian survey as a road safety project. The questionnaire is voluntary and confidential. It will only take 2 minutes of your time. Would you like to answer a few questions?

Thank the respondent for his/her help: "Thank you very much for your help."

Date:_____ Time:_____

1. Purpose of walking trip

a. Travelling to work
b. Travelling from work
c. Health benefits
d. Shopping
e. Recreation
f. Other _____

2. Gender Female □Male □

Age 0-5 ☐ 6-12 ☐ 13-18 ☐ 19-25 ☐ 26-30 ☐ 31-40 ☐ 41-50 ☐ 51-65 ☐ 66-80 ☐ over 80 ☐

Mobility / Vision Impairment Yes ☐ No ☐ Type _____

Local or visitor Local ☐ Visitor ☐ Overseas ☐

Regular user (more than once per week) Yes ☐ No ☐

3. Consideration of the pedestrian crossing/facility to be a satisfactory type/standard Why or why not?

Satisfactory☐ Unsatisfactory☐ Reasons:_____

4. Is the crossing safe Why or why not?

Yes ☐ No ☐ Reasons: _____

5. Do you find the crossing convenient? Why or why not?

Yes ☐ No ☐ Reasons: _____

6. What do you think about the footpath along this street?

a. Adequate width Yes ☐ No ☐

b. Well designed and in good repair Yes ☐ No ☐ Other comments: _____

7. Do you find the surrounding walking environment pleasant and convenient? Why/why not?

Yes☐ No☐ Reasons: _____

8. Do you consider pedestrianising the city centre to be a good idea? Why/why not?

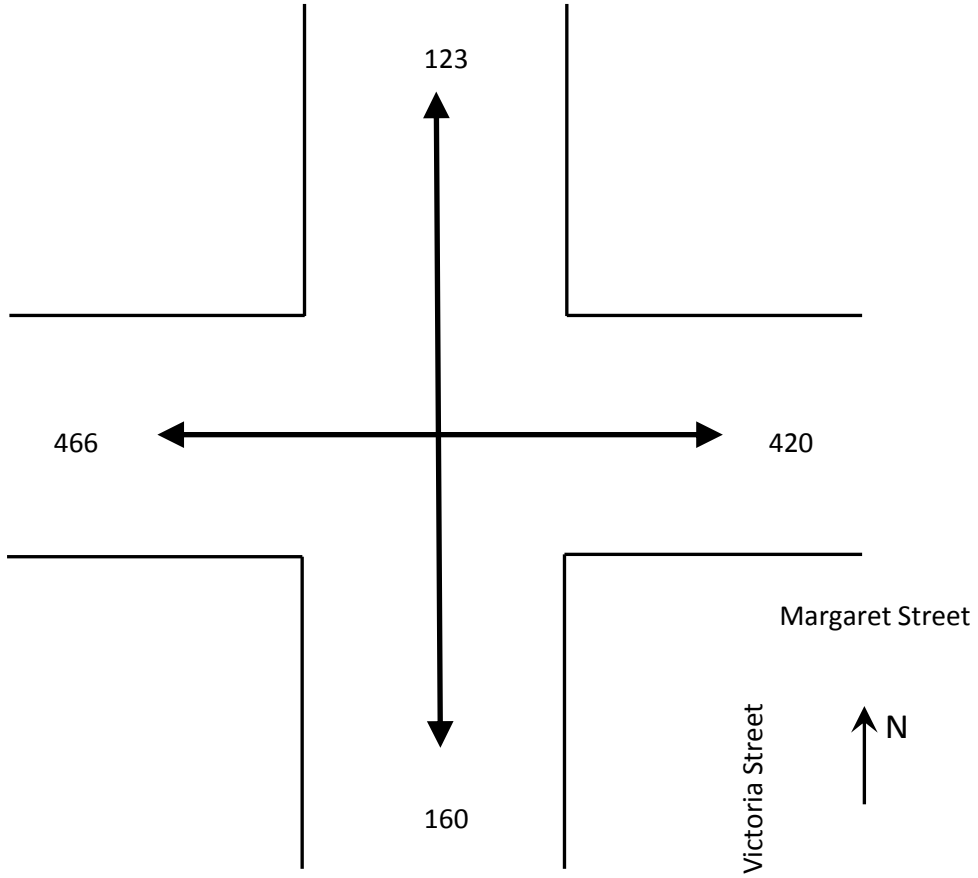
Yes☐ No☐ Reasons: _____

Appendix D – Intersection Data Sheets

Intersection:	Margaret Street / Victoria Street		
Date:	Thursday 9/09/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:	Fine		

Green Time:

Total Time:

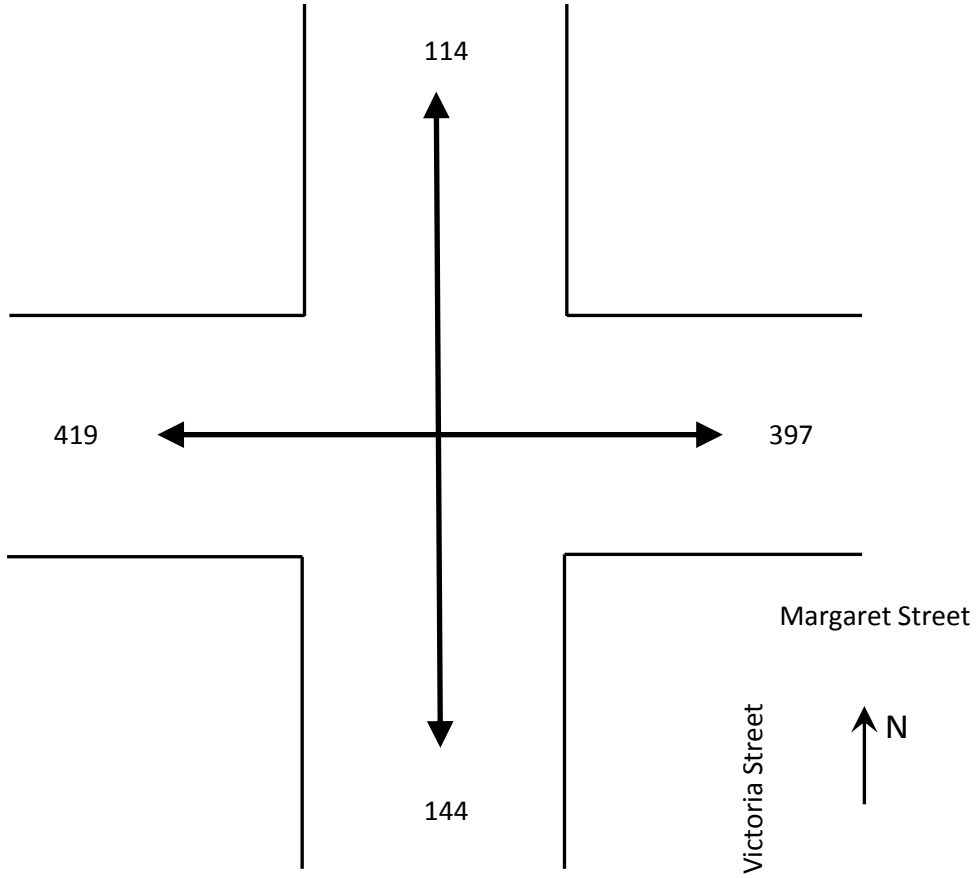


Qtr.	↑		↑	↑	↓		↓	↓	→		→	→	←		←	←
1	6	5	7	9	6	12	10	7	15	70	11	12	8	80	7	13
2	2	9	5	12	11	8	14	9	8	72	9	8	14	82	5	15
3	7	8	2	15	10	9	12	7	9	68	10	16	9	90	5	18
4	7	11	6	12	8	14	16	7	6	84	7	15	9	88	6	17
Tot.	22	33	20	48	35	43	52	30	38	294	37	51	40	340	23	63

Intersection:	Margaret Street / Victoria Street		
Date:	Saturday 11/09/2010		
Time	Start: 1130	Finish:1230	Period: 1.0 hr
Weather:	Fine		

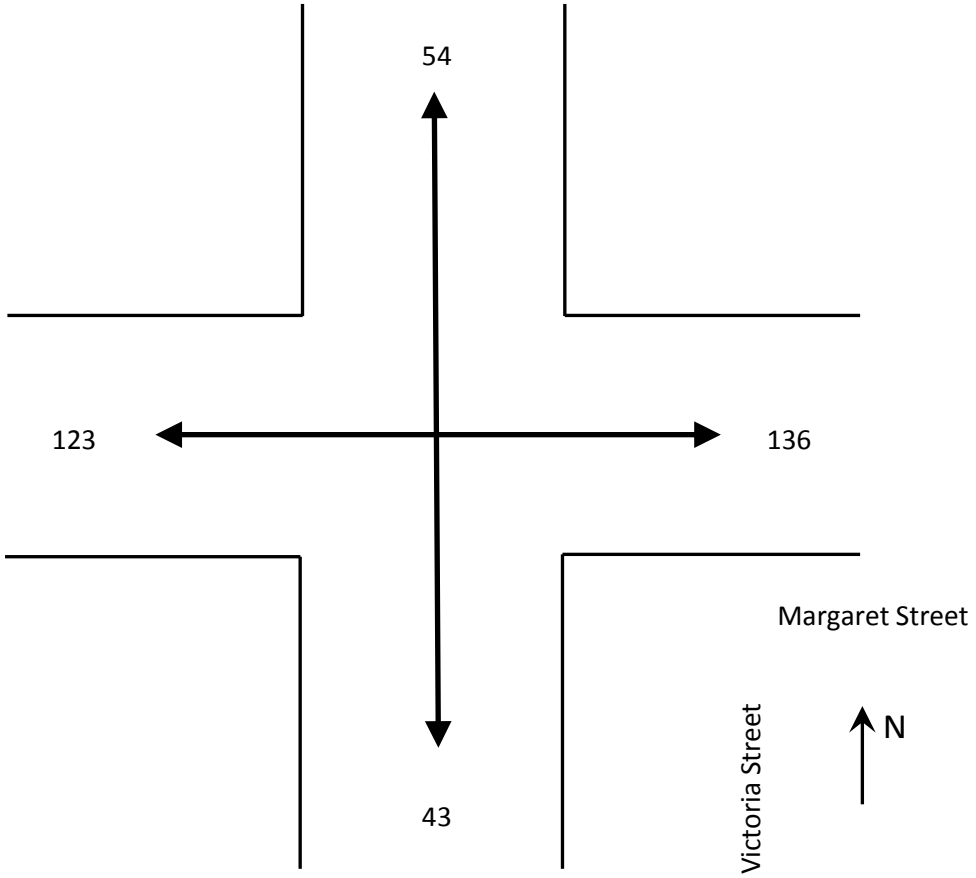
Green Time:

Total Time:



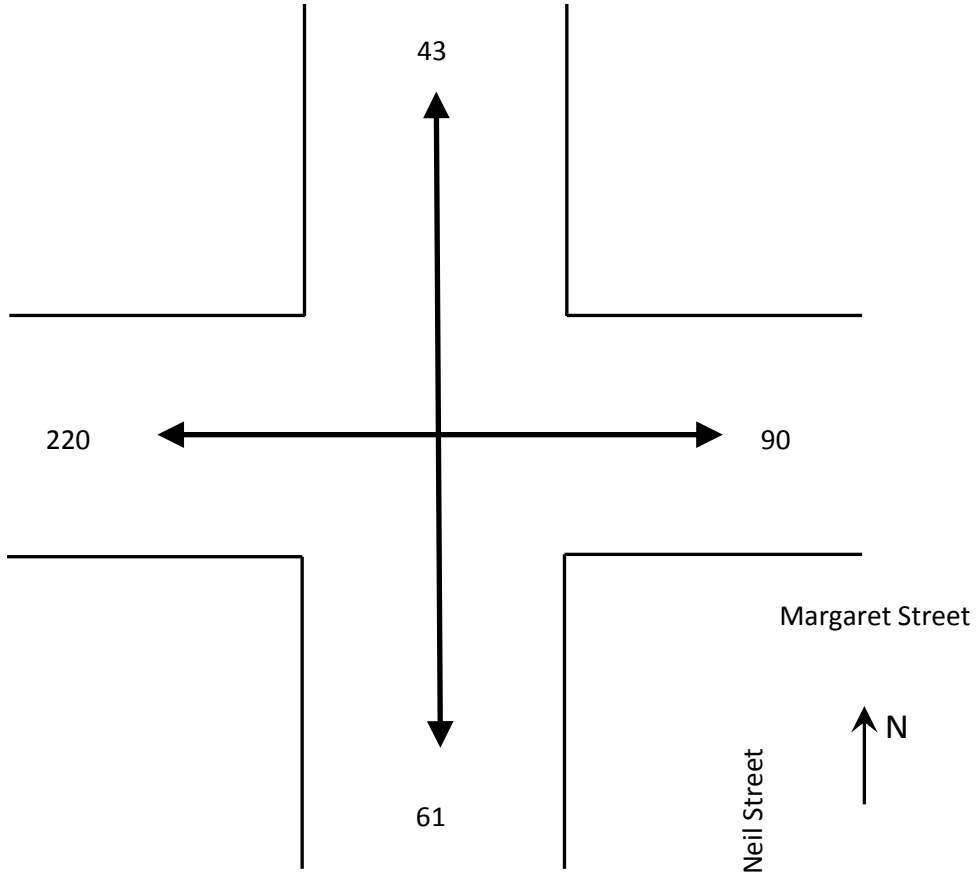
Qtr.	↑		↑	↑	↓		↓	↓	→		→	→	←		←	←
1	5	8	4	6	10	15	8	3	14	61	4	13	17	63	9	7
2	7	5	3	9	9	8	14	6	11	68	8	4	12	71	2	10
3	2	12	1	14	6	12	10	8	12	75	11	7	15	81	5	12
4	6	15	6	11	6	10	12	7	15	70	13	11	9	84	7	15
Tot.	20	40	14	40	31	45	44	24	52	274	36	35	53	299	23	44

Intersection:	Margaret Street / Victoria Street		
Date:	Sunday 12/09/2010		
Time	Start: 1130	Finish:1230	Period: 1.0 hr
Weather:			
Green Time:			
Total Time:			



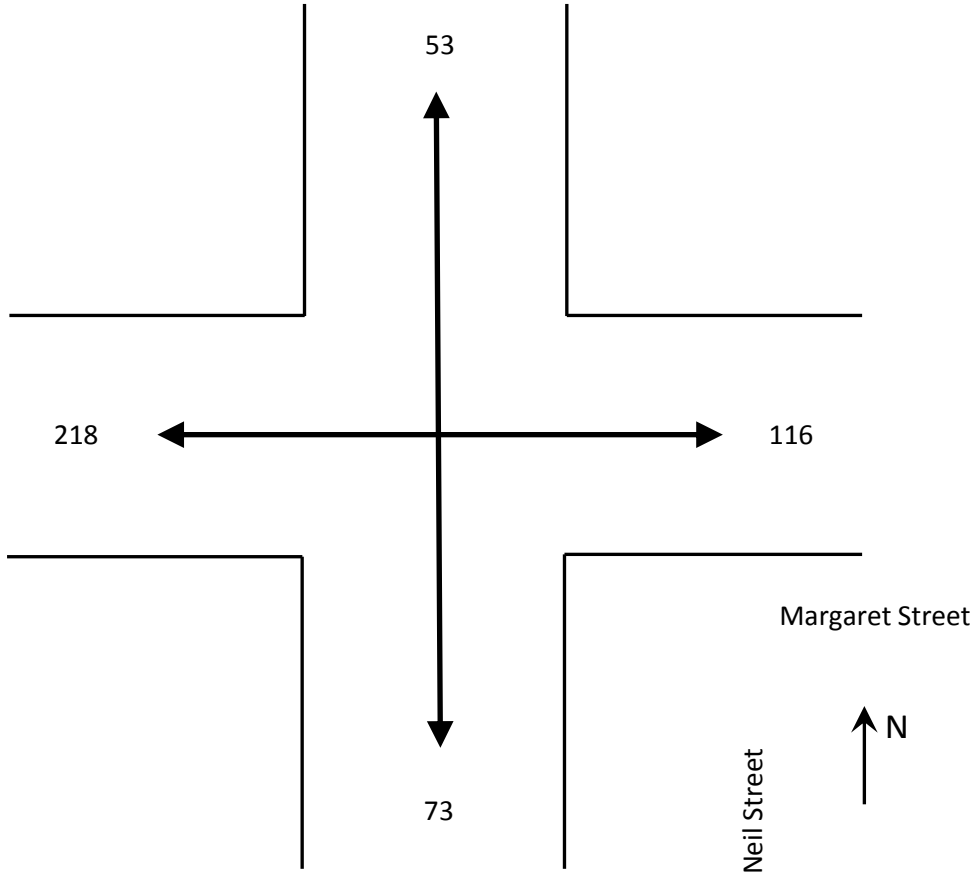
Qtr.	↑		↑	↱	↑	↓		↓	↴	↓	→		→	↱	↳	←		↲	↰
1	2	5	2	5	2	6	3	1	0	30	5	2	4	20	0	3
2	5	6	2	4	4	3	6	3	3	15	2	1	1	25	2	5
3	2	4	4	4	0	2	1	2	4	26	3	6	0	18	2	4
4	1	4	1	7	3	3	2	2	2	27	4	6	5	29	1	4
Tot.	10	15	9	20	9	14	12	8	9	98	14	15	10	92	5	16

Intersection:	Margaret Street / Neil Street		
Date:	Thursday 26/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			



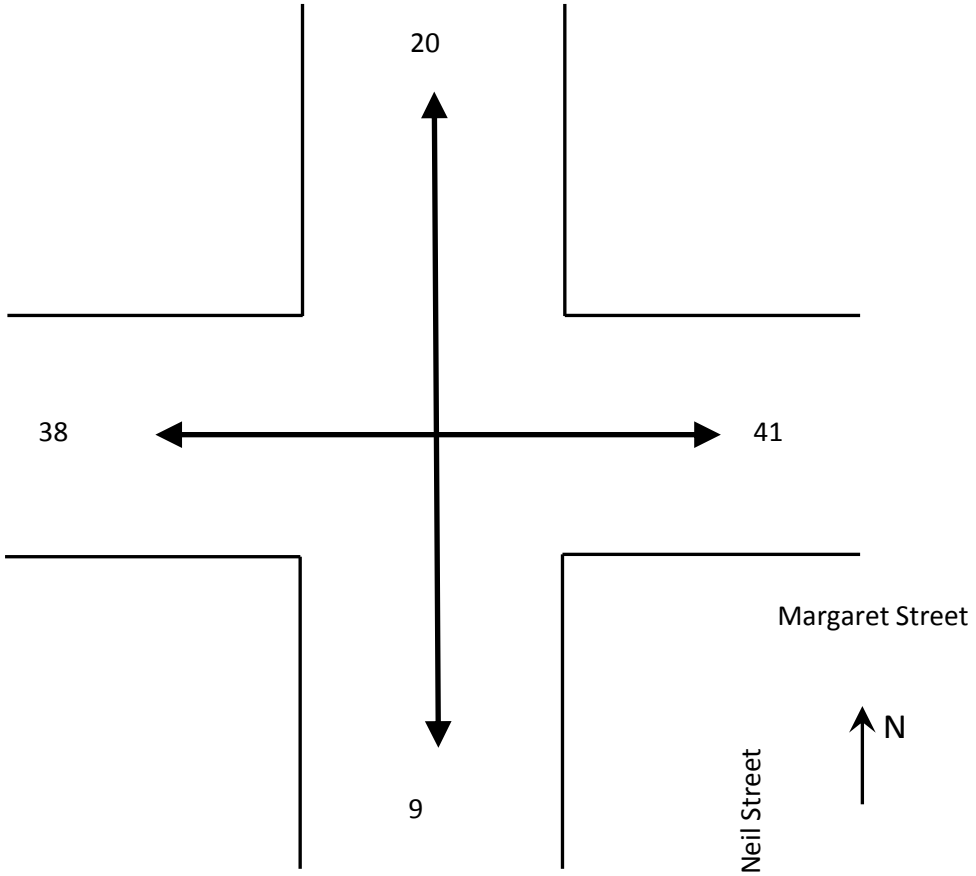
Qtr.	↑	↑	↱	↰	↓	↓	↴	↴	→	→	↱	↳	←	←	↲	↰
1	2	3	3	0	6	2	5	2	12	3	2	1	21	24	10	1
2	4	6	2	5	2	1	5	0	15	6	0	2	18	16	5	1
3	1	1	2	1	7	2	4	2	11	1	4	5	27	28	9	0
4	0	5	5	3	7	5	9	2	14	12	0	2	22	23	12	3
Tot.	7	15	12	9	22	10	23	6	52	22	6	10	88	91	36	5

Intersection:	Margaret Street / Neil Street		
Date:	Saturday 28/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			



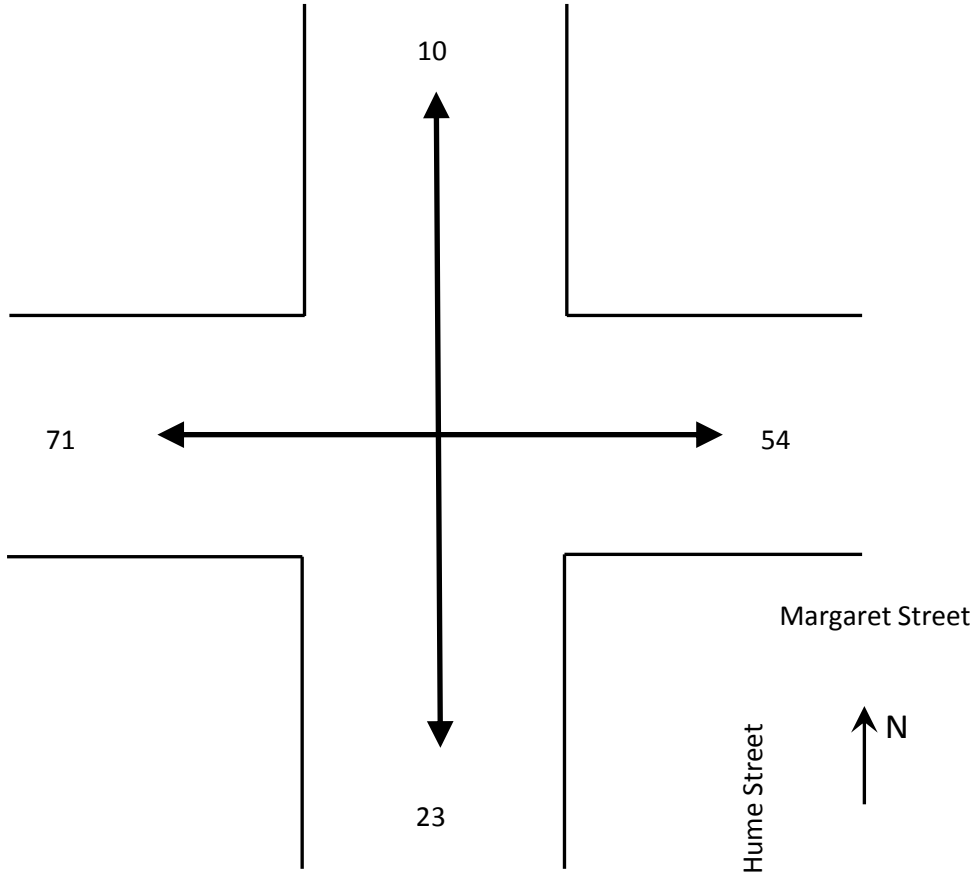
Qtr.	↑		↑	↱	↑	↓		↓	↴	↓	→		→	↱	↳	←		←	↲	↰
1	4	5	4	2	8	2	4	4	13	6	1	5	22	19	7	6
2	0	2	3	3	4	2	6	2	18	5	5	3	25	22	4	2
3	1	7	3	3	6	1	3	7	17	8	3	0	20	15	9	5
4	2	6	5	3	9	4	5	6	12	8	5	7	23	24	9	6
Tot.	7	20	15	11	27	9	18	19	60	27	14	15	90	80	29	19

Intersection:	Margaret Street / Neil Street		
Date:	Sunday 29/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			



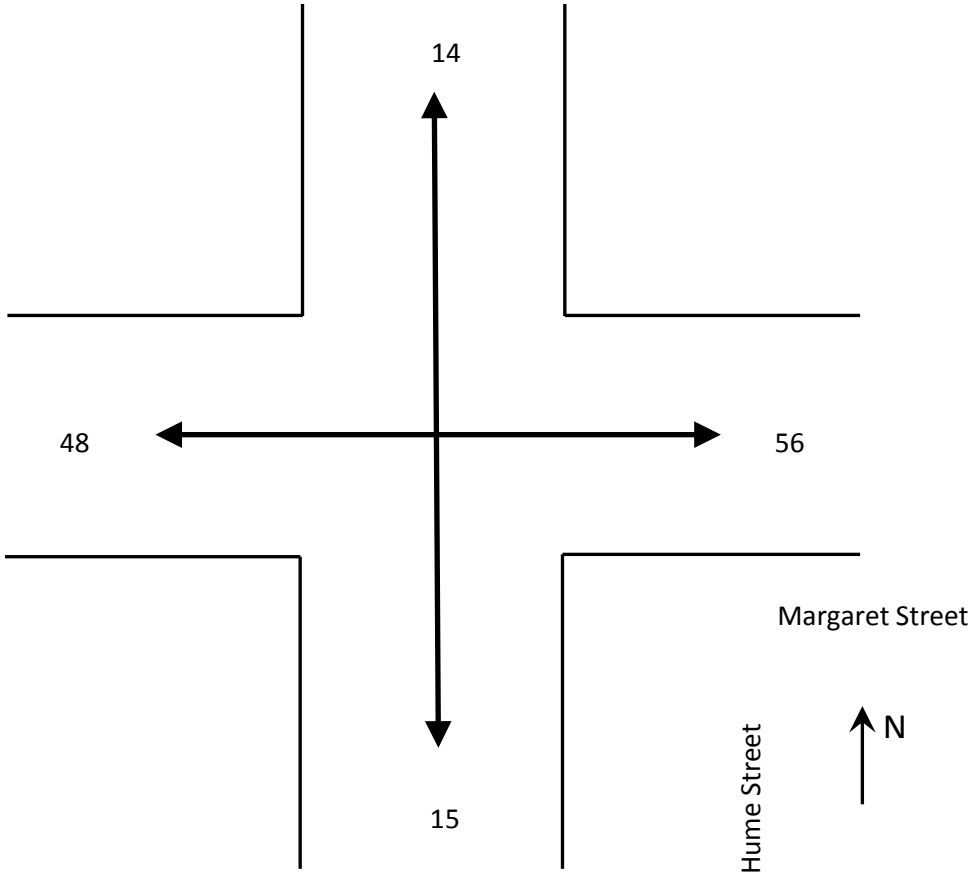
Qtr.	↑	↑	↱	↰	↓	↓	↴	↴	→	→	↱	↳	←	←	↲	↰
1	2	3	0	1	4	0	0	0	5	3	1	0	5	5	2	0
2	0	0	0	2	0	0	1	0	0	8	1	1	2	2	0	0
3	1	4	1	0	0	2	0	0	7	2	4	1	1	7	1	2
4	1	5	0	0	1	0	0	1	3	4	0	1	4	5	1	1
Tot.	4	12	1	3	5	2	1	1	15	17	6	3	12	19	4	3

Intersection:	Margaret Street / Hume Street		
Date:	Thursday 2/09/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			



Qtr.	↑		↑	↱	↑	↓		↓	↴	↓	→		→	↱	↳	←		←	↲	↰
1	0	1	2	0	3	1	1	0	4	8	0	0	5	8	2	1
2	1	0	0	0	2	1	3	1	6	5	0	0	5	10	1	2
3	1	2	1	1	0	1	0	2	7	9	1	0	9	7	3	0
4	0	1	0	0	4	2	1	1	5	8	1	0	4	8	2	2
Tot.	2	4	3	1	9	5	5	4	22	30	2	0	23	33	10	5

Intersection:	Margaret Street / Hume Street		
Date:	Saturday 4/09/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			



Qtr.	↑		↑	↑	↓		↓	↓	→		→	→	←		←	←
1	2	0	1	0	1	2	1	0	5	7	1	0	4	5	3	2
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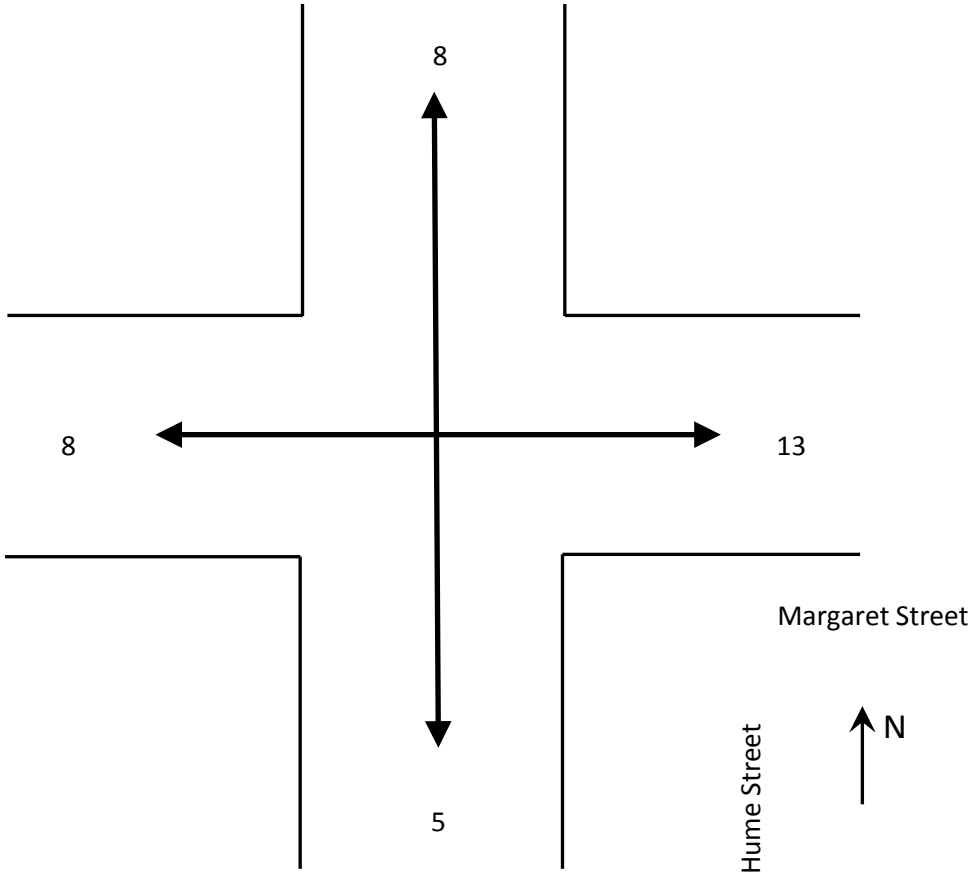
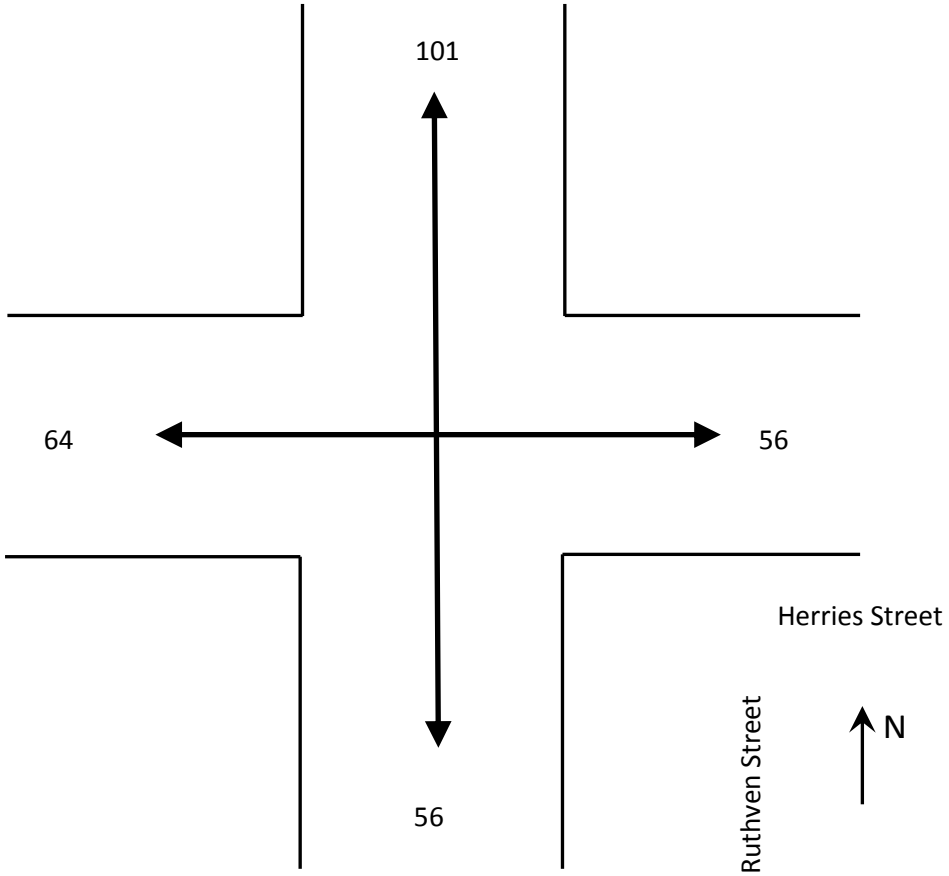
3	1	1	3	0	1	1	2	2	7	9	0	1	7	1	3	0
4	1	2	0	0	1	1	1	0	7	8	3	0	5	8	2	1
Tot.	4	6	4	0	5	4	4	2	24	27	4	1	20	16	9	3

Intersection:	Margaret Street / Hume Street		
Date:	Sunday 5/09/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			



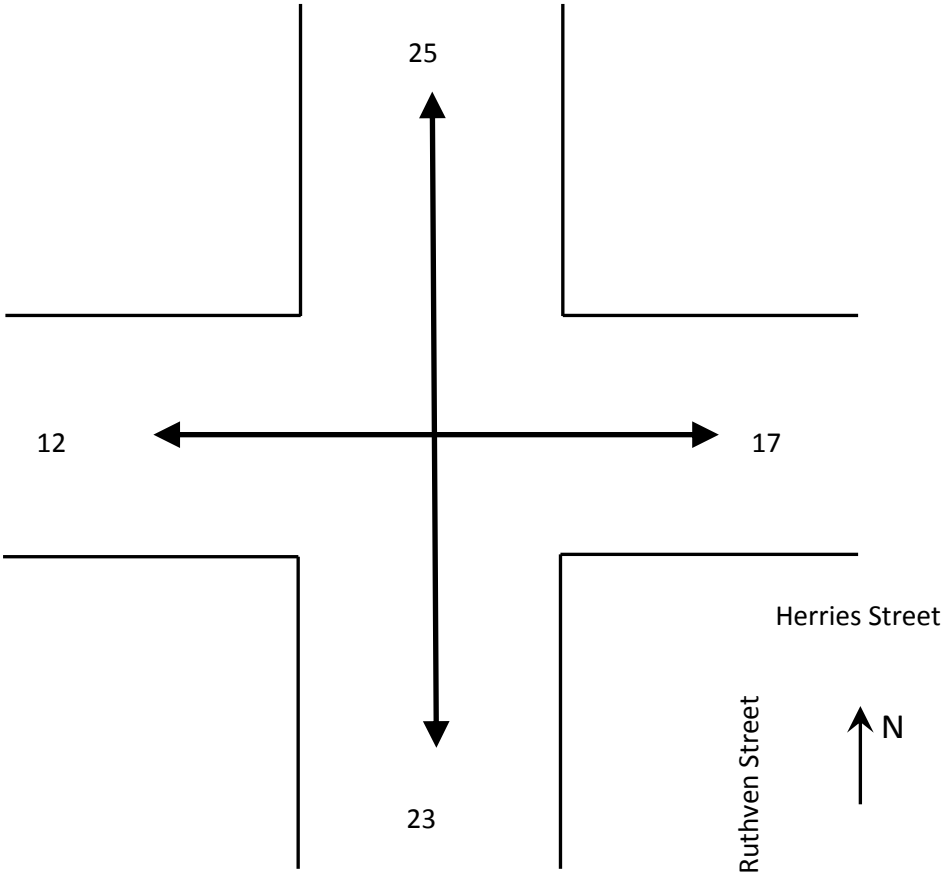
Qtr.	↑		↑	↑	↓		↓	↓	→		→	→	←		←	←
1	0	2	0	0	0	0	0	0	3	1	2	0	1	0	2	0
2	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	1
3	2	0	1	0	0	0	0	1	2	0	0	0	0	2	0	0
4	2	1	0	0	2	0	0	0	2	1	1	0	1	0	0	0
Tot.	4	3	1	0	3	0	1	1	7	2	4	0	3	2	2	1

Intersection:	Ruthven Street / Herries Street		
Date:	Thursday 12/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			



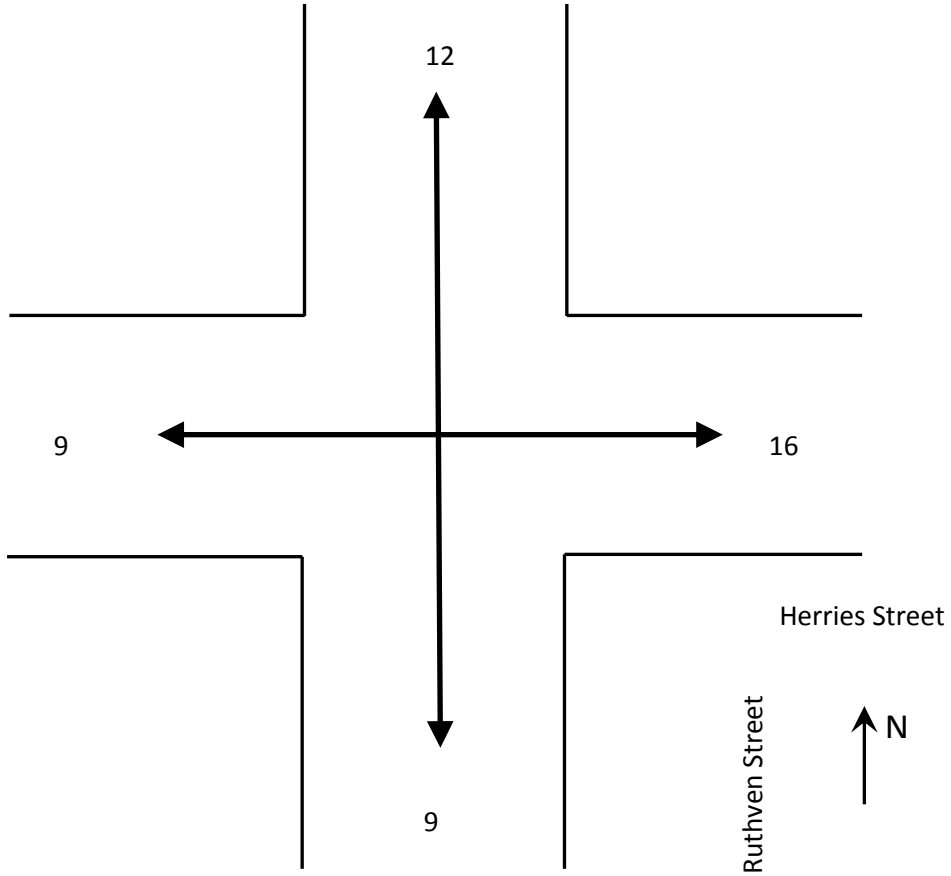
Qtr.	↑		↑	↱	↑	↓		↓	↴	↓	→		→	↱	↳	←		←	↲	↰
1	10	7	5	3	11	3	1	0	0	3	1	9	9	2	4	1
2	8	6	6	5	6	1	0	2	0	4	1	14	8	2	5	0
3	3	9	2	8	9	4	1	1	2	0	1	5	12	3	4	0
4	12	7	6	4	12	3	2	0	5	2	1	8	6	1	5	2
Tot.	33	29	19	20	38	11	4	3	7	9	4	36	35	8	18	3

Intersection:	Ruthven Street / Herries Street		
Date:	Saturday 14/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			



Qtr.	↑		↑	↱	↑	↓		↓	↴	↓	→		→	↱	↳	←		↲	↰
1	2	0	4	2	1	1	1	0	3	0	1	2	1	1	2	1
2	4	4	2	0	4	0	0	0	0	2	0	0	1	0	0	1
3	3	0	0	0	5	4	2	2	0	2	3	2	1	0	1	0
4	0	1	0	3	1	1	1	0	1	0	0	1	1	2	0	0
Tot.	9	5	6	5	11	6	4	2	4	4	4	5	4	3	3	2

Intersection:	Ruthven Street / Herries Street		
Date:	Sunday 15/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:			
Green Time:			
Total Time:			

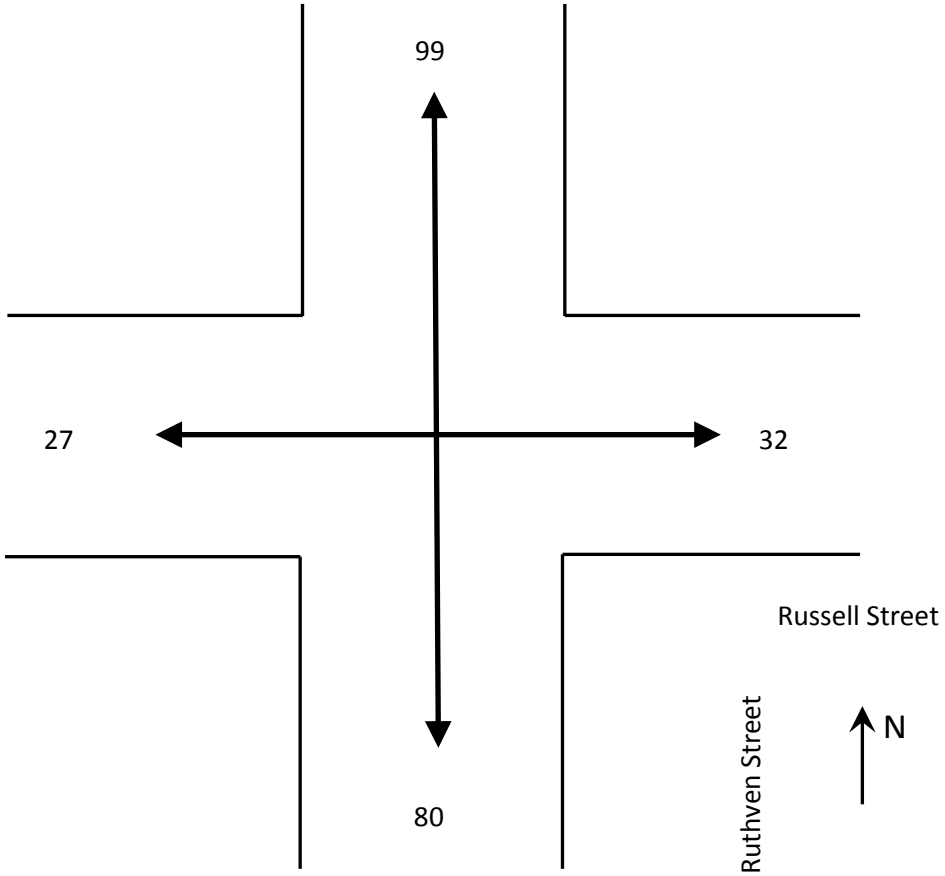


Qtr.	↑		↑	↱	↑	↓		↓	↴	↓	→		→	↳		←		↲	←
1	0	1	0	1	0	0	0	0	2	3	1	0	0	0	0	2
2	3	0	0	1	0	0	0	3	3	1	0	0	0	0	0	1
3	2	0	1	0	0	2	0	2	1	0	0	0	1	2	0	0
4	1	2	0	0	0	0	1	1	1	1	2	1	0	1	2	0
Tot.	6	3	1	2	0	2	1	6	7	5	3	1	1	3	2	3

Intersection:	Ruthven Street / Russell Street		
Date:	Thursday 19/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:	Fine		

Green Time:

Total Time:

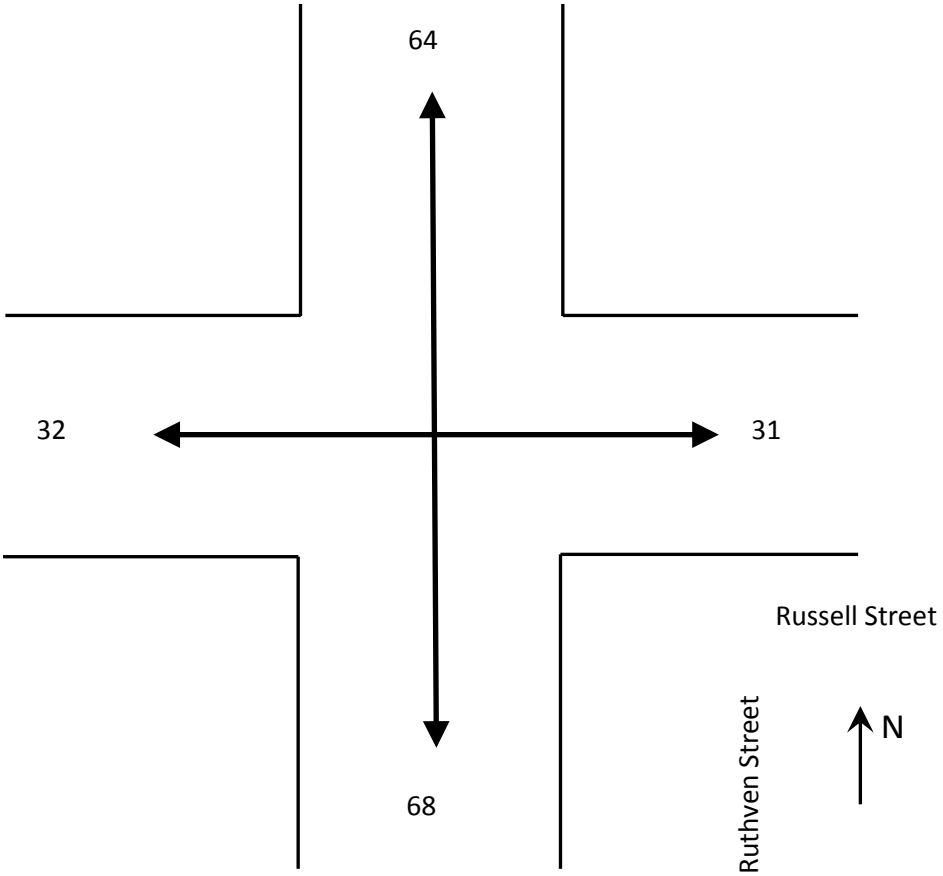


Qtr.	↑		↑	↑	↓		↓	↓	→		→	→	←		←	←
1	10	7	3	6	6	5	4	3	2	2	1	3	0	2	0	3
2	9	4	1	9	6	7	5	3	4	0	1	1	0	4	0	2
3	6	9	3	3	3	7	6	2	3	3	0	2	3	0	4	3
4	11	9	2	7	8	7	4	4	3	0	4	3	3	3	0	0
Tot.	36	29	9	25	23	26	19	12	12	5	6	9	6	9	4	8

Intersection:	Ruthven Street / Russell Street		
Date:	Saturday 21/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:	Fine		

Green Time:

Total Time:

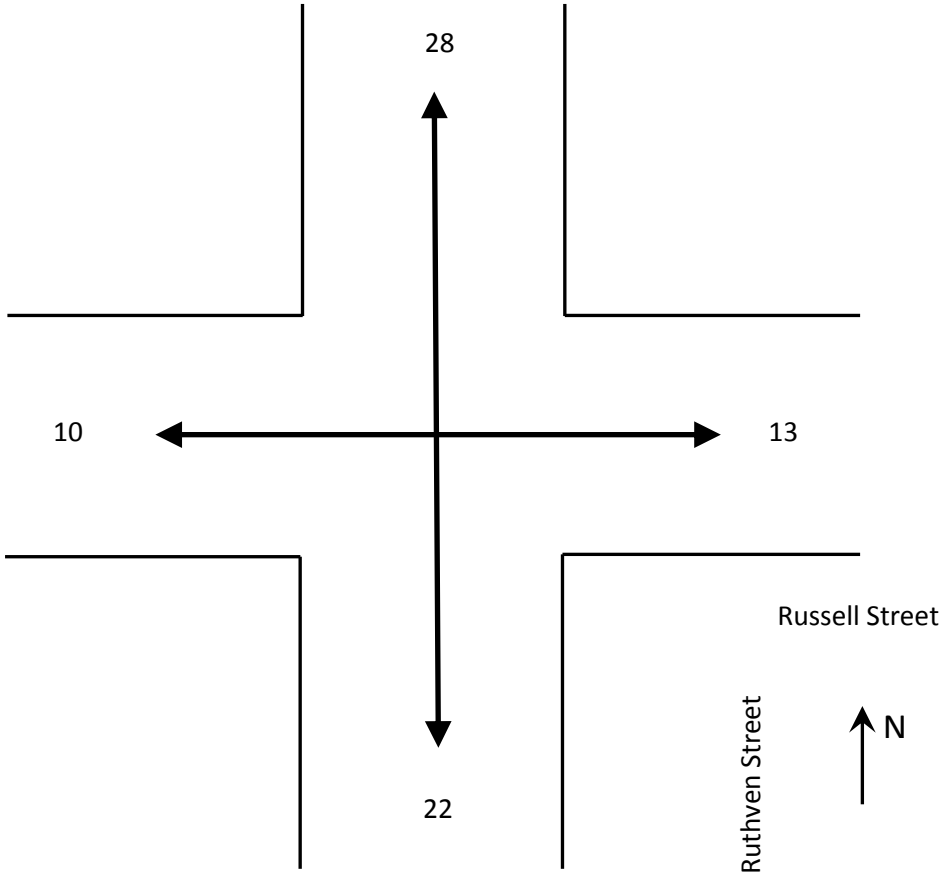


Qtr.	↑		↑	↱	↑	↓		↓	↴	↓	→		→	↱	↳	←		←	↲	↰
1	8	3	0	3	3	7	6	0	2	2	0	1	0	0	3	6
2	6	0	1	3	6	3	9	1	7	2	3	4	0	2	1	2
3	12	5	0	2	2	7	8	0	0	2	0	0	2	1	1	7
4	9	3	4	5	1	6	5	4	3	3	1	1	0	3	1	3
Tot.	35	11	5	13	12	23	28	5	12	9	4	6	2	6	6	18

Intersection:	Ruthven Street / Russell Street		
Date:	Sunday 22/08/2010		
Time	Start:1130	Finish:1230	Period:1.0 hr
Weather:	Overcast		

Green Time:

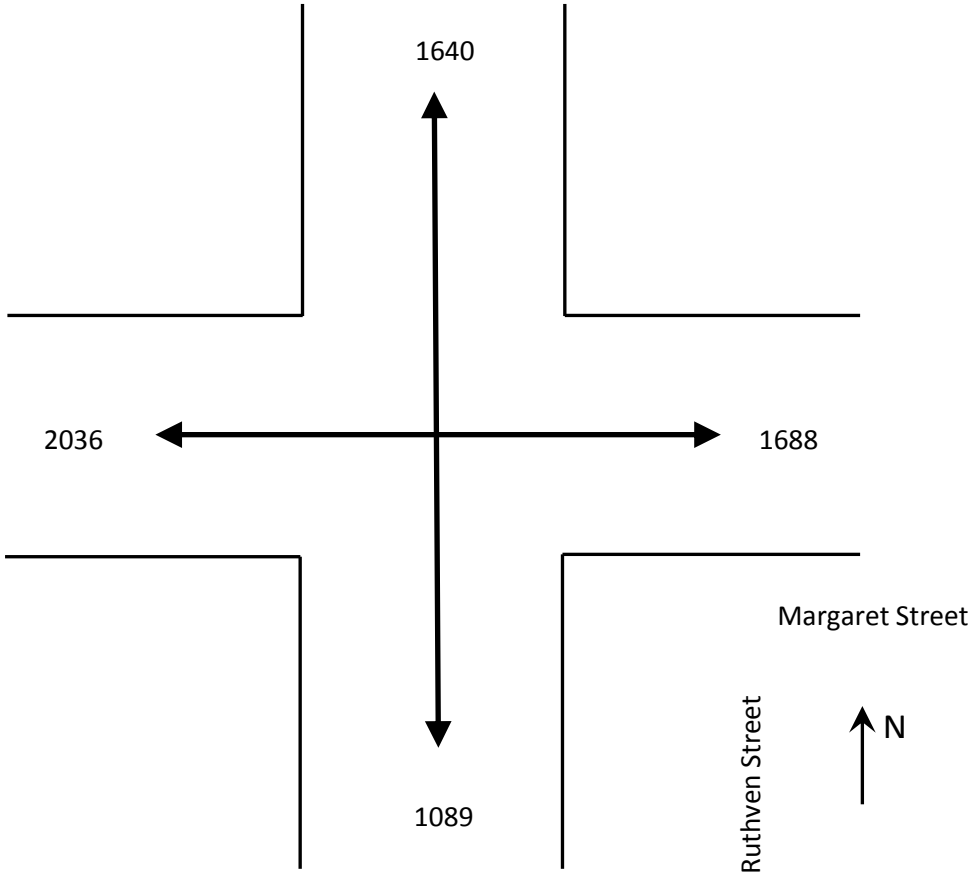
Total Time:



Qtr.	↑		↑	↱	↑	↓		↓	↴	↓	→		→	↳	→	←		←	↲	←
1	2	3	0	2	1	4	0	3	0	3	0	0	0	2	0	1
2	2	5	0	2	0	0	0	0	0	2	0	0	0	0	0	1
3	0	0	4	0	0	4	0	1	2	2	2	1	2	1	0	1
4	3	4	1	0	2	4	2	1	1	0	0	0	0	0	2	0
Tot.	7	12	5	4	3	12	2	5	3	7	2	1	2	3	2	3

Appendix E – Intersection Data Sheets (Ruthven/Margaret)

Intersection:	Ruthven Street / Margaret Street		
Date:	Thursday Total		
Time	Start:0730	Finish:1830	Period:11.0 hr
Weather:	Variable Generally Fine		
Green Time:	8 Seconds		
Total Time:	30 seconds		



See Next Page for Pedestrian Counts.

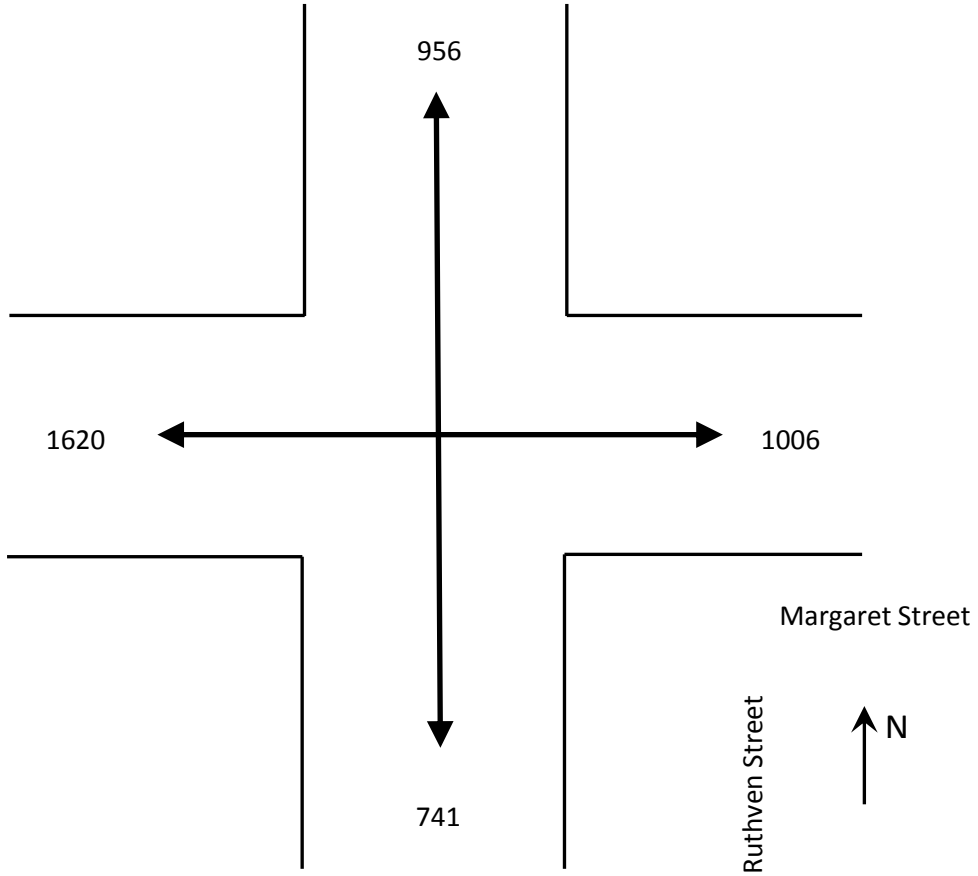
When determining total pedestrian volume, diagonal counts have been split 50 % in respective directions.

Time	↑		↑	↑	↑	↖	↗	↓		↓	↴	↳	↙	↘	→	→	↱	↳	←	←	↵	↰
0730	0	0	10	0	0	1	2	1	4	0	0	1	1	3	1	5	0	5	2	1
0745	2	5	7	4	2	0	2	2	2	1	1	0	2	1	1	1	0	4	6	5
0800	2	3	8	2	1	0	1	1	8	4	0	0	5	5	1	2	4	5	7	3
0815	5	6	9	10	0	2	4	7	9	4	0	2	7	3	5	4	2	7	7	4
0830	6	3	8	13	0	3	7	1	8	3	0	3	12	12	1	5	2	6	9	6
0845	3	6	6	7	2	4	3	3	11	7	6	0	15	8	7	6	9	8	8	8
0900	4	1	21	5	5	9	3	3	2	11	7	1	14	7	6	5	3	14	22	8
0915	11	13	16	4	1	8	8	7	8	9	1	2	9	22	6	5	11	10	18	11
0930	12	11	20	6	5	7	9	9	8	5	6	3	5	23	4	8	9	7	22	3
0945	9	8	22	9	6	9	5	4	11	12	7	6	9	18	7	7	15	13	10	3
1000	10	7	19	8	8	7	3	7	14	7	8	8	8	24	3	6	10	9	20	3
1015	12	8	24	4	5	6	2	9	9	5	5	10	10	18	5	9	12	13	21	5
1030	8	3	15	7	6	2	8	4	8	6	7	11	15	25	2	6	17	16	19	4
1045	10	9	23	4	4	6	6	4	9	4	3	6	11	13	3	9	8	18	29	2
1100	16	6	16	6	7	4	11	8	2	8	5	4	14	12	7	10	9	15	19	8
1115	24	3	20	5	3	7	5	4	7	2	7	3	21	15	9	2	5	21	16	1
1130	14	8	23	1	5	6	8	6	7	5	3	4	19	21	3	6	8	18	20	5

Time	↑		↑	↱	↰	↖	↗	↓		↴	↳	↙	↘	→		↱	↳	←		↲	↰
1145	9	13	29	5	9	3	6	10	4	7	4	8	12	20	4	9	6	22	8	9
1200	16	8	14	6	8	3	10	9	2	9	4	5	12	12	9	9	10	17	19	7
1215	17	6	23	2	4	6	5	9	7	5	3	4	15	19	7	6	8	20	20	6
1230	19	7	18	3	6	4	8	5	13	5	6	2	17	18	6	4	9	23	9	9
1245	16	3	21	1	2	6	5	8	8	4	8	7	21	24	2	7	3	15	26	8
1300	12	6	15	5	6	5	7	9	3	2	1	9	18	17	4	4	12	18	21	11
1315	7	2	20	6	5	10	3	6	7	4	7	5	15	19	8	2	8	21	22	6
1330	10	8	16	6	2	7	8	4	2	3	4	7	14	17	4	3	10	19	24	7
1345	14	5	23	4	8	3	11	9	6	3	5	1	20	19	5	2	11	13	7	2
1400	15	4	14	2	3	2	21	11	3	2	3	3	12	16	1	3	18	15	19	6
1415	12	9	24	6	1	0	12	10	6	2	0	4	18	23	3	2	15	12	8	1
1430	9	6	21	4	2	4	10	2	2	3	1	1	14	19	4	1	20	16	22	5
1445	14	10	18	7	2	2	13	8	4	3	2	1	10	12	2	2	19	22	11	8
1500	7	3	17	2	5	1	15	14	7	4	6	2	17	22	3	3	15	13	9	7
1515	6	5	19	5	3	2	5	6	7	6	4	3	10	17	4	2	14	22	23	5
1530	4	5	16	1	3	1	5	6	2	4	0	1	15	19	6	5	16	20	19	4

Time	↑		↑	↑	↖	↗	↓		↓	↓	↙	↘	→	→	→	→	←	←	←	←
1545	8	4	19	3	2	5	7	4	5	4	1	3	12	22	2	3	21	15	18	4
1600	6	4	15	3	3	2	5	6	3	5	2	6	8	17	7	3	11	18	14	5
1615	5	7	12	2	1	5	2	3	2	4	1	1	13	14	2	1	17	19	16	4
1630	7	5	16	2	0	0	4	4	3	1	0	2	15	11	4	2	13	15	16	8
1645	5	3	15	3	0	3	5	7	1	3	5	1	11	9	1	1	10	13	11	4
1700	2	1	13	2	0	0	2	1	3	1	1	0	9	14	1	0	8	12	15	1
1715	3	3	8	2	1	1	7	4	4	2	0	2	8	9	1	3	5	10	14	5
1730	4	3	2	3	0	0	4	3	2	5	0	0	11	8	3	1	6	4	9	2
1745	5	5	6	0	0	0	2	4	0	1	0	0	8	12	2	3	11	7	5	3
1800	2	1	6	2	0	1	4	2	3	5	2	0	10	9	3	2	6	7	6	0
1815	2	2	3	0	0	0	2	1	3	1	0	0	5	10	4	2	5	7	2	1
Tot.	384	238	690	182	136	157	275	245	239	191	136	142	527	658	173	181	431	604	648	217

Intersection:	Ruthven Street / Margaret Street		
Date:	Saturday Total		
Time	Start:0730	Finish:1730	Period:10.0 hr
Weather:	Variable Generally Fine		
Green Time:	8 Seconds		
Total Time:	30 seconds		



See Next Page for Pedestrian Counts.

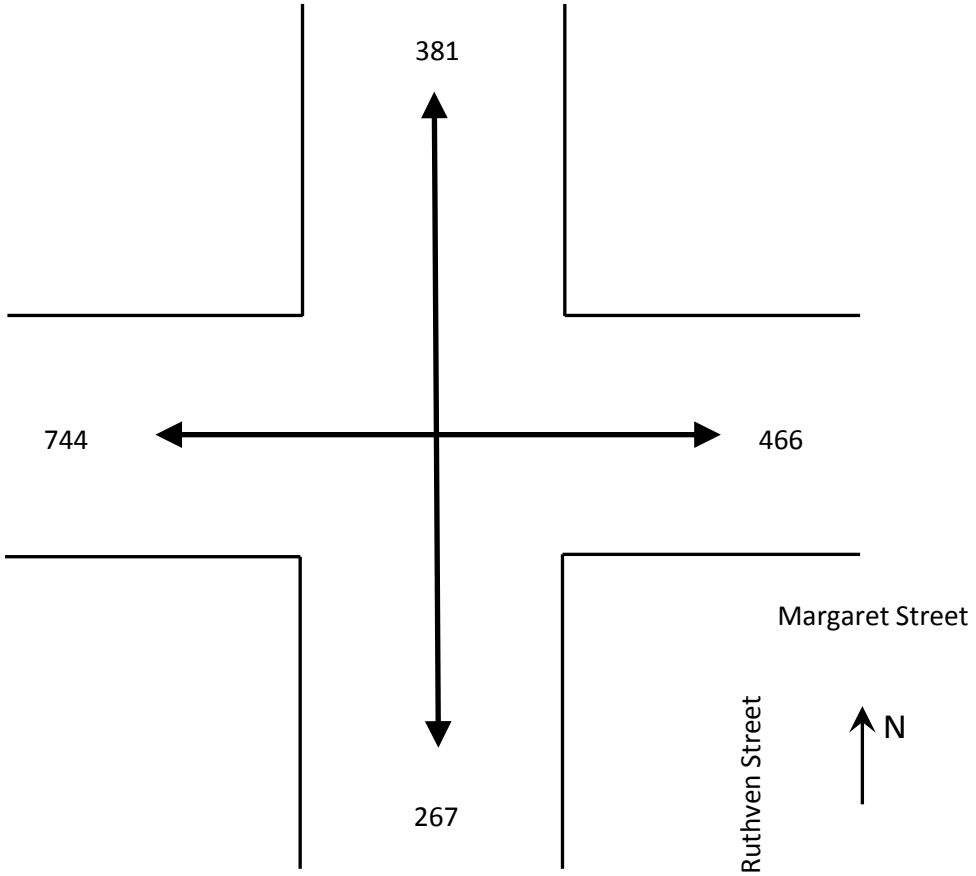
When determining total pedestrian volume, diagonal counts have been split 50 % in respective directions.

Time	↑		↑	↑	↑	↖	↗	↓		↓	↴	↳	↙	↘	→	→	↱	↳	←	←	↵	↰
0730	0	0	1	0	0	0	2	0	0	0	0	0	0	1	1	0	2	1	0	1
0745	0	1	0	0	0	1	1	0	3	1	0	0	1	1	0	1	2	3	0	4
0800	0	0	0	0	0	0	1	2	0	0	0	0	0	1	0	2	0	2	5	1
0815	4	1	1	2	0	1	1	2	3	5	0	0	2	3	1	0	3	4	1	3
0830	4	2	7	2	1	3	2	2	2	2	0	1	0	2	2	2	2	4	5	2
0845	5	3	6	5	0	5	2	2	3	5	3	0	3	3	2	2	5	3	4	2
0900	5	6	8	1	1	1	4	5	4	2	4	3	7	4	2	3	12	5	3	5
0915	5	5	7	4	3	7	2	13	3	2	1	0	14	4	1	8	8	17	14	3
0930	15	2	6	2	7	4	14	8	6	4	0	3	7	5	6	7	10	10	19	10
0945	10	10	6	4	3	2	11	9	6	12	10	10	12	13	6	6	14	5	16	5
1000	9	7	9	5	9	2	11	2	7	6	1	4	9	10	4	2	14	17	30	10
1015	14	4	17	0	2	3	7	5	4	4	3	4	10	12	9	2	20	6	25	17
1030	12	3	12	0	0	1	12	3	5	10	0	0	15	20	4	3	22	18	21	4
1045	10	9	10	0	8	6	1	8	5	8	0	0	11	15	9	4	18	20	10	7
1100	5	4	9	5	5	8	5	4	4	6	8	5	12	9	5	2	10	25	22	9
1115	9	5	11	2	4	2	11	1	6	9	2	0	9	11	5	0	15	17	26	5
1130	8	2	10	0	7	5	4	2	2	4	4	8	14	7	6	0	17	15	23	8

Time	↑		↑	↑	↑	↖	↗	↓		↓	↓	↓	↙	↘	→	→	→	→	←	←	←	←
1145	3	9	8	4	5	5	6	1	3	7	3	4	7	7	10	5	14	21	18	16
1200	8	5	9	3	4	7	2	5	8	7	5	3	7	19	4	1	12	24	15	2
1215	7	8	10	2	6	1	8	4	4	4	6	7	8	8	2	3	15	26	16	7
1230	5	2	11	0	1	6	7	6	6	4	0	7	10	14	6	4	9	29	21	5
1245	5	4	8	3	8	8	1	5	2	4	2	0	10	9	2	2	7	32	25	11
1300	7	5	21	6	3	2	1	2	5	8	1	0	12	12	2	1	12	15	15	10
1315	7	11	12	1	3	2	5	4	4	3	5	5	9	10	1	6	10	23	18	3
1330	12	15	9	7	2	0	10	4	3	6	1	4	12	20	6	4	10	12	5	0
1345	8	0	14	2	4	7	8	9	2	5	6	6	15	11	9	3	8	15	9	3
1400	5	7	8	1	5	1	1	6	0	6	0	3	8	12	15	8	6	20	19	7
1415	11	12	19	6	9	0	4	10	2	2	9	1	8	4	0	2	11	12	7	0
1430	13	3	14	6	2	3	3	3	4	4	4	1	16	9	1	5	9	5	10	0
1445	7	8	10	2	0	6	3	5	9	1	3	1	7	6	2	4	9	18	15	4
1500	2	2	15	6	4	5	4	3	7	5	2	5	4	9	3	4	12	4	13	3
1515	8	2	14	5	4	4	8	0	0	5	0	4	14	3	4	5	8	16	13	3
1530	2	3	9	2	1	3	1	2	5	4	2	1	5	11	5	5	9	9	13	1

Time	↑		↑	↑	↖	↗	↓		↓	↓	↙	↘	→	→	→	→	←	←	←	←
1545	3	4	4	0	0	1	5	0	11	3	3	0	6	8	3	2	2	6	4	4
1600	2	1	9	5	0	7	7	1	2	4	0	0	11	2	4	6	7	4	10	1
1615	3	0	4	0	0	0	0	2	5	4	0	0	4	2	4	5	5	2	0	0
1630	2	2	4	1	0	0	6	4	2	0	0	0	2	2	0	0	13	7	9	1
1645	0	0	0	1	0	1	1	0	6	2	4	0	2	8	2	0	3	2	2	3
1700	0	1	7	0	0	0	1	0	0	0	0	0	9	6	0	0	7	1	4	0
1715	1	2	1	0	0	0	2	0	0	0	0	0	8	0	0	0	4	1	0	1
Tot.	236	170	340	95	111	120	185	144	153	168	92	90	320	313	149	119	376	476	485	181

Intersection:	Ruthven Street / Margaret Street		
Date:	Sunday Total		
Time	Start:0730	Finish:1530	Period:10.0 hr
Weather:	Variable Generally Fine		
Green Time:	8 Seconds		
Total Time:	30 seconds		



See Next Page for Pedestrian Counts.

When determining total pedestrian volume, diagonal counts have been split 50 % in respective directions.

Time	↑		↑	↑	↑	↖	↗	↓		↓	↴	↳	↙	↘	→	→	↱	↳	←	←	↵	↰
0730	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0		
0745	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	0	0		
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0		
0815	1	1	1	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0		
0830	3	1	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	2	1	1		
0845	2	1	4	1	0	0	2	1	2	3	0	0	4	2	1	2	3	1	2	1		
0900	0	2	0	1	1	1	4	0	4	2	0	0	3	4	2	3	2	5	1	0		
0915	0	0	5	0	0	0	2	2	0	2	0	0	3	3	0	4	4	6	7	2		
0930	3	2	0	0	0	0	4	5	3	2	0	0	5	7	4	3	5	4	6	3		
0945	5	0	5	4	0	0	8	3	2	2	3	4	8	8	3	0	9	9	5	4		
1000	2	2	8	1	0	0	3	6	0	5	2	0	4	9	2	2	11	10	7	4		
1015	6	2	10	0	0	0	6	2	2	4	2	0	7	5	0	2	9	8	12	3		
1030	5	1	9	2	0	0	3	4	1	0	0	0	4	6	0	8	11	12	6	3		
1045	3	0	11	0	2	0	3	2	2	4	5	2	9	14	2	4	6	6	15	2		
1100	8	2	9	4	0	0	6	4	2	1	0	3	6	9	1	4	4	10	8	8		
1115	0	3	8	2	0	0	5	2	2	1	4	0	5	8	0	3	10	16	16	5		
1130	8	2	4	3	0	3	0	2	0	2	3	0	5	6	3	0	12	21	11	8		

Time	↑		↑	↗	↖	↖	↗	↓		↓	↴	↳	↙	↘	→	→	↱	↳	←	←	↵	↰
1145	1	5	9	2	0	0	2	4	3	1	0	1	8	4	0	0	10	16	15	4
1200	5	2	8	1	0	0	2	1	0	1	5	0	9	10	1	2	11	12	15	4
1215	5	2	11	0	0	0	4	2	4	0	1	0	9	18	0	1	8	6	4	3
1230	3	0	0	4	1	1	3	0	3	2	1	2	4	11	1	0	9	10	5	4
1245	3	4	8	3	0	3	6	3	1	2	2	0	8	10	1	0	6	4	4	2
1300	3	1	10	3	2	0	2	2	0	1	1	0	6	12	0	2	0	5	10	0
1315	3	1	6	1	0	6	0	2	2	0	0	0	5	9	3	0	10	5	5	4
1330	2	6	12	1	1	0	0	2	3	0	0	0	6	6	0	3	4	11	2	2
1345	0	0	0	0	2	0	5	0	2	0	0	0	5	8	6	0	9	10	15	3
1400	5	3	8	0	3	0	6	0	0	2	3	0	4	9	4	1	3	9	8	3
1415	5	3	8	2	0	0	0	3	3	0	2	0	3	8	5	1	4	6	5	3
1430	1	2	8	4	0	1	3	1	0	3	0	0	2	5	0	1	8	2	4	3
1445	2	0	6	2	0	0	6	2	3	0	0	0	3	6	2	1	3	9	0	1
1500	2	0	4	1	0	2	1	2	0	1	1	0	1	6	2	0	2	5	3	1
1515	1	1	4	0	0	0	1	2	1	0	1	1	0	0	1	0	5	3	0	0
1530	0	2	2	0	0	0	0	1	1	0	1	0	0	1	1	0	0	1	8	0

Time																				
1545	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	5	5
1600	0	0	2	0	1	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0
1615	0	0	0	1	0	0	1	0	0	0	0	0	0	0	3	0	0	2	1	0
1630	1	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0	2	1	1	0
1645	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0
1700	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
1715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1
Tot.	88	52	183	43	13	17	91	61	48	42	38	13	138	212	50	51	188	234	209	87