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Assessment item name: Final Project Report  
Assessment due date: 10-06-11  
Campus: Gold Coast

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<table>
<thead>
<tr>
<th>Industry partner/supervisor name:</th>
<th>mark mcgonagle</th>
</tr>
</thead>
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<td>Organisation name:</td>
<td>transport + main roads department</td>
</tr>
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<td>Industry partner/supervisor signature:</td>
<td>[Signature]</td>
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<td>Date:</td>
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EXTENDED JOURNAL ABSTRACT

This extended journal abstract is for submission in the Journal Accident Analysis and Prevention and has conformed to their submission standards.

Speed Limit Setting on Shared Paths

Abstract:
It has become common practice in the development of new bicycle facilities in Queensland to implement a speed limit to ensure the safety of all users of the facility, and to reduce the likelihood of litigation against the developer in the case of a conflict between users being attributed to excessive speed.

Currently there is no technical guidance on the implementation of speed limits available in Queensland resulting in speed limits being applied to facilities at the discretion of developers. This practice has created controversy amongst users, prompting the Department of Transport and Main Roads to address this gap in guidance.

Introduction:
Early transport engineering practices did not recognize the need to provide dedicated cycling facilities. Possibly attributed to the small proportion of cyclists. Recently, however, there has been a significant shift towards cycling, (Australian Bureau of Statistics 2003) and a growing push to provide cycling facilities to assist in mitigating some of the issues currently being experienced by populations in metropolitan centers, as well as regional areas. This has resulted in a dramatic increase in the cycling participation rate, meaning that in some locations more cyclists are required to share the same space.

Providing adequate cycling facilities to meet the needs of all users presents unique problems for modern transport engineers. Different users on the same path may have vastly different motivations, and therefore needs. Cyclists may be riding for recreation, leisure or sightseeing, or may be competitively training or commuting.

This project aims to address what is becoming a very politically sensitive topic by conducting a thorough evaluation on literature to determine national and international Standards and guidelines on
speed limits for cyclists. Methods for estimating conflict between cyclists and pedestrians will also be looked at.

This will be combined with an analysis on available data in an attempt to identify defensible justifications for the use of speed limits on shared paths.

**Literature Review:**

No recommendations for the use of speed limits for cyclists on off-road cycling facilities were uncovered either nationally or internationally.

The only example of a speed limit that could be found internationally was in Stanley Park in Vancouver. This speed limit was established as an additional measure of safety while a shared path was converted into a separated path. As that process is being completed the speed limit is being removed.

Several national and international publications suggest minimum design speeds for paths accommodating commuter cyclists should be 30km/h. This suggests that paths that meet current design standards should be able to safely accommodate bicycles travelling at this speed.

Several reports on crash modeling techniques were also reviewed, however modeling data shows that variables such the cyclists line of impact with the pedestrians centre of gravity and the mass of both parties can dramatically affect the probable outcome of a collision, making predictions about pedestrian injury based on cyclist speed difficult.

**Data Analysis:**

Crash data was requested from the Queensland Police Service (QPS) using the online crash database WebCrash for all crashes that have occurred in Queensland for the period 1992 to 2009. The results were 204 crashes, of which only 80 occurred on off-road facilities.

Figure 1 shows a breakdown of the pedestrian injury levels by the type of facility extracted from the WebCrash data.

![Pedestrian Injury Severity by Roadway Feature](image)

**Figure 1:** A chart displaying the frequency and severity of pedestrian injury arising
from pedestrian cyclist impacts on Queensland roads.

This data suggests that the highest risk of injury resulting from conflicts between cyclists and pedestrians occurs on the road. 61% of all recorded crashes occurred on the road, with 28% occurring on footpaths and only 11% occurring on bikeways. This may be due to cyclists using the roads being unprepared for a pedestrian to step out into their path, whereas on a footpath or bikeway there is a high frequency with which pedestrians are encountered, and therefore the expectation of pedestrian encounters, may result in cyclists being more alert to pedestrians.

Data was also obtained from four bicycle counters installed on pathways in Brisbane. A basic site description of each counter is included in Table 1.

Table 1: A table comparing preliminary observations of each counter recorded during initial the initial site visit.

<table>
<thead>
<tr>
<th>Description</th>
<th>Toowong Footbridge</th>
<th>Goodwill Bridge</th>
<th>Normanby Bikeway</th>
<th>Mowbray Park</th>
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</thead>
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<tr>
<td>Shared path:</td>
<td>Undivided</td>
<td>Shared path:</td>
<td>Divided</td>
<td>Shared path:</td>
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<tr>
<td>Grade</td>
<td>7%</td>
<td>3.8%</td>
<td>3.2%</td>
<td>0.5%</td>
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<tr>
<td>Crossfall</td>
<td>1.75%</td>
<td>1%</td>
<td>2.5%</td>
<td>3%</td>
</tr>
<tr>
<td>Path width</td>
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<td>6.8m</td>
<td>4.2m</td>
<td>3.1m</td>
</tr>
<tr>
<td>Shoulder Width</td>
<td>No shoulder</td>
<td>No Shoulder</td>
<td>No shoulder</td>
<td>0.2m - 0.7m</td>
</tr>
<tr>
<td>Sight Distance</td>
<td>50m +</td>
<td>20m</td>
<td>50m +</td>
<td>50m +</td>
</tr>
<tr>
<td>Average Daily Traffic</td>
<td>350</td>
<td>2200</td>
<td>550</td>
<td>450</td>
</tr>
</tbody>
</table>

The data from the counters was processed using the MetroCount software package. Speed data was distributed into bins of 1 hour’s duration, and then the average and 85th percentile speed of each speed bin was calculated. The results allowed average and 85th percentile speed to be graphed against path volume.

Figure 2: The graph of 85th percentile speed against path volume for the four locations analyzed.
This data shows that at times when the path is unoccupied, and therefore users are not required to modify their speed to accommodate other persons using the facility those users will set their travel speed dependant only on the current needs; however at increased path volumes average speeds become very consistent.

This may be due to cyclists self-moderating their speed to be appropriate to current conditions.

It is also noted that at the peak volume on each site the 85th percentile speed approximates the design speed.

**Community Consultation:**

As one motivating factor for this project stems from the attention this topic has been receiving in the media, which has in part been perpetrated by some vocal user organizations, it seemed illogical to not include a discussion component with users of the facilities in question.

The purpose of the consultation was to gain some perspective from people who use these facilities, on whether imposing speed limits will have an effect on safety, and whether cyclists will observe the speed limit.

The feedback received from members in attendance suggested decisively that the cycling community was opposed to the introduction of regulatory speed limits on shared paths. There was agreement however that there is a safety issue in some locations that needs to be addressed. A number of alternative treatment measures were discussed to address safety issues in place of a speed limit.

**Conclusion:**

A review of literature has demonstrated that speed limits are not used or recommended as a safety device. No mention of specific speed limits applying to cyclists applying to shared paths in national or international guidelines or standards, with the exception of the rule which states that the speed limit of the adjacent roadway shall apply to any road related area.
The speed limit in Vancouver serves as the only practicable example of a speed limit being used, and was clearly intended to meet a specific and immediate safety concern whilst a long term solution was implemented. It was imposed to act as a subtle suggestion, rather than a decisive order, for cyclists to exercise caution.

Methods currently being developed to model pedestrian cyclist conflicts were analyzed. This literature suggested potential outcomes of pedestrian cyclist impacts, however it was highlighted that there are variable factors that will dramatically alter the outcome of a collision.

An analysis was performed on a range of data available. Crash data suggested that the frequency of crashes between pedestrians and cyclists on footpaths and bikeways is extremely low, with an average of 4.7 crashes on off road facilities being recorded each year across the state of Queensland. In the 17 year period analyzed only two fatalities were recorded, and in both circumstances the crash occurred on the road.

Data sourced from traffic counters installed on shared paths in Brisbane suggested that at periods of higher volume there is more consistent speed on the paths, whereas when the path is unoccupied cyclists will travel freely at a broad range of speeds.

Counter data shows that the average speed of each facility at peak times approximates a reasonable design speed for each location. It is therefore posed that the cycling community is able to self moderate speeds that are appropriate to the location.

**Recommendations**

It is recommended that a trial phase be conducted in order to determine if there is a justification for imposing a speed limit on a facility, however from the research undertaken no defensible justification for imposing regulatory speed limits has been uncovered. There are a range of alternative treatment measures available for use to address the safety concerns that the use of speed limits targets.

Alternative treatment methods may be as or more effective as a safety device, however avoid the negative connotations associated with regulation. If a speed limit is to be imposed it is recommended that advisory speed signs be used in place of regulatory speed limits.

It is recommended that only sections of path that are below current design standards or have a localized safety hazard be assessed for speed limits.
Speed Limit Setting on Shared Paths

Nicholas Rees

S2592824

Submission Date: 10/06/2011 (Friday, Week 14, Semester 1)

Industry Partner: Transport and Main Roads
Industry Supervisor: Mark McDonald
Academic Advisor: Dr Kali Nepal

A report submitted in partial fulfillment of the degree of Bachelor of Engineering (Civil)

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EXECUTIVE SUMMARY:
Recently speed limits have been installed on new a few key bicycle projects in South-East Queensland. This has created controversy amongst user groups and in the media, as currently there are no technical guidelines for the provision of speed limits.

This IAP project has been created to serve as the first stage in addressing the lack of guidance that has been uncovered. The project aims to evaluate current practices both nationally and globally in the use of speed limits as a safety device for shared paths.

A thorough literature review was undertaken to determine what guidelines and standards currently exist.

Crash data available from the Queensland Police Service was used in conjunction with data from bicycle counters installed on shared path facilities around Brisbane. This was used to better understand the probable risk being experienced on shared paths in Brisbane.

A procedure has been developed to validate the conclusions of this report.

Finally, a consultation period was undertaken with members of the pedestrian and cycling community to canvas their views in relation to speed limits on shared paths, and suggest alternative treatment measures to address safety concerns.

This was used to base a series of recommendations on speed limits on shared paths.
ACKNOWLEDGEMENTS

It is necessary for me to offer my gratitude to a number of people who have provided invaluable assistance to me throughout the course of this project.

Firstly I would like to acknowledge Transport and Main Roads for allowing me the opportunity to undertake this project and supplying the resources required to complete it. Particular thanks however must go to Robyn Davies and Mark McDonald.

Mark McDonald took on the at times dubious challenge of being my industry supervisor, and was at all times willing to assist me in any way he could. Robyn Davies also offered her time and support, helping me through some of the more challenging times in the project, yet giving me the freedom to achieve my own goals.

Special thanks also need to be given to the wonderful staff at TMR. To Jon, Roberto, Michael, Jonathan, Kylie, Michelle, Kendrick and Carroll, you have each made a contribution to this project, and made my time at TMR more memorable.

I would also like to offer my thanks to the staff at Vancouver City Council for the efforts they went to searching for resources for me.

Thanks must be given to Dr Kali Nepal, my academic advisor from Griffith University on this project, for his assistance, guidance and feedback. The staff at the IAP office must also be acknowledged for their tireless efforts in organizing and running this program behind the scenes.

Finally I would like to extend my warmest thanks to my family and friends who have stood by me throughout this project. Whether you have brainstormed ideas with me, helped me to think about something else for a while or just listened to me talk on and on about something you don’t find interesting. Thank you.
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## LIST OF ABBREVIATIONS:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>BCC</td>
<td>Brisbane City Council</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Aided Design</td>
</tr>
<tr>
<td>CBD BUG</td>
<td>Central Business District Bicycle User Group</td>
</tr>
<tr>
<td>COG</td>
<td>Centre Of Gravity</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>MADYMO</td>
<td>Mathematical Dynamic Model</td>
</tr>
<tr>
<td>MUTCD</td>
<td>Manual of Uniform Traffic Control Devices</td>
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<td>QPS</td>
<td>Queensland Police Service</td>
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<td>Transport and Main Roads</td>
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<td>VCC</td>
<td>Vancouver City Council</td>
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<td>WRD</td>
<td>Wheeled Recreational Devices</td>
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1 INTRODUCTION

1.1 Background
Early transport engineering practices did not recognize the need to provide dedicated cycling facilities, possibly attributed to the small proportion of cyclists. Recently, however, there has been a significant shift towards cycling, (Australian Bureau of Statistics 2003) and a growing push to provide cycling facilities to assist in mitigating some of the issues currently being experienced by populations in metropolitan centers, as well as regional areas.

Providing adequate cycling facilities to meet the needs of all users presents unique problems for modern transport engineers.(Australian Bicycle Council 2010) Different users on the same path may have vastly different motivations, and therefore needs. Cyclists may be riding for recreation, leisure or sightseeing, or may be competitively training or commuting.

The provision of adequate cycling facilities is also restricted by early planning decisions, which often provided very limited cycling facilities. Consequently there are many instances where upgrading these facilities may be significantly restricted by space.

Governments and councils are dedicating funding to providing new facilities, and expanding the current network of off-road facilities.(Australian Bicycle Council 2010) The most frequent provision is the shared path, as these facilities can prove more cost effective for conditions where a path can be expected to have moderate demand by pedestrians and cyclists.

As the cycling participation rate increases, more users are required to safely occupy the same space. This problem is particularly prevalent in high traffic areas such as the Brisbane CBD, and arterial cycling routes such as the Bicentennial Bikeway. Consequently a number of different treatment measures are currently being researched and implemented to ensure the safety of all users.(Queensland Department of Transport 2003)

Encouraging active modes of transport, such as cycling, walking or jogging, can make significant improvements in the health of a population; reduce congestion and travel delays and reduce our carbon footprint and dependency on fossil fuels. (Arundell 2008) These points will be elaborated on further in this report.
The main justification behind this project is that speed limits have been established in recent years on shared paths around Brisbane. These facilities include the Goodwill, Kurilpa, Story and Gateway Bridges, as well as the foreshore in the Southbank Parklands. The Gateway has an advisory speed limit, whereas the others are all regulatory, but signed as 10, 15 or 20km/h. To your average cyclist or pedestrian, it may not always be clear why these facilities have speed limits, or why the speed limit on each facility is different. The absence of clarity in these limits, and feedback from the cycling community has exposed gap in technical guidance. (Queensland Department of Main Roads 2003) This project is the first step in addressing this.

1.2 Project Aims and Objectives

This project aims to address what is becoming a politically sensitive topic, which has many involved parties divided. It is indented that this will be achieved by conducting a thorough evaluation on the current literature, standards and guidelines available both nationally and from around the world. Additionally an analysis on available data will be undertaken in an attempt to establish whether there is a need for speed limits on shared paths in Queensland.

The findings of this research will be presented to some key relevant parties for comment, and subsequent recommendations and guidelines for implementing speed limits on shared paths shall be given.

1.3 Report Structure

This report covers the research undertaken during the project. As outlined in the Project Planning Report, the project has been broken down into a series of stages, the results of which are included in this report:

- Literature review;
- Data analysis;
- Procedure for evaluation;
- Community consultation.

In each stage of the project the results are presented and described. This precedes a discussion, and a series of recommendations.
2 LITERATURE REVIEW

2.1 The Growth of Bicycle Usage

Cycling is a form of active transport which has existed since the late 1800’s. Originally, cycling was a transportation mode reserved for the wealthy and elite, however, as technology has improved to a point where bicycles are affordable and reliable, and cycling is now an attractive transportation mode to an increasing proportion of the population.(Australian Bicycle Council 2010)

Data obtained by the Australian Bureau of Statistics (ABS) (Australian Bureau of Statistics 2003) from the national census conducted every five years includes data on the mode of transportation used to get to work. The trip to work data is valuable in determining the growth and decline of transport modes, and assists transport engineers to allocate resources appropriately. Data from the last 20 years shows significant growth in the use of bicycles, as shown in Figure 1. In 1986 there were only 10 suburbs in Brisbane that recorded more than 1% of residents using a bicycle to travel to work. In 1996 there were 45 suburbs with greater than 1%, extending beyond 12km from the CBD. In 2006 there were 76 suburbs with greater than 1%, with three suburbs recording greater than 7% of residents using a bicycle for trips to work.

Figure 1: Data from the ABS showing the increase in trips to work using a bicycle, by suburb in Brisbane. The data shows the growth of cycling over a 20 year period from 1986 to 2006. (a) 1986; (b) 1996; (c) 2006; (d) Legend (Australian Bureau of Statistics 2003)
Data available in the South East Queensland (SEQ) Principal Cycle Network Plan (Queensland Transport 2007) shows a significant growth in the provision of cycling facilities. In 2003 Brisbane City Council (BCC) had 92km of dedicated cycling routes. By the time of publication in 2007 this network had expanded to 223km, with a further 645km planned. This is a total of 868km of dedicated cycling facilities across the BCC.

2.2 Different User Types

Shared paths by nature accommodate a broad variety of different users. Conflicts often arise as a result of differing needs in relation to spatial positioning and speed, and a lack of recognition by users of the needs of users of different types. It is widely accepted that the use of shared paths inherently requires some compromise, due to the diverse range of needs users have of the facility.

Austroads 2009a recommends that where sufficient demand exists it is preferable to provide separated path facilities for the exclusive use of cyclists and pedestrians, however the costs associated with building a separated path can be prohibitive in some locations. High traffic paths are often in areas where space is not readily available, such as the CBD of major cities.

Users of shared paths include, but are not limited to:

Pedestrians – can include recreational walkers or joggers, children or the elderly, family groups and commuters. Some pedestrians may change direction suddenly or stop without warning.

Cyclists – cyclists of varying skill levels may be present on a path. Children and recreational cyclists may travel slowly and erratically, whereas commuters or competitively training cyclists may have a much higher desired speed.

Users with Disabilities – such as those with impaired vision or hearing may be unable to hear warning bells or see oncoming traffic. Shared paths may also accommodate users on mobility scooters or wheelchairs.

Wheeled recreational device users: Users of wheeled recreational devices (WRD) can include scooters, skateboards and rollerblades.
Others – From time to time shared paths may be used by maintenance workers, or members of the emergency services. Shared paths may also be used for sports such as horse riding, or fishing, and at times the path may form part of an area being used for a special event.

When users of different types are required to share the same space there can be a broad range of desired speeds on the path concurrently. Figure 2 shows box and whisker plots of the average speeds of different user types.

![Box and whisker plots of average speeds of different user types.](image)

**Figure 2**: The range of expected speeds by users of different types. (Shepherd 1994)

### 2.3 Details of off-road facilities utilized in South East Queensland

Current legislation in Queensland permits the use of bicycles on footpaths and roads except where “No Bicycle” signs have been erected (Queensland Department of Main Roads 2003). In addition to that there is a growing network of off road cycling provisions. These include exclusive bicycle paths, legally restricted to cyclists only; separated paths and shared paths. (Ker et al. 2006)
2.3.1 Exclusive Bicycle Path

Exclusive Bicycle paths are set aside for the exclusive use of bicycles only, and are designed to provide a high speed cycling route, generally along commuter corridors where very few pedestrians desire to use the path. Exclusive bicycle paths are rare, because few situations exist where a path will be desirable to a cyclist, but not so for a pedestrian. They are generally located along freeway or rail reserves.

2.3.2 Pedestrian Path

Generally, pedestrian only paths are only used in areas of significant pedestrian traffic, such as malls or shopping centers.

2.3.3 Separated Path

A separated path provides a physical or visual divide between pedestrians and cyclists, in order to designate the separated area each user is required to occupy. Separated paths can utilize pavement markings, surface colour treatments and regulatory signs to assist in separating users. This reduces the chance of conflict between users of different types, however separated paths are more expensive to install occupy more space.

2.3.4 Shared Path

A shared path is a type of off-road cycling facility which is accessible by pedestrians and cyclists. Shared paths are the most common type of facility due to the cost of constructing separated paths, limitations in the physical area available for a path and the versatility of a shared path, being accessible by all users listed in section 2.2. (Austroads 2009a)
Paths are frequently constructed through reserves, or along rivers or coastal areas, and as a result often offer pleasant and relaxing conditions that appeal to recreational users, however as these paths frequently fall on commuter routes as well, there is the potential for conflict between different users. As a result, shared paths need to be designed to a high standard which provides adequate path width and sight distances.

Austroads also recommends that shared paths should be used in situations where there is demand for both a cycling and a pedestrian facility, but where the demand is not expected to be sufficiently great to provide separated facilities.

2.4 Case Study: Vancouver, BC.

2.4.1 Background

On the 20th of January 1994 a motion was passed by the Vancouver City Council (VCC) that “a speed limit of 15km/h on recreational bicycle paths be approved as a pilot project for the Seaside Bicycle Route and the Stanley Park Seawall”. A policy report from the Vancouver Traffic Commission also states that the project is not to exceed 18 months in duration, and that a report is to be delivered to VCC at its conclusion. (Vancouver Traffic Commission 1995)

Both the Seaside Bicycle Route and the Stanley Park Seawall are primarily recreational routes, through the centre of Vancouver. They traverse popular beaches, parks and residential developments through central Vancouver. As a result they are both high traffic areas. Both paths are classed as shared paths, and at the time of installation there was no delineation between users of different type or direction.

There is no mention whether the speed limit was installed as an advisory speed limit, or a regulatory limit, however it is suggested that no additional police resources would be allocated to ensure compliance with the limit, nor does any documentation refer to any infringement being issued.

This motion was enacted in May of 1994 and paths were signed as 15km/h.
2.4.2 Initial observations:
Inconclusive results were obtained from speed checks undertaken before and after the installation. The recorded change in speed was minimal; however the average speed of cyclists was 18km/h, which was only marginally higher than the posted limit of 15km/h. Very few cyclists were observed to be travelling at greater than 25km/h.

The initial policy document from the Vancouver Traffic Commission suggests that whilst the speed limit signage does not alter the speed at which cyclists travel on the path, the signs provide a constant reminder to users that the space is shared, and therefore a reminder to cyclists to maintain a moderate speed. The speed limit is generally perceived to be beneficial, with no negative impacts being identified in the report.

2.4.3 Evaluations:
After an extensive search online for documents evaluating the successes of Vancouver’s shared path speed limit yielded no results, city officials were contacted directly. The information received is that since the installation of the limits on 1994 there has been no formal study into the speed limit of any form.

Since the installation of the speed limit, the majority of the shared path has been upgraded to a separated path, with entirely divided carriageways for users of different types. On sections of path that have been successfully divided, speed limit signs have been removed, and remaining speed limit signs are in the process of being removed as works on the path continue.

2.5 Methods for Implementing Speed Limits on Roads

2.5.1 Modern Speed Limits:
In most instances modern speed limits are set according to clearly defined criteria. Roads are given a hierarchical classification, and given a corresponding speed limit based on factors such as the frequency of intersections and access points. This method for speed limit setting is not appropriate for shared paths at this time. A large amount of research has been conducted in setting these guidelines, and currently the same research has not been undertaken for cycling facilities. (Austroads 2008, Austroads 2009b)
2.5.2 Crash Statistics:
An early tool used in setting speed limits was an analysis of crash data for a particular section of road. Roads were either classified by the crashes per km of road, or by the crashes per vehicle km on a stretch of road. This method of speed limit setting is not currently applicable to speed limits on shared paths, as there is currently insufficient crash data available. This may be due to low instances of conflict between users, or may represent a proportion of pedestrian cyclist crashes that go unreported.

2.5.3 85th Percentile Speed
Another early tool used in the setting of speed limits on roads was the 85th percentile speed. This refers to the speed under which 85% of motorists using a particular section of roadway will, under unrestricted and free flowing conditions, choose to drive. The theory behind this is that the collective mentality of drivers will be able to set a sensible and reasonable speed for the conditions on a particular roadway. The 85th percentile is selected to accommodate for a broader range of vehicular capabilities yet still account for a small proportion of the population who drive in excess of safe speeds.

While the use of the 85th Percentile speed is no longer recommended for use on roads, insufficient research has been done to create criteria based speed limit setting guidelines for bicycles, therefore may still be a beneficial tool in speed limit setting on shared paths.

2.6 International Technical Publications
2.6.1 CROW (Netherlands)
The Dutch organization CROW is a similar organization to Australia’s Austroads. CROW is a non-profit organization that works closely with national, provincial and municipal councils, as well as relevant consultancies and construction companies. CROW creates guidelines and recommendations for policy preparation, planning, design, management and maintenance.

In the Design Manual for Bicycle Traffic (Groot 2007) it is recommended that “a normal cycling speed is 15 to 20km/h” depending on the personal traits of the cyclist and the prevailing road and weather conditions. It does however recommend that for arterial or commuter routes a design speed of 30km/h should be adopted.
No guidelines or reference is made on speed limits.

2.6.2 American Association of State Highway and Transportation Officials:
Design guidance is provided in America by the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA). Both the AASHTO and FHWA recommend a design speed for bicycles be 20mph (32km/h) for bicycles. (AASHTO, 1991, 2004) It is acknowledged in the literature that free flowing cyclist speeds vary greatly, with values suggested between 10km/h and 28km/h.

No guidance is given on setting speed limits on shared paths.

2.7 Australian Technical Publications

2.7.1 Australian Road Rules:
A number of Australian Road Rules apply to the issue of conflict between cyclists and pedestrians. A full list of these has been attached in Appendix A of this report. These rules are in place to make recommendations about the behavior of different user types on shared paths, and currently no mention of speed limits applying specifically to shared paths is included in the Road Rules. (National Transport Commission 2009)

There is a clause in the road rules which states that the road speed limit shall apply to all road related areas. As shared paths are considered a road related area, this in effect means that there is a speed limit in place on all shared paths in Australia which is equal to that of the adjoining roadway. (National Transport Commission 2009)

2.7.2 Manual of Uniform Traffic Control Devices:
Technical guidance is also provided in the Manual of Uniform Traffic Control Devices (MUTCD) (Standards Australia 2000, 2008, 2009) for the provision of signage, including details of the regulatory signs shown in Figures 3 & 4.

Covered in the MUTCD Part 9, Bicycle Facilities, are details and specifications for the provision of all regulatory signs and pavement markings for bicycles, including those presented in Figure 3. These details include the positioning and spacing of signs, as well as
the minimum dimensions for signs and line markings. No technical guidance currently exists in the MUTCD for the provision of speed limits for cyclists.

In the MUTCD Part 4, Speed Controls, details of the types of speed limit currently recognized in Queensland. These are:

- General speed limits; often referred to as the default speed limit.
- Criteria based speed limits; based on a risk management approach, and are determined by the functional classification of the road.
- Special speed limits; used for temporary limits such as road works, or for special areas such as parks or camping areas.
- Speed zones; where a speed limit is applied to an area rather than a road, such as the Brisbane CBD.
- Variable speed limits.

The speed limit types that are applicable to this project are criteria based and special speed limits.

In the determination of criteria based speed limits on rural residential roads the road is first classified as an access, collector or trunk road, then the number of accesses per 100m is counted. Using these criteria an appropriate speed limit is read from Table 3.3. For this to be applicable to shared path facilities, research would be required to develop relevant criteria for shared paths.

Special speed limits are set at the discretion of the engineer; however details of appropriate uses of special speed limits are only given for vehicles and only for speed limits of 40km/h or above.

Speed Limit Sign Details:
MUTCD Part 4, Section 5 details speed control signs. (Standards Australia 2008) Sign number R4-1A is the smallest speed restriction sign recognized by the MUTCD. Measurements are 450mm by 600mm.
Figure 4: Current signage available in the MUTCD relating to speed. (a) the speed limit sign. This is the only regulatory speed limit sign recognized in the MUTCD. (b) The advisory speed sign. Speeds indicated on the advisory sign are not a speed limit, and are not regulatory.

The MUTCD does make allowance for a reduction in the minimum sign size to be applied on shared paths and bike ways. Currently the only sign that is approved to be reproduced is the standard “Give Way” sign, which has minimum dimensions of 750mm high for road use. Signs of height 375mm are permitted for use on shared paths and bikeways. The “Give Way” sign is a regulatory sign. It can be assumed from this that allowance can be made in the provision of regulatory signs to be reduced by half.

2.7.3 Austroads:

Current Australian publications relating to the provision of off-road cycling facilities in Australia are detailed in a recent publication from Austroads “Cycling aspects of Austroads Publications”. This publication contains key information sourced from Austroads guidelines, primarily the Guide to Road Design, Guide to Traffic Management and Guide to Road Safety publications. (Veith, Eady 2011)

Austroads suggests that the operating speeds of bicycles are influenced by a range of human and environmental factors, including the purpose of trip, type of bicycle, cyclist age and the condition of the facility. It is noted that some cyclists can maintain speeds greater than 35km/h, significantly greater for downhill inclines. Austroads therefore recommends where possible that a minimum design speed for cyclists be 30km/h.

Austroads recommends that for a shared path catering to commuter or recreational users and a design speed of 30km/h the minimum path width should be 3.0m, however if the path is to cater to commuter and recreational users, a minimum path width of 3.5m is recommended.
In situations where the design of a path is not constrained by topography, space or other physical features it is desirable to provide a path with large radius curves and straights, however this is not always possible. For a path with a design speed of 30km/h the minimum curve radius should be 25m and the minimum stopping sight distance should be 35m for flat terrain, increasing to 45m for paths with a downhill gradient of 10%.

No guidelines or reference is made on speed limits for bicycles.

2.7.4  VicRoads:

VicRoads, Cycle note number 10 (shared path behavioral signs) (VicRoads 2001) provides details of behavioral signage available for use on shared paths in Victoria. This document is also referenced in the NSW bicycle guidelines. (Roads and Traffic Authority 2003)

Vicroads suggests using four different behavioral signs to encourage path users to behave in a predictable fashion. These signs also serve to educate all paths users on appropriate behavior and etiquette on the path.

![Behavioral signs recommended for use on shared paths by VicRoads.](image)

(a) Warn When Approaching signs encourage path users to call out or use their bells. (b) Keep Left signs encourage all path users to travel on the left. (c) Stop off Path signs encourage path users to keep the path clear. (d) Control Your Dog signs remind dog owners of their responsibilities.

Figure 5: Behavioral signs recommended for use on shared paths by VicRoads. (VicRoads 2001)
The use of these signs is recommended at all major access points, in the configuration shown in Figure 6 (a) or (b), and intersections along the length of a path. Signs should also be installed periodically along the length of a path, however excessive sign usage is warned against as they can increase visual clutter and installation expense, and may actually reduce the effectiveness.

![Figure 6: Group sign design for shared path behavioral signs (a) Preferred design. (b) Alternative design where space is limited.](image)

Individual signs may also be installed at particular locations to address specific issues. For example the Control Your Dog sign may be installed in a location known to be popular for dog walkers.

2.7.5 Roads and Traffic Authority NSW:

In 2003 the Roads and Traffic Authority (RTA) of NSW published the NSW Bicycle Guidelines. (Roads and Traffic Authority 2003) These guidelines recommend a design speed of 30km/k for bicycle path, although make allowances for paths functioning as local access routes and recreational only paths to be designed for 20km/h speeds.

The guidelines do however acknowledge that under some circumstances speed control devices may need to be used to limit the speed of cyclists on paths. Suggested areas that may require speed control devices are at the entry to paths and in areas shared with pedestrians. The speed control devices currently suggested for use in the NSW bicycle guidelines are included in Table 1.
Table 1: Path speed limiting devices for bicycles recommended in the NSW bicycle guidelines. (Roads and Traffic Authority 2003)

<table>
<thead>
<tr>
<th>Device</th>
<th>Recommended</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed humps</td>
<td>No</td>
<td>Can destabilise riders and increase hazards</td>
</tr>
<tr>
<td>Path narrowing</td>
<td>Yes</td>
<td>Minimum one-way width 1.4m. Warning signage and adequate linemarking required</td>
</tr>
<tr>
<td>Path deflection</td>
<td>Yes</td>
<td>Maximum deflection angle 10 degrees for high-speed path and 20 degrees for low-speed path</td>
</tr>
<tr>
<td>Path terminal deflection rails</td>
<td>No</td>
<td>Can destabilise riders and increase hazards if used as speed limiting device. Used only to prevent unauthorised vehicle entry</td>
</tr>
<tr>
<td>Rumble strips</td>
<td>No</td>
<td>Used only as a warning device to alert riders to changed conditions ahead</td>
</tr>
<tr>
<td>Warning signage</td>
<td>Yes</td>
<td>Used to warn of approaching hazard and to advise of need to reduce speed. Used in conjunction with other methods</td>
</tr>
<tr>
<td>Holding rails</td>
<td>No</td>
<td>Not recommended at all by these guidelines</td>
</tr>
<tr>
<td>Bollards</td>
<td>No</td>
<td>Not recommended as a speed control device. Only used to prevent unauthorised vehicle entry</td>
</tr>
<tr>
<td>Alternative paving</td>
<td>Yes</td>
<td>Use different materials and colours</td>
</tr>
</tbody>
</table>

It is of significance that whilst the guidelines do acknowledge the need to limit cyclists speed in some instances, there is no mention of using speed limits. Warning signs, which would include the use of speed limit signs, are suggested as a means of alerting a cyclist of an approaching hazard; however it is recommended that warning signs should not stand alone, rather that they need to supplement other methods of limiting speed.

2.8 Alternative Treatment Methods

The methods suggested in the NSW Bicycle Guidelines for limiting path speed are also recommended in the Australian National Cycling Strategy (Australian Bicycle Council 2010) and the Queensland Cycle Strategy (Queensland Department of Transport 2003). Some key treatment measures that can be installed to meet the safety concerns being addressed with a speed limit are detailed here:

- Centerline
A centerline is simply used to provide delineation between lanes of opposing flow. This acts as a subtle reminder to all users to remain on the left hand side of a path, even when there is no opposing traffic.

Centerlines are easy to install, needing only a white pained line down the centre of a path. They require very little maintenance and are appropriate for use on all two way moderately trafficked facilities.

- Surface treatments
Surface treatments are used as a means of alerting a user that the conditions may have changed. Frequently surface treatments involve the use of different colour treatments to denote a unique path feature, such as cycle lanes on separated paths being painted green. Other examples include the use of different paving materials to suggest different conditions, such as a paved walkway adjacent to a bitumen sealed bikeway on a separated path.

Different surface treatments are also used to denote intersections with major pedestrian routes, such as in front of ferry terminals. They have been shown to be effective in reducing conflicts as they alert a cyclist to the possibility of unexpected events.

- Warning signage
Warning signs used to specifically alert a user to the presence of a danger. This could include a narrow section of path or a sharp bend. The use of warning signs can be an effective way of treating localized hazards.

Advisory speed signs such as those in figure 4 (b) could be used effectively to alert cyclists to the presence of a hazard requiring them to slow down.

2.9 Crash Modeling Techniques
Cycling safety is a significant concern for road safety authorities and cycling organization; however there has been very little research into different types of crashes experienced by riders, especially compared to the volume of research available for crash modeling of vehicles. The difficulty faced with reconstruction of pedestrian cyclist conflicts is the complex...
kinematics involved in a bicycle collision. Data collected at the scene of an accident is often insufficient to reconstruct the impact velocities.

Pang et al (Pang et al. 2008) attempts a series of crash reconstructions using a Mathematical Dynamic Model (MADYMO) solver, in order to develop a generic computer model of a cyclist to simulate a rider in an accident. The results of this model showed that crash simulations can be reconstructed using MADYMO; however no simple methodology for estimating impact speeds without conducting a complete reconstruction of the crash.

This can be explained by Short et al (Short, Grzebieta & Arndt 2007) who also used MADYMO technology to estimate collision velocities between pedestrians and cyclists. The report suggests that reconstruction equations used in vehicle accidents cannot be applied to cyclist pedestrian impacts. There are a number of widely regarded methods for predicting the pedestrian throw distance from conflicts between pedestrians and vehicles; however no specific method currently exists for pedestrian cyclist impacts.

In the study the MADYMO software was used to test the effect a range of parameters had on the final throw distance of the pedestrian. These included the mass of the cyclist and pedestrian, as well as the pedestrian height. The study also modified the coefficient of friction of the path surface.

Of greatest significance to this report however was the ascertainment that significant throw distances were only achieved when the line of impact was close to the pedestrian’s centre of gravity (COG). Figure 7 is extracted from the report to demonstrate the likely outcome of an impact off centre.

During the research only crashes where the line of impact was directly on the COG were analyzed, however it is noted in the findings that the outcomes would only apply to crashes of that nature. The results of the modeling are shown in Figure 8. If the range shown by different combinations of cyclist and pedestrian mass and path surface friction coefficient can be taken to represent a range of values likely to be experienced in real world collisions, then the data shows a relatively linear relationship between the cyclist impact speed and the likely throw distance for the pedestrian.
The study by Short et al relies on a direct hit on the COG. This is an extremely unlikely impact point on a shared path. For impacts to occur on the COG a cyclist would need to be in the full tuck position, as shown in Figure 7, and not look up before impact. When riding on a shared facility there is an expectation that pedestrians will be encountered, so it is unlikely that a cyclist on a shared path will be in this position.

The range of alternative locations where the initial strike could have occurred are considered more likely impact points, and would greatly affect the outcome of a crash with regard to injury severity.
Figure 8: The results of modeling conducted by Short, Grzebieta & Arndt (2007) showing the modeled relationship between cyclist impact speed and pedestrian throw distance.

The data in Figure 8 suggests that even in crashes where the line of impact matches the COG there is still a broad range of outcomes present for crashes at all speeds. This is due to the mass of both the cyclist and the pedestrian being variable. Whilst the data presented in Figure 8 provides some data on the potential outcome of a pedestrian cyclist crash, the data should be considered as the worst outcome of an incident.

3 DATA ANALYSIS

3.1 Crash Data
Crash data was obtained from the Queensland Police Service (QPS) using WebCrash from 1992 to 2009. WebCrash is an online database for crashes recorded by the QPS on Queensland roads, which allows registered users to analyze a broad range of crash information. There is a data lag while records are validated of approximately 18 months, therefore to ensure the integrity of the data only the period up to 2009 was used.

For the 17 year period a total of 204 crashes between pedestrians and cyclists were recorded across the state of Queensland. This equates to an average of 12 crashes per year on roads,
footpaths and bikeways. It is noted however that a significant proportion of accidents involving only bicycles or bicycles and pedestrians go unreported. (Graw, König 2002) Roads were the most represented facility in this, with 61% of all recorded crashes. Footpaths were the site for 28% of crashes, whilst 11% occurred on bikeways. Note: There is no indication given in the crash data whether “bikeway” refers to shared, separated or exclusive bicycle facilities.

Observed trends to emerge from the description of crash circumstances suggest lighting is a frequent contributing factor, with several references to unlit paths, cyclists not using lights and pedestrians wearing dark clothing in areas of low light. Rain is also frequently mentioned. It is noted that a cyclist does not have a windscreen or visor to deflect incoming rain, so cyclists may reduce the distance that they look ahead so as to minimize rain hitting the face and eyes. Pedestrians emerging from behind concealed objects, such as parked cars, are also noted in 16 crashes.

Crash data has been classified by injury severity and the type of facility the crash occurred on. The data presented in Figures 9 and 10 represent the same set of recorded crashes, however show the relative injury severity sustained by the pedestrian and the cyclist from the same crashes.

**Figure 9:** A chart displaying the frequency and severity of pedestrian injury arising from pedestrian cyclist impacts on Queensland roads.
Figure 10: A chart displaying the frequency and severity of cyclist injury arising from pedestrian cyclist impacts on Queensland roads.

This data suggests that the highest risk of injury resulting from conflicts between cyclists and pedestrians occurs on the road. 61% of all recorded crashes occurred on the road, with 28% occurring on footpaths and only 11% occurring on bikeways. This may be due to cyclists using the roads being unprepared for a pedestrian to step out into their path, whereas on a footpath or bikeway there is a high frequency with which pedestrians are encountered, and therefore the expectation of pedestrian encounters, may result in cyclistst being more alert to pedestrians.

The data also suggests that in a conflict between a pedestrian and a cyclist, the pedestrian is at the greater risk of injury. Two theories are presented as to the reason for this. Firstly, vulnerable users such as the elderly, or small children are unlikely to be cycling, that is to say that there is a higher probability that the cyclist will be fit and healthy and less likely to sustain major injuries from a comparable impact. The second reason suggested for this is that in Australia it is a regulation that cyclists must wear a helmet at all time when cycling. The helmet is designed to protect the head during an impact. Impacts to the head have been shown to be the worst cause of major or fatal injury between pedestrians and cyclists. No specific studies have been conducted to confirm the lower rates of injury sustained by the cyclist in pedestrian cyclist conflict.
Further data was extracted from WebCrash from the same period of 1992 to 2009 to show crashes that have occurred between pedestrians and vehicles and bicycles and vehicles. This data is presented in Table 2.

**Table 2:** A table showing the injury severity of crashes recorded for pedestrians and cyclists. This table serves as a comparison of injury levels between pedestrian cyclist crashes and vehicle impacts.

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>Minor Injury</th>
<th>Medical Treatment</th>
<th>Hospitalisation</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian injury from cyclist</td>
<td>9</td>
<td>22</td>
<td>92</td>
<td>79</td>
<td>2</td>
</tr>
<tr>
<td>Cyclist injury from pedestrian</td>
<td>122</td>
<td>38</td>
<td>25</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>Pedestrian injury from vehicle</td>
<td>0</td>
<td>70</td>
<td>160</td>
<td>224</td>
<td>46</td>
</tr>
<tr>
<td>Cyclist injury from vehicle</td>
<td>6</td>
<td>91</td>
<td>243</td>
<td>152</td>
<td>8</td>
</tr>
</tbody>
</table>

This data shows that the risk posed to cyclists by riding on the roadway is significantly higher than the risk posed to pedestrians by requiring they use a space shared with cyclists. Whilst specific details of all vehicle crashes have not been analyzed in this report, and therefore it cannot be directly suggested that the level of cyclist injury from vehicle crashes relates to cyclists travelling along the roadway or crossing the roadway, it does suggest the need to provide off-road facilities for cyclists.

### 3.2 Traffic Counters

Traffic counters have been installed on shared path facilities at various locations around Brisbane. These counters are similar to axle counters installed on roads to monitor vehicular traffic, by recording the time, direction and speed of a passing vehicle. Before the installation of these devices, engineers relied on modeled flow data based on sporadic survey counts that frequently did not include speed recordings. The accuracy of the conclusions that can be drawn from this data is far greater than survey results.

#### 3.2.1 Counter Descriptions:

In total there are 11 counters installed on Brisbane shared paths, however for the purpose of this report only four (4) have been selected for use. Counters have been excluded from this analysis in cases where the counter has been recently installed or have been decommissioned, as sufficient data is unavailable to make an accurate analysis. On the Normanby Bikeway there are two (2) counters installed in relatively close proximity to each other (<1km), therefore only the eastern counter has been selected for analysis.
The approximate location of the counters was known, so the location of all recorded crashes analyzed in chapter 3.1 was imported into MapInfo, a software package which is able to apply a series of layers to a map, including data points, CAD layers of topographic or geographic features and aerial imagery. The results of this showed that no recorded accident has occurred on a section of path that has a counter installed, therefore crash details cannot be specifically compared to known data about the behavior of cyclists at the location of the crash.

Initially, site descriptions were sought from each counter, so a site visit was arranged to each counter location, and details of the site conditions relevant to the project were recorded. The data obtained from each site includes:

Grade and crossfall
Path width and shoulder width
Sight distance

The four (4) counters being analyzed in this report are:
The Toowong Footbridge
Goodwill Bridge
Normanby Bikeway (east)
Mowbray Park

The Toowong Footbridge is primarily a commuter route. It is located approximately 5.3km from the Brisbane CBD and forms a connection over the Western Motorway. The footbridge is also located at the base of Mt Coot-Tha, and consequently the speeds recorded at this location may be skewed by cyclists maintaining a high speed after the descent. The counter itself is located close to the bottom of the ramp leading onto the bridge on the Mt Coot-Tha side. This may also skew results as cyclists travelling toward Mt Coot-Tha will have just descended a 7% grade ramp. Hence, the data presented on Toowong Footbridge may not be representative of the path as a whole.

Goodwill Bridge is a highly trafficked pedestrian & cyclist bridge connecting the Queensland University of Technology (QUT), located adjacent to Brisbane’s CBD, with Southbank. It is a primary pedestrian and cycling route used by commuters, students and recreational users, therefore speeds recorded on this facility are expected to be lower than on other paths.
Normanby Bikeway is also primarily a commuter cyclist route; however being located 1.5km from Brisbane’s CBD, forms an arterial purpose for commuter to gain access to the city.

Mowbray Park is primarily a commuter bike route running through a recreational park on the banks of the Brisbane River, located approximately 4km from the CBD. It is the only facility being analyzed in this report that has shoulders accessible by cyclists, however also has the narrowest path width. The Mowbray Park counter is located at the bottom of a small valley, beyond the entry to the park from Laidlaw Parade. The positioning of this counter at the low point may result in speed values higher than what should be indicative of the path as a whole.

Each of these counters was also selected as it presents unique conditions to the project. The basic conditions at each bicycle counter are recorded in Table 3. This shows that the four selected sites have significant variations in the path width and grade. A detailed site description of each site is included in Appendix C of this report.

Table 3: A table comparing preliminary observations of each counter recorded during initial the initial site visit. Table also includes the average daily cycle traffic experienced on the path.

<table>
<thead>
<tr>
<th>Description</th>
<th>Toowong Footbridge</th>
<th>Goodwill Bridge</th>
<th>Normanby Bikeway</th>
<th>Mowbray Park</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shared path; Undivided</td>
<td>Shared Path; Divided</td>
<td>Shared path; Divided</td>
<td>Shared Path; Undivided</td>
</tr>
<tr>
<td>Grade</td>
<td>7%</td>
<td>3.8%</td>
<td>3.2%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Crossfall</td>
<td>1.75%</td>
<td>1%</td>
<td>2.5%</td>
<td>3%</td>
</tr>
<tr>
<td>Path width</td>
<td>4.5m</td>
<td>6.8m</td>
<td>4.2m</td>
<td>3.1m</td>
</tr>
<tr>
<td>Shoulder Width</td>
<td>No shoulder</td>
<td>No Shoulder</td>
<td>No shoulder</td>
<td>0.2m - 0.7m</td>
</tr>
<tr>
<td>Sight Distance (to city)</td>
<td>50m +</td>
<td>20m</td>
<td>50m +</td>
<td>50m +</td>
</tr>
<tr>
<td>Sight Distance (from city)</td>
<td>50m +</td>
<td>50m +</td>
<td>50m +</td>
<td>30m</td>
</tr>
<tr>
<td>Average Daily Traffic</td>
<td>350</td>
<td>2200</td>
<td>550</td>
<td>450</td>
</tr>
</tbody>
</table>

At each location a 2 week data set was selected from each season, and then analyzed. Doing this ensured a sufficient sample size from which to draw conclusions, and also allowed observations to determine any seasonal variations to be observed at each site.
3.2.2 Pedestrian Volumes:

An error in the data capture only resulted in pedestrian counts only being available for Toowong Footbridge and Mowbray Park. The data suggested that for both facilities pedestrians accounted for 17.5% of all users on the facility.

3.2.3 Class Speed Matrix:

Initially, trends in average speed were sought on each facility. The MetroCount Software package was used to produce the class speed matrix output. This function arranges speed data into bin groups of 10km/h and provides a total of the counts made in that speed group over the data period requested. The results of this extraction are included in Table 4, and an example of the MetroCount Software output has been included in Appendix B.

Table 4: A basic speed profile of each bicycle counter location. Recorded speeds are displayed in bins of 10km/h, and the percentage of speeds within that bin recorded. Note: No comparison of volume should be drawn from the data presented in this table. The data sets presented are similar, however due to the nature of the data captured do not represent exactly the same time period.

<table>
<thead>
<tr>
<th>Speed km/h</th>
<th>Toowong Footbridge</th>
<th>Goodwill Bridge</th>
<th>Normanby Bikeway</th>
<th>Mowbray Park</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>10 – 20</td>
<td>212</td>
<td>0.6</td>
<td>54410</td>
<td>48.3</td>
</tr>
<tr>
<td>20 – 30</td>
<td>3271</td>
<td>9.6</td>
<td>50331</td>
<td>44.7</td>
</tr>
<tr>
<td>30 – 40</td>
<td>28467</td>
<td>83.8</td>
<td>3205</td>
<td>2.8</td>
</tr>
<tr>
<td>40 – 50</td>
<td>1928</td>
<td>5.7</td>
<td>5</td>
<td>0.0</td>
</tr>
<tr>
<td>50 – 60</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0.0</td>
</tr>
</tbody>
</table>

The data presented in Table 4 is consistent with the description of path use. Toowong Footbridge has the highest average speed, at 34.5km/h. This may be slightly elevated on account of cyclists riding down Mt Coot-Tha retaining speed from their descent. The data could also be elevated due to the relatively steep grade experienced by cyclists coming off the bridge, however elevated average speeds can be expected on paths of a good design standard with low volumes of cyclists and minimal usage by pedestrians. (Veith, Eady 2011)
The data for Mowbray Park and Normanby Bikeway are similar, with the median speed bin for both facilities being 20 – 30km/h. The average speed recorded on the Mowbray Park counter was 26.6km/h, 3.8km/h faster than the average speed on Normanby Bikeway, at 22.8km/h. This may be on account of the counters location at the bottom of a small valley; however it is of some concern given that the path runs through a park. Despite pedestrians being encountered on the Normanby Bikeway it is a more controlled environment. In a park setting there is the possibility of people inadvertently entering the path space, such as a child chasing a ball. Mowbray Park is equipped with playground equipment and BBQ facilities, so the potential for conflict with people partaking in leisure or recreational activity is increased.

The data shown for Goodwill Bridge shows the slowest average speed, at 20.2km/h. This is consistent with expectations despite being the widest facility analyzed in this report. The high volumes of pedestrian traffic that have been observed on the facility require cyclists to ride at a slower speed.

The lower speeds recorded at the Goodwill Bridge counter could also be attributed to the plaza located 20m towards the city from the counter. Approaching the entrance to the plaza there is a concealed entry point. The presence of this combined with a change in location may prompt cyclists to reduce their speed in anticipation of interactions with pedestrians.

3.2.4 Rolling Day Totals:
An analysis of data was undertaken to determine the effect of increased traffic on average speed. This was done using the Rolling Day Totals function of the MetroCount software. Counter data was arranged into bins of one hour duration, and both the average and 85th percentile speed of each bin was calculated. The data was then graphed to observe any apparent trends. The average speed is presented showing all data points, and then again only displaying data with more than 20 cyclists per hour. As shown in the data this is due to the broad range of average speeds observed when the path is relatively unoccupied. The 85th percentile speed is only calculated for volumes greater than 10 cyclists per hour.
Figure 11: Results of the analysis on the Toowong Footbridge counter, showing the average speed and 85th percentile speed as the observed volume of cyclists per hour changes. (a) Average speed displaying all data points. (b) Average speed for cyclist volumes greater than 10 cyclists per hour. (c) the 85th percentile speed of cyclists.
Figure 12: Results of the analysis on the Goodwill Bridge counter, showing the average speed and 85th percentile speed as the observed volume of cyclists per hour changes. 

(a) Average speed displaying all data points.  
(b) Average speed for cyclist volumes greater than 10 cyclists per hour.  
(c) the 85th percentile speed of cyclists.
Figure 13: Results of the analysis on the Normanby Bikeway counter, showing the average speed and 85th percentile speed as the observed volume of cyclists per hour changes. (a) Average speed displaying all data points. (b) Average speed for cyclist volumes greater than 10 cyclists per hour. (c) the 85th percentile speed of cyclists.
Figure 14: Results of the analysis on the Mowbray Park counter, showing the average speed and 85th percentile speed as the observed volume of cyclists per hour changes. (a) Average speed displaying all data points. (b) Average speed for cyclist volumes greater than 10 cyclists per hour. (c) The 85th percentile speed of cyclists.
Each counter site was graphed for each season, however the results on all facilities were extremely similar. The full data set for each season at each location has been included in Appendix D of this report, however only one data set for each site is presented here.

It was initially predicted that the data would show that as the path became more crowded the average speed would drop. It was suspected that increased volumes of path use would increase the frequency of delay caused by obstruction by other users, such as waiting for a safe passing gap to pass a slower cyclist. It was predicted that these delays would become apparent in the data.

This was discredited by initial manipulations made on the raw data captured by the counters which suggested an increase in average speed as the path volume increased. Initially it was suspected that this could be caused by groups of cyclists training competitively skewing the data positively, however once graphed the data showed that as path volumes increase the average speed becomes very consistent, therefore discounting the theory that groups of cyclists travelling at one consistent speed could be skewing the data.

A linear trend line was added to each graph, which served to reinforce this initial observation on the data. In each example presented in this report, the trend line shows a slight positive slope. This was consistent for all data sets analyzed.

One theory as to why the data may suggest this is that at periods of high use, inexperienced or nervous cyclists may opt to use an alternative facility, or not to participate in the activity until a later time. Being that each route is used by commuter cyclists it maybe the case that in situations where the path is heavily trafficked the proportion of experienced commuting cyclists is over represented in the data, pushing average speeds up, whereas outside of peak commuting times path users are made up more of recreational users.

Another theory is that some cyclists behave competitively on the path, in that a cyclist travelling above the average speed may act as a pace setter, prompting slower cyclists to travel faster in order to keep up. It is also proposed that a decrease in wind resistance occurs during periods of high flow. Peak hourly volume on the path through Mowbray Park is shown to be approximately 600 cyclists per hour. In a 50/50 directional split situation this equates to an average following gap of 12 seconds, however being a commuter route the directional split...
is significant with cyclists heading towards the city in the morning and returning home in the afternoon.

Specific knowledge of the directional split for these data points is unknown, however if a 75% split is assumed the average following gap is 9 seconds. At 32km/h this is a following distance of 80m. While travelling at a distance of 80m the effects of reduced wind resistance would not be felt, there is a higher probability at higher cyclist volumes that cyclists would be travelling together. This effect may account for a small proportion of the increase in average speed at higher volumes.

The data also shows that for the Goodwill Bridge, Normanby Bikeway and Mowbray Park facilities, which experience larger volumes of cyclists per hour, a distinct decrease in average speed at mid range values of volume. This can be seen between 500 and 100 cyclists per hour on the Goodwill Bridge, and between 200 and 300 cyclists per hour on the Normanby Bikeway and Mowbray Park. This trend is not observed on the Toowong footbridge, and it is suggested that this is related to the comparably low peak cyclist volume.

One theory to explain the decline in speeds is that the dip may correspond to recreational users, whereas the data points above the dip on the trend line may correspond to commuter cyclists. This is consistent with recommendations made in Austroads that commuter cyclists have a higher desired speed than recreational cyclists. This is also explained by the paths status as key commuter routes accounting for the higher volumes recorded for higher average speeds.

Potentially the most significant outcome of the counter data analysis is the apparent change in the range of average speeds that is experienced on the path as the volume of cyclists changes. Figure (a) in each of the data sets represents the average speed recorded for all data points. This is included in the report to demonstrate the increased speed range observed when the path is unoccupied. This trend is detailed in Table 5 which shows the total average speed range recorded when data values from periods of low occupancy are included.
Table 5: Raw data extracted from MetroCount Software showing the range of average speeds recorded for different volumes of cyclists per hour. The 85th Percentile speed is also displayed for the highest volume recorded.

<table>
<thead>
<tr>
<th>Volume (cyclist/h)</th>
<th>Toowong Footbridge</th>
<th>Goodwill Bridge</th>
<th>Normanby Bikeway</th>
<th>Mowbray Park</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10</td>
<td>15.0 – 44.8</td>
<td>1.9 – 29.9</td>
<td>1.0 – 33.8</td>
<td>3.7 – 32.4</td>
</tr>
<tr>
<td>Greater than 10</td>
<td>23.2 – 38.0</td>
<td>13.0 – 24.5</td>
<td>14.6 – 26.6</td>
<td>16 – 29.4</td>
</tr>
<tr>
<td>Highest recorded</td>
<td>35.7</td>
<td>19.8</td>
<td>23.6</td>
<td>27</td>
</tr>
<tr>
<td>85th Percentile</td>
<td>39.2</td>
<td>25.6</td>
<td>29.5</td>
<td>31.3</td>
</tr>
</tbody>
</table>

It is interesting to note that on the Goodwill Bridge, Normanby Bikeway and Mowbray Park facilities the slowest recorded speed approximates the Austroads suggested pedestrian walking speed of 1.4km/h (Austroads, 2009a), whereas the lowest recorded speed on the Toowong footbridge was 15km/h. As previously mentioned however this may be due to the specific location of the counter, not a representaion of the path as a whole.

This trend suggests that at times when the path is unoccupied, and therefore users are not required to modify their speed to accommodate other persons using the facility that users will set their travel speed dependant only on the current needs. This data reinforces the notion presented in the literature review that cyclists using shared paths may have a wide and varied rage of motivating factors for using the facility, and hence the range of speeds that needs to be designed for is large.

At a volume of less than 10 cyclists per hour, which equates to a flow equal to or less than one cyclist per six minutes, a path of good design standard of width and sight distance may be able to safely accommodate athletic or competitive cyclists looking to travel at high speeds, or a novice cyclist undertaking their first timid attempts at cycling.

The data suggests that in periods of higher volume cyclists will more readily conform to the behavior of other cyclists, creating a relatively steady stream of users.

It is suggested that the average speed recorded during periods of peak volume is a function of the path design. Toowong Footbridge has the highest design standards of the paths analyzed.
in this report. It is the second widest path being analyzed, yet has the lowest average daily volume. The path has ample sight distances in both directions, and good horizontal and vertical alignment. The path also has the highest recorded average speed, 85th percentile speed, as well as the highest minimum and maximum recorded average speeds.

The Normanby Bikeway and the path through Mowbray Park have the most similar characteristics of the paths analyzed. Both paths form arterial commuter paths close to the Brisbane CBD, and both paths experience a similar volume of users. Despite the Mowbray Park path being narrower than Normanby Bikeway it has shoulders on both sides, in effect allowing users to occupy more of the space.

The data for these facilities shows that the average and 85th percentile speed are comparable. The figures for Mowbray Park are slightly higher, however as previously mentioned this could be due in part to the counters location at the bottom of a valley.

The Goodwill Bridge counter recorded the highest volumes of traffic, however should have the highest capacity as it is the widest facility presented in this report. The peak, average and 85th percentile speeds observed on the Goodwill Bridge were the lowest observed in this report. This is consistent with predictions that the higher levels of pedestrian activity on the bridge will result in lower bicycle speeds.

3.3 Description of Current Path Usage

The data suggests that cyclists will tend to self-moderate their speeds in accordance with the prevailing conditions of path design and user volumes. High speeds are observed at times of low traffic on high standard facilities, where the risk posed to other users is reduced, however the range of speeds is narrowed with increased path usage volume.

If a speed limit were to be imposed on each of the facilities analyzed in this report based purely on the 85th percentile speed method then Toowong Footbridge would be signed as 40km/h, Normanby Bikeway and Mowbray Park would be signed as 30km/h and Goodwill Bridge would be signed as 25km/h.
4 PROCEDURE FOR EVALUATION

4.1 Evaluation Objectives
There exists a political push from some members of the community to have speed limits established. This occurs despite there being an absence of research demonstrating a clear link between the application of speed limits and an increase in safety. It is therefore proposed that a period of evaluation be established to determine the effectiveness of using speed limits on shared paths as a safety device. The evaluation period would assess the level of perceived safety experienced by users, and whether the installation of speed limits will reduce the incidence of conflict between users of different types.

4.2 Proposed Methodology
An evaluation period would be broken down into a series of phases:

1. Selection of sites:
Sites would need to be selected for inclusion in a trial phase based on the specific conditions present at the location. The locations selected would need to presently have a safety issue that the implementation of a speed limit would address. This could include sights that are identified as having a high accident rate, or received a high volume of complaints.

Other sites that may be considered for inclusion in the trial study include sites that were constructed below the standards for a 30km/h design speed as stipulated in Austroads. This may include sights constructed according to outdated versions of the Standards, or may have been restricted by geographical constrains or budget at the time of construction.

It is suggested in the development of future projects where a speed limit is being considered that the site be used as the platform for which to conduct a trial of this nature. In order for this to occur, once agreement was obtained by all relevant parties, the facility would be opened to the public without a speed limit in place. Once initial observations were taken the speed limit could be imposed as per the designer’s recommendations.
2. Installation of observational devices:
Once an appropriate site is selected for inclusion in the trial phase, whether it be that the site is selected specifically to be trialed, or advantage is taken of a new development where a speed limit is considered, suitable observational devices would need to be installed on the path. The bicycle and pedestrian counters currently in use on Brisbane’s paths provide sufficient detail from which to make an analysis.

In order to obtain consistent data it recommended that the counter be installed on a level, unobstructed part of the path. Of hindrance to this project was inconsistent placement of the counters, reducing the accuracy of comparisons made between different sites.

Counters would need to be installed well in advance of the period of baseline data capture. This is to ensure that the data captured is not misrepresented by people slowing down through road works, or slowing to indulge in curiosity at the activity taking place. Sufficient time after the installation of the device would be required to ensure that the baseline data was indicative of the general behavior on the path.

3. Observation of usage and trends:
The baseline data would need to be captured, from which to compare at the end of the trial phase. This report suggests that there little or no seasonal variations in path usage in Brisbane, so the period of data capture is suggested as a minimum of two weeks, however to ensure the integrity of the data it is recommended that an analysis be carried out on at least a one month data capture.

4. Initial Surveying:
It would be important to conduct surveying before the implementation of to gain an understanding of the perception of the facility. It is recommended that the survey be undertaken by both pedestrians and cyclists, to determine the level of perceived safety, actual safety and opinion on the implementation of a speed limit.

In order to understand the level of perceived safety questions would need to be asked such as:

- How safe do you feel using this facility?
- Are there times you try to avoid using the facility?
In order to understand actual safety questions would need to be asked such as:

- Have you witnessed or been involved in a conflict or accident using this facility/using a similar facility?

Opinion based questions should also be asked such as:

- Do you believe that a speed limit would increase the safety for cyclists and pedestrians on shared facilities
- As a cyclist would you modify your behavior as a result of a speed limit being imposed?
- As a pedestrian would a speed limit alter your perceptions of that is appropriate rider behavior?

5. Education campaign:
An important phase of the trial would be an education campaign to inform users of shared facilities what the purpose of the speed limit being imposed is and what obligations they are being asked to adhere to. In this education campaign it would be relevant to inform users of what the possible outcome of disobedience may be. This could include warnings or fines.

It is suggested that this information be distributed in a number of different ways to ensure that the message is received by as many users as possible. It is recommended that an advertising campaign be undertaken with this information, focusing on community and user group newsletters, as well as radio advertising and social media sites such as facebook and Twitter.

It is suggested that without an educational campaign to inform users of the purpose and obligations of the trial phase the data that will result may not reflect the potential benefits of a speed limit.

6. Re-observation of usage and trends:
The same data capture undertaken in Part 3 of this trial recommendation would need to be undertaken in order to make a direct comparison of results. Outcomes of this part of the trial would determine whether cyclists are modifying their behavior as a result of the speed limit.

7. Final surveying
Finally, it is suggested that a second survey of cyclists and pedestrians be undertaken to determine whether the collective perception of perceived safety has changed. It may also be possible to determine if the implementation of a speed limit has reduced the frequency of conflicts on shared paths, however based on the volume of reported crash data used in the preparation of this report it is not predicted that sufficient data will be captured in the trial phase to draw these conclusions.

In the final survey additional questions to be asked of a cyclist could include:

- Whether the implementation of a speed limit has noticeably delayed travel time or increased congestion on shared paths?
- Whether there has been any chance in the perception of cyclists by pedestrians?

8. Monitoring behavior

It would have been of benefit to this project if more crash data was unavailable. Due to the problem of underreporting of minor incidents and near misses it is suggested that an intense period of path monitoring be undertaken to observe the actual rates of minor conflict and near misses. Observations taken from the ground could provide valuable data, however it is recommended that a video analysis be undertaken, as this would enable not just the counting of minor conflicts and near misses, but an analysis of the circumstances leading up to the incident.

9. Application of treatment devices:

It is suggested that this trial phase could form a part of a larger trial comparing the effectiveness of alternative treatment measures. A list of available treatment measures is included in Chapter 2.8. Upon selection of treatment measures to be evaluated in this study the relevant measures would be installed at period intervals of at least a month, so as to allow for a data capture between the installations of treatment devices. Upon completion of the installation of treatment measures, data analysis could be used to quantify the effect that particular devices had on user behavior.

4.3 Implementation

A trial phase similar to what has been described in chapter 4 would be required to validate the predictions contained in this report. Successful implementation of this trail phase could result in unique understanding on the use of speed limits as a safety measure on shared paths.
5 COMMUNITY CONSULTATION

5.1 Community Consultation Objectives
As one motivating factor for this project stems from the attention this topic has been receiving in the media, which has in part been perpetrated by some vocal user organizations, it seemed illogical to not include a discussion component with users of the facilities in question.

The purpose of the consultation was to gain some perspective from people who use these facilities, on whether imposing speed limits will have an effect on safety, and whether cyclists will observe the speed limit.

By nature shared paths are occupied by cyclists and pedestrians, as a result are of interest to parties involved in both activities.

5.2 Pedestrian Council of Australia
The Pedestrian Council of Australia (PCA) is the only national user group for pedestrians. It is a non-profit organization which was founded in 1996, and consists of a board of 10 members headed by Harold Scruby. Membership to the PCA is by invitation only, to individuals of institutions with interests or concerns of similar nature.

The PCA is an advocacy group promoting the continual improvement of pedestrian facilities throughout Australia. This includes advocating the installation of new facilities and improving existing facilities. Consequently, the PCA has taken a keen interest in the topic of speed limits on shared paths, releasing several press statements on the topic.

Harold Scruby was contacted directly via email and asked for comment. His response was that he believes that Queensland should conform to other states in Australia by banning the use of bicycles on footpaths, and that a regulatory speed limit of 10km/h should be applied to all shared paths nationwide.

No further correspondence was entered into with the PCA.
5.3 Brisbane CBD Bicycle User Group:

In their own words, available on the website: (Brisbane CBD Bicycle User Group, 2011)

The Brisbane Central Business District Bicycle User Group (CBD BUG) is an organization of city cyclists, representing and articulating the interests of the very large number of Brisbane residents who commute or ride bicycles to, from and within the Brisbane City Centre.

The group has over 500 members, and potentially advocates on behalf of the several thousand regular cyclists in Brisbane.

CBD BUG was established in early 2005 to:

- monitor and identify CBD cycling facilities (and deficiencies);
- act as a resource for CBD commuter cyclists;
- lobby for improvements; and
- Act as an informal network of cycle commuters and other cycle users in the CBD.

The CBD Bug meets monthly, discussing issues and happenings of concern and interest to CBD cyclists.

The topic of speed limits on shared facilities is one of particular concern to members of the CBD BUG, as well as the cycling community in Brisbane as a whole. During the monthly meeting held in May a presentation was given on the progress of this project. The objective was to seek opinions on speed limits to feed into the project.

During the subsequent deliberations audience members were asked to discuss advantages and disadvantages they could see to implementing speed limits on shared paths, they were also asked to consider alternative measures the government could adopt to address the safety concerns associated with speed limits. The responses are as follows:
Advantages:

- Good intention;
- Raise awareness of the need to slow down.

Disadvantages:

- Visual pollution – too many signs becoming confusing;
- Speed limits used in place of better design;
- Difficult to enforce, as speedometers are not mandatory on bicycles;
- Lower speeds may clog bikeways and force faster cyclists onto the road;
- Apportion blame onto the cyclist in an accident;
- Permit a negative view of cyclists by pedestrians (if they pedestrian believes the cyclist is exceeding the speed limit);
- Speed limits may increase conflict if the limit is inappropriate (too low or too high).

Alternatives

- Education of cyclists and pedestrians of appropriate behavior on shared facilities;
- Advisory speed limits;
- Warning signs for approaching hazards (e.g. Caution Blind Corner);
- Traffic Calming devices such as speed humps;
- More lighting;
- Education campaigns to encourage faster cyclists to use the road;
- Signs reminding users that the facility needs to be shared with other users (e.g. Share The Path);
- Better linkages between paths and roads permitting faster cyclists to change from path to road to avoid congested areas or pedestrians;
- Lower speed limit on roads where cyclists need to enter;
- Promote good cycling behavior, such as using bells and wearing visible clothing.

5.4 Community Consultation Discussion and Conclusions

It was predicted that members of the CBD bug would for the most part disagree with the concept of speed limits on shared paths, and therefore provide a greater number of disadvantages to their use than advantages. It was noted in the discussion that the concept of addressing path safety for all users was advantageous, which suggest that the cycling
community may be receptive to safety measures being installed, however point out some significant flaws in the use of regulatory speed limits. It was suggested by some members present that if a regulatory speed limit was applied to a path they would opt to use on-road facilities in place of the shared path.

The disadvantages suggested can be grouped into categories:

- Legislation being no substitute for good design
  During the meeting it was discussed numerous times that, in the opinion of the members in attendance, speed limits should not be used as a substitute for poor design. Designing a facility that is below standards and applying a speed limit to it is not a credible solution to the problem.

  It was also discussed that by slowing cyclists down, each cyclist will be required to use the path for longer to make the same journey. It was suggested that this would increase congestion levels on paths, causing further problems.

- Speed limits discrediting cyclists:
  Even in a situation where a cyclist is travelling at a reasonable speed, if that cyclist overtakes a pedestrian leaving only a small gap it may be perceived by the pedestrian that the cyclist was using unreasonable speed. It was discussed that if there was a speed limit on the facility, it would give pedestrians a reason to blame the cyclist, when in fact it may have been the pedestrian who stepped into the path of the cyclist. Similarly, in the event of a crash occurring between a pedestrian and a cyclist, it may be easier to blame the cyclist.

- Difficulties with enforcement:
  It was discussed that it is not a regulation that cyclists must carry a speed measuring device; therefore it was posed that it may be difficult to enforce a regulatory speed limit on a path. Mention was also made in the discussions of the inconsistent reports in the media about the enforceability of speed limits on shared paths. Anna Bligh, the Queensland Premier was quoted as saying that cyclists would be booked for exceeding the 10km/h advisory speed on the Gateway Motorway, and reports have been received from the QPS that police cannot issue tickets for speeding on a shared path.
In actuality, any shared path that is signed with a regulatory speed sign of a number contained within a red annulus such as that provided in Figure 4 (a) is enforceable by the police. Not being aware of your own speed is not a defense against speeding. Issuing of infringement tickets for speeding on shared paths is at the discretion of the police.

Members in attendance at the meeting were asked to discuss alternative treatment measures that they could see as having a beneficial impact on safety for users. Several alternative measures were suggested that could be supported by cyclists. Again, these have been grouped into categories:

- **Better design**
  Several points were raised on design features that cyclists perceive to be beneficial. These included better lighting, path access and roadway intersections. Path design recommendations are outside the scope of this report, so shall not be discussed here, however this discussion was used as a means to reinforce that legislation is no substitute for good design

- **Physical traffic calming devices**
  The use of physical calming devices, such as bollards and speed humps is a significant debate in its own right. While some installations may reduce cyclists speed, they have been shown to cause additional hazards by destabilizing riders or creating obstructions on the path.

- **Better education**
  The concept of educating users on what is appropriate behavior on shared paths was discussed at length. Suggestions were made that the education campaign should start with children in Primary School. It was also suggested that education campaigns should involve advertising.

  Education campaigns using messages on the path, such as the VicRoads behavioral message signs in chapter 2.7.4 were discussed several times as being an appropriate way to get the message of path safety and user obligations across to all users.

- **Warning signs**
  The use of warning signs to alert cyclists to approaching hazards was generally considered to be beneficial, including the use of advisory speed signs, as shown in Figure 4 (b). Advisory
speed signs are already in place on the Gateway Motorway. It was generally agreed upon in the discussion that alerting a cyclist to the presence of a hazard or danger is preferable to regulating that a cyclist shall slow to a given speed through the use of speed limits.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

A review of literature has demonstrated that speed limits are not used or recommended as a safety device. No mention of specific speed limits applying to cyclists applying to shared paths in national or international guidelines or standards, with the exception of the rule which states that the speed limit of the adjacent roadway shall apply to any road related area.

The only example of a speed limit that could be found internationally was in Vancouver. This speed limit was established as an additional measure of safety while the shared path was converted into a separated path. As that process is being completed the speed limit is being removed. Despite there being no mention of whether the speed limit is regulatory or advisory, it can be assumed that the speed limit in Vancouver functioned as an advisory speed. Despite speed recordings suggesting little or no change in the travelling speed of cyclists after the limit came into effect, no additional policing resources were allocated after the establishment of the speed limit, and no record was made of any infringements issued.

This serves as the only practicable example of a speed limit being used, and was clearly intended to meet a specific and immediate safety concern whilst a long term solution was implemented. It was imposed to act as a subtle suggestion, rather than a decisive order, for cyclists to exercise caution.

Methods currently being developed to model pedestrian cyclist conflicts were analyzed. This literature suggested potential outcomes of pedestrian cyclist impacts, however it was highlighted that here are variable factors that will dramatically alter the outcome of a collision. Additional research needs to be undertaken to better understand the relationship between cyclist speed and probable outcome of a collision with a pedestrian, particularly if that data is used in the formation of guidelines on setting speed limits on shared paths.
An analysis was performed on a range of data available. Crash data suggested that the frequency of crashes between pedestrians and cyclists on footpaths and bikeways is extremely low, with an average of 4.7 crashes on off road facilities being recorded each year across the state of Queensland. In the 17 year period analyzed only two fatalities were recorded, and in both circumstances the crash occurred on the road.

Data sourced from traffic counters installed on shared paths in Brisbane suggested that at periods of higher volume there is more consistent speed on the paths, whereas when the path is unoccupied cyclists will travel freely at a broad range of speeds. Pedestrian counter data was unavailable for two facilities analyzed, the Goodwill Bridge and Normanby Bikeway facilities; however it was shown that pedestrians comprise 17.5% of users on the Mowbray Park and Toowong Footbridge facilities. While average speeds recorded on Mowbray Park were significantly lower than those on Toowong Footbridge, the reduced total volume experienced on the Toowong Footbridge, in addition to a significantly wider path width (1.4m wider) suggest that cyclists could safely operate at higher speeds.

The data shows what could be a distinction between commuters and recreational users. This supports the suggestion in the literature that commuter cyclists will have a higher desired speed than recreational cyclists.

Counter data shows that the average speed of each facility at peak times approximates a reasonable design speed for each location. It is therefore posed that the cycling community is able to self moderate speeds that are appropriate to the location.

Consultations with members of the cycling community acknowledge the problem of pedestrian cyclist conflict on shared paths. A range of alternative measures were discussed openly, and agreement was reached on measures that would be deemed appropriate for use by the cycling community.

The outline of a procedure to obtain the data required to validate the assumptions in this report has been included. Due to the scope and timeframe of this project the trial of speed limits and alternative treatment measures was unable to be undertaken.
6.2 Recommendations

It is recommended that a trial phase be conducted in order to determine if there is a justification for imposing a speed limit on a facility, however from the research undertaken no defensible justification for imposing regulatory speed limits has been uncovered. There are a range of alternative treatment measures available and recommended for use to address the safety concerns that the use of speed limits targets.

Alternative treatment methods may be as or more effective as a safety device, however avoid the negative connotations associated with regulation. If a speed limit is to be imposed it is recommended that advisory speed signs be used in place of regulatory speed limits.

It is recommended that only sections of path that are below current design standards or have a localized safety hazard be assessed for speed limits.
7 REFERENCES


Nicholas Rees

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Queensland Department of Main Roads 2003, *Manual of Uniform Traffic Control Guidelines*, Department of Main Roads, Brisbane, Queensland, Australia.


APPENDIX A: AUSTRALIAN ROAD RULES FOR PEDESTRIANS AND CYCLISTS

Pedestrians and persons travelling in or on wheeled recreational devices and wheeled toys

- Rule 236 – a pedestrian must not unreasonably obstruct the path of any driver or another pedestrian.

- Rule 239 – a pedestrian must not be on a part of a separated footpath designated for the use of bicycles, unless the pedestrian is crossing the path. However, a pedestrian may be on the separated footpath designated for the use of bicycles, if the pedestrian is in or pushing a wheelchair, or is on rollerblades, roller skates or a similar wheeled recreational device, or there is no traffic control device indicating that the pedestrian is not permitted to be on that part of the separated footpath.

- Rule 242 – a person travelling in or on a wheeled recreational device or wheeled toy on a footpath or shared path must a) keep to the left of the footpath or shared path unless it is impracticable to do so, and b) give way to any pedestrian (except a person travelling in or on a wheeled recreational device or wheeled toy) who is on the path or footpath.

- Rule 243 – a person travelling on rollerblades, roller skates, or a similar wheeled recreational device, must not be a part of a separated footpath designated for the use of pedestrians unless the person is crossing the path. This person must keep out of the path of any bicycle if travelling on a part of separated footpath designated for the use of bicycles.

Bicycle riders

- Rule 249 – the rider of a bicycle must not ride on a part of separated footpath designated for the use of pedestrians.

- Rule 250 - the rider of a bicycle who is 12 years old or older must not ride on a footpath if another law of this jurisdiction prohibits it. The rider of a bicycle riding on a footpath or shared path must a) keep to the left of the footpath or shared path unless it is impracticable to do so and b) give way to any pedestrian on the footpath or shared path.

- Rule 251 – the rider of a bicycle riding on a footpath or shared path must keep to the left of any oncoming bicycle rider on the path.
- Rule 252 – the rider of a bicycle must not ride on a length of footpath or road to which a ‘no bicycles’ sign or marking applies.

- Rule 253 – the rider of a bicycle must not cause a traffic hazard by moving into a path of a pedestrian.

- Rule 258 – a person must not ride a bicycle that does not have a bell, horn, or similar warning device in working order.

- Rule 259 – the rider of a bicycle must not ride at night or in hazardous weather conditions causing reduced visibility unless the bicycle or the rider displays appropriate lighting.
### APPENDIX B: EXAMPLE OF METROCOUNT DATA OUTPUT

#### Class Speed Matrix

**ClassMatrix-130**

**Site:** IQT001B.0.0EW  
**Description:** Bicycle/ Pedestrian Count Normanby East  
**Filter time:** 8:48 Tuesday, 15 February 2011 => 8:48 Sunday, 6 March 2011  
**Scheme:** Vehicle classification (ARX)  
**Filter:** Cls(1) Dir(NESW) Sp(0,160) Headway(>0)

<table>
<thead>
<tr>
<th>Speed (km/h)</th>
<th>Speed Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Class</td>
<td></td>
</tr>
<tr>
<td>10 - 20</td>
<td>2784</td>
</tr>
<tr>
<td>20 - 30</td>
<td>6335</td>
</tr>
<tr>
<td>30 - 40</td>
<td>795</td>
</tr>
<tr>
<td>40 - 50</td>
<td>3</td>
</tr>
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<td>50 - 60</td>
<td>0</td>
</tr>
<tr>
<td>60 - 70</td>
<td>0</td>
</tr>
<tr>
<td>70 - 80</td>
<td>0</td>
</tr>
<tr>
<td>80 - 90</td>
<td>0</td>
</tr>
<tr>
<td>90 - 100</td>
<td>1</td>
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<tr>
<td>100 - 110</td>
<td>0</td>
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<tr>
<td>110 - 120</td>
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</tr>
<tr>
<td>120 - 130</td>
<td>0</td>
</tr>
<tr>
<td>130 - 140</td>
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</tr>
<tr>
<td>140 - 150</td>
<td>0</td>
</tr>
<tr>
<td>150 - 160</td>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
<td></td>
<td>9918</td>
</tr>
<tr>
<td></td>
<td>99.1%</td>
</tr>
</tbody>
</table>

**Class Totals**

The Profile is wider than the displayed bins. 92 vehicles are hidden.
APPENDIX C: SITE DESCRIPTIONS

Site: Toowong Footbridge
Site description:
Undivided lane shared path, located at the bottom of the descending ramp from the footbridge. Located just before a gentle bend towards Mt Coot-Tha. Unencumbered sight distance
Lane Width 4.5m. No Shoulder.
7% Grade (East = Downgrade)
1.75% Crossfall
Sight Distance 50m+ both directions
Site: Goodwill Bridge

Site description:
Divided lane shared path at eastern end of 300m bridge. Located at eastern end of bridge 15m from bridge end. Bridge end has concealed entry points.
Lane Width 3.4m. No Shoulder
3.8% Grade (East = Downgrade)
0.7% Crossfall (Eastern Lane) - 1% Crossfall (Western Lane)
Sight Distance 50m+ Sight Distance heading west, 15m concealed sight distance heading east.
Open sight Distance 50m+
Site: Normanby East:

Site description:
Divided lane shared path, 120m east of intersection between bikeway and controlled access location, 40m west of gentle corner (35m radius of curve).
Lane Width 2.1m. No Shoulder.
3.2% Grade (East = Downgrade)
2.5% Crossfall (Eastern Lane) - 1% Crossfall (Western Lane)
Sight Distance 50m+ both directions
Site: Mowbray Park

Site description:
Non-divided lane shared path crossing park parallel to River. Counter located 15m west of transition between road and bikeway.

Total Path Width 3.1m. Northern shoulder 0.2m Southern shoulder 0.7m
0.5% Grade (bottom of depression)
3% Crossfall

Sight Distance 50m+ Sight Distance heading west, 30m sight distance heading east.
APPENDIX D: SEASONAL COUNTER DATA

Toowong Footbridge (Summer) - Average Speed

\[ y = 0.0008x + 33.978 \]

Toowong Footbridge (Summer) - 85th Percentile Speed

\[ y = 0.0006x + 37.259 \]

Toowong Footbridge (Summer) - Average Speed

\[ y = -0.0004x + 34.307 \]
Speed Limit Setting on Shared Paths

Towong Footbridge (Spring) - Average Speed

\[ y = 0.0133x + 34.179 \]

Towong Footbridge (Spring) - Average Speed

\[ y = 0.0192x + 33.896 \]

Towong Footbridge (Spring) - 85th Percentile Speed

\[ y = 0.0163x + 37.062 \]
Toowong Footbridge (Winter) - 85th Percentile Speed

\[ y = 0.0092x + 36.801 \]

Toowong Footbridge (Winter) - Average Speed

\[ y = 0.0153x + 33.573 \]

Toowong Footbridge (Winter) - Average Speed

\[ y = 0.005x + 33.913 \]
Goodwill Bridge (Autumn)- 85th Percentile Speed

\[ y = 0.0011x + 22.709 \]

Volume of Cyclists per Hour

Goodwill Bridge (Autumn)- Average Speed

\[ y = 0.0007x + 18.268 \]

Volume of Cyclists per Hour (>10)

Goodwill Bridge (Autumn)- Average Speed

\[ y = 0.001x + 17.823 \]

Volume of Cyclists per Hour
**Normanby Bikeway (Spring) - Average Speed**

\[ y = 0.0022x + 21.857 \]

**Normanby Bikeway (Spring) - 85th Percentile Speed**

\[ y = 0.0034x + 26.973 \]

**Normanby Bikeway (Spring) - Average Speed**

\[ y = 0.0043x + 20.699 \]
Normanby Bikeway (Autumn)- Average Speed

\[ y = 0.0039x + 21.045 \]

Volume of Cyclists per Hour

Normanby Bikeway (Autumn)- Average Speed

\[ y = 0.0013x + 22.337 \]

Volume of Cyclist per Hour (>10)

Normanby Bikeway (Autumn)- 85th Percentile Speed

\[ y = 0.0021x + 26.997 \]

Volume of Cyclists per Hour

Speed Limit Setting on Shared Paths
Mowbray Park (Winter)-
Average Speed

\[ y = 0.0051x + 24.591 \]

Volume of Cyclists per Hour

Mowbray Park (Winter)- 85th Percentile Speed

\[ y = 0.0037x + 29.427 \]

Volume of Cyclists per Hour

Mowbary Park (Winter)-
Average Speed

\[ y = 0.0035x + 25.24 \]

Volume of Cyclists per Hour (>10)
### Mowbray Park (Spring)- Average Speed

![Graph showing average speed vs. volume of cyclists per hour.]

\[ y = 0.0055x + 25.022 \]

### Mowbray Park (Spring)- 85th Percentile Speed

![Graph showing 85th percentile speed vs. volume of cyclists per hour.]

\[ y = 0.0051x + 29.291 \]

### Mowbray Park (Spring)- Average Speed

![Graph showing average speed vs. volume of cyclists per hour (>10).]

\[ y = 0.0043x + 25.477 \]