26th Australasian Transport Research Forum
Wellington
New Zealand
1-3 October 2003

COMFORT LEVEL OF CYCLISTS AT INTERSECTIONS

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ABSTRACT

Patronage of the cycling mode is enhanced if cyclist felt comfortable and safe when sharing road infrastructure with motorists. The perception of riding comfort can influence the decision to cycle or not. Cyclists are vulnerable road users and don't feel secure in the company of faster motorised modes, especially when they have to manoeuvre an intersection. Fundamental research is required to establish key factors that influence the cyclists' perception of comfort at intersections. These factors may include geometric, operational and environmental conditions. The relative significance of these factors is modelled quantitatively in the form of a Comfort Index and is analogous to the concept of Bicycle Compatibility Index developed by the U.S. Federal Highway Administration for mid-block road segments. This paper describes a research project in North Queensland, Australia to model the comfort level of cyclists at several intersections in Cairns and Townsville. Some preliminary results of an extensive survey conducted for this study are presented.

1. INTRODUCTION

1.1 BACKGROUND

Cycling is an important mode of travel for work, education, and other trips, and is a viable alternative to car travel especially for shorter trips. It is a cheap, efficient, healthy and a sustainable transport mode and needs encouragement. Local and State governments in Australia are developing strategies to increase the patronage of cycling in cities. The motivation behind these strategies is to reduce congestion, air pollution, and fuel consumption, to improve public health, to reduce the costs of building additional infrastructure, and to move towards sustainable transportation in our urban environments.

In order to achieve the goal of increasing bicycle ridership, cycling must be made safer. Cycling should be perceived as a comfortable, safe and respectable mode of travel. Between 50-70% of bicycle-related accidents happen at intersections. These are traffic bottlenecks, difficult to manoeuvre by cyclists, and require special considerations by infrastructure providers. It is vital that cyclists are able to negotiate intersections with comfort and confidence.

However, cycling is perceived to be less safe than other modes. Traffic operations and geometric features of an intersection influence the cyclists' perception of riding comfort and consequentially their decision to cycle or not. This effect is modelled to develop Bicycle Comfort Index at Intersections (BCII) and is purported to be an index of the comfort level of the cyclists at an intersection. It is premised that higher the index, the safer the intersection.

The study reported in this paper has involved taking videos that depict varying geometric and traffic characteristics at a variety of intersections, and acquiring actual data and dimensions of flow and geometric characteristics. A sample of pedestrians and cyclists viewed the videos and were asked to assess the level of comfort and safety for each condition videoed, if they were negotiating the particular intersection under the conditions shown. Relationships are explored between comfort level experienced by the subject and the geometric, operational and environmental factors at an intersection.

1.2 OBJECTIVES

The primary objective of this research is to develop a methodology for formulating strategies to make intersections more safe for the cyclists and make cyclists feel comfortable while manoeuvring the intersections. It is widely recognised that traffic operations and geometric conditions at an intersection influence the cyclists' perception of riding comfort and safety and consequentially their decision to cycle. In this research, the effects of physical and operational conditions on cyclists' comfort are investigated through a video survey methodology. This index is purported to be a manifestation of the comfort and safety level of the cyclists at an intersection. The index is also a proxy for the likely use of roadway facilities by cyclists.

1.3 COMFORT AND STRESS

The cyclist's stress results from conflict with motor vehicles, interaction with heavy vehicles, and having to concentrate for long periods of time while riding on high-volume and high-speed roads. Of course stress and comfort are inversely related. The comfort level does not refer to the smoothness of the ride but to the cyclists perceived level of risk. For example, generous space to manoeuvre increases the level of comfort to the cyclists.

2. METHODOLOGY

2.1 OVERVIEW

The study reported in this paper uses the videotape technology to obtain the perception of cyclists to geometric and operational features at an intersection. The methodology has been tested, validated and used in a major study supported by the U.S. Federal Highway Administration (FHWA) to develop a Bicycle Compatibility Index for cycling through mid-block roadway segments. In the FHWA study, the perspectives of participants were obtained by having them view numerous roadway segments captured on videotapes and asking them to provide a rating on how comfortable they would feel if riding through the conditions shown. The bicycle safety ratings were linked to a number of geometric and operational characteristics of the roadway. No information is available on how the association of variables within the model was determined. The resulting model links the comfort level (called the Bicycle Compatibility Index, BCI) to various geometric and operational variables.

A similar methodology has been adopted to model the Bicycle Comfort Index at Intersections, BCII.

2.2 VARIABLES AFFECTING BICYCLE SAFETY

The variables to be included in the model are based on the previous studies (Davis, 1987; Harkey, 1997), as well as from the responses obtained from the survey participants. These factors are discussed below:

2.2.1 Geometric or physical features

The most significant variable is the amount of space available to cyclists to ride their bicycle through the intersection. This is the width of kerbside lane used by cyclists.

Pavement condition is also important although in all of the intersections studied, the paved surface had good or very good condition. Cyclists will switch from their lane to the road pavement if the latter was in better condition. The available space is also important to cyclists.

Other factors include grades and available sight distances.

Some other geometric factors that are important for cyclists riding along the mid block are less relevant to intersections. These include parking along the roadside, driveways, physical medians and paved shoulders.

2.2.2 Operational Factors

The key operational factors affecting cyclist's perception of safety and comfort include traffic volumes, traffic speed, proportion of heavy vehicles and turning traffic.

Traffic volume is by far the most significant factor when cyclists have to share the roadway infrastructure with motorists. It is well known that the more traffic present at the intersection, the more difficulty a cyclist will have in manoeuvring the intersection. The video clips show varying levels of traffic volumes and the participants are asked to rate the comfort level for varying conditions.

Higher traffic speeds are known to reduce safety level for cyclists. A high proportion of cyclist fatalities occur on roadways with speed limit greater than 60 km/h (Cross and Fisher, 1977).

Presence of heavy vehicles at the intersection is a source of discomfort for cyclists. Higher the proportion of heavy vehicles in the traffic stream, higher is the level of discomfort. Turning vehicles also affect the comfort and safety of cyclists. This variable is also considered in the video survey.

Both signalised and unsignalised intersections are included in the survey to model the effect of the forms of control at the intersection.

2.3 INTERSECTIONS

The study has involved the selection of a variety of signalised and unsignalised intersections in North Queensland. Highways as well as urban and suburban roads have been covered in the survey. These intersections have diverse features in terms of traffic volumes, geometric characteristics and cycle facilities. Videos depicting the physical and operational characteristics, rights-of-way, control and signage at each

intersection have been produced. A major source of these videos is the footage from the traffic control centre in Cairns which monitors and records traffic flows on several intersections on National Highway 1 in the North Queensland coastal region. In addition videos have also been taken, from the road level, at a number of intersections in Townsville and Cairns. In all 38 videos, each of about 40-sec. duration, have been selected for this study. The intersections were photographed from several approaches and up to four clips were made for some intersections. In all, twelve intersections were involved. Special intersection treatment and landscaping features as well as pedestrians and cyclists are included in the videos.

Table 1 shows the list of intersections used in this study.

Table 1: Study Intersections

No	Type	Control	Road 1	Road 2	City	Clip No
1	Cross	Sig.	Bruce Highway	Sheehy Rd	Cairns	1-8
2	Cross	Sig.	Bruce Highway	Portsmith Rd	Cairns	9-12
3	Cross	Sig.	Bruce Highway	Robert Rd	Cairns	13-16
4	Cross	Sig.	Swallow Rd	Robert Rd	Cairns	17-18
5	Cross	Sig.	Bruce Highway	Progress Rd	Cairns	19-20
6	T	Unsig.	Forest Garden Blvd	Progress Rd	Cairns	21
7	Cross	Sig.	Ray Jones St.	Rigg St	Cairns	22-23
8	Cross	Sig.	Shield St	Abbot St	Cairns	24-29
9	Cross	Sig.	Love Lane	Bowen Rd	Townsville	30
10	Cross	Sig.	Stokes St	Walker St	Townsville	31-34
11	T	Unsig.	Sturt St	Fletcher St	Townsville	35
12	T	Unsig.	Walker St	Denham St	Townsville	36-38

The road and traffic features are listed in Table 2. These are categorised into various groups. The Table shows that the clips have covered

- Peak and off-peak periods
- Several approaches at the same intersections
- Signalised and unsignalised intersections
- T- and Cross intersections
- Highways, urban and suburban roads
- Ground and overhead views

Posted speeds have been shown for most locations as the 85th percentile speeds were not available. The traffic engineer believes that 85th percentile speeds are about 0-5 km/h greater than the posted speeds (verbal communication).

Other features of video are shown in Table 2.

2.4 SURVEY

The videos were played to a sample of cyclists (school students and bicycle user groups) who were asked to give a rating for the friendliness or level of comfort and safety for each condition videoed if the subject was negotiating the intersection under the conditions shown. The respondents were asked to provide a rating with respect to traffic flow, vehicle speeds, turning volumes, heavy vehicles, signage and line marking, and manoeuvring space for cyclists. The sample of cyclists covered different age groups, experience, and the amount of weekly cycling. A supplementary questionnaire was also handed out to the respondents, which solicited their views on what should be done at the sample intersections to make

them more cyclists-friendly. Information was sought to develop an inventory of significant factors that are considered to influence the cyclist's level of comfort at an intersection. This information is regarded as significant in designing intersections that are friendly towards cyclists.

Table 2: Features of Intersection Video Clips

Clip	View location	Peak/off-peak	Appr. bike lane	Road type	Sight distance	Vol. AADT	Speed	% Heavy vehicle
1	Overhead	Off peak	1.9	Highway	Excellent	17279	80	5.5
2	Overhead	Off peak	1.9	Highway	Excellent	17279	80	5.5
3	Overhead	Peak	1.9	Highway	Excellent	17279	80	5.5
4	Overhead	Off-peak	1.9	Highway	Excellent	17279	80	5.5
5	Overhead	Peak	1.9	Highway	Excellent	17279	80	5.5
6	Overhead	Off-peak	1.9	Highway	Excellent	17279	80	5.5
7	Overhead	Peak	1.9	Highway	Excellent	17279	80	5.5
8	Overhead	Off-peak	1.9	Highway	Excellent	17279	80	5.5
9	Overhead	Peak	2	Highway	Excellent	18550	80	5.1
10	Overhead	Peak	2	Highway	Excellent	18550	80	5.1
11	Overhead	Off-peak	2	Highway	Excellent	18550	80	5.1
12	Overhead	Off-peak	2	Highway	Excellent	18550	80	5.1
13	Overhead	Peak	n.a.	Highway	Good	17279	80	5.5
14	Overhead	Off-peak	n.a.	Highway	Good	17279	80	5.5
15	Overhead	Peak	n.a.	Highway	Good	17279	80	5.5
16	Overhead	Off-peak	n.a.	Highway	Good	17279	80	5.5
17	Overhead	Off-peak	n.a.	Suburban	Good	4215	60	25
18	Overhead	Off-peak	n.a.	Suburban	Good	5269	60	0
19	Overhead	Off-peak	n.a.	Suburban	Good	5269	60	0
20	Overhead	Off-peak	1.9	Suburban	Excellent	17279	60	5.5
21	Overhead	Off-peak	1.9	Suburban	Excellent	17279	60	5.5
22	Overhead	Off-peak	2	Suburban	Excellent	18550	60	5.1
23	Overhead	Off-peak	2	Suburban	Excellent	18550	60	5.1
24	Ground	Off-peak	1.7	Urban	Good	6322	50	0
25	Ground	Off-peak	1.4	Urban	Poor	3161	50	0
26	Ground	Off-peak	1.3	Urban	Good	11590	50	0
27	Ground	Off-peak	1.3	Urban	Good	11590	50	0
28	Ground	Off-peak	1.1	Urban	Good	7376	50	0
29	Ground	Off-peak	1.1	Urban	Good	7376	50	0
30	Ground	Peak	0.8	Urban	Excellent	17596	50	0.1
31	Ground	Peak	0	Urban	Good	1038	57	1.3
32	Ground	Peak	0	Urban	Good	1900	50	2.7
33	Ground	Peak	0	Urban	Good	869	64	1.3
34	Ground	Peak	0	Urban	Good	1900	50	2.7
35	Ground	Peak	1.36	Urban	Excellent	9371	64	2.8
36	Ground	Peak	0	Urban	Good	1900	50	2.7
37	Ground	Peak	2.1	Urban	Excellent	6758	58	2.6
38	Ground	Peak	0	Urban	Good	6339	58	2.8

2.5 CLASSIFICATION OF RESPONDENTS

It is premised that respondents may perceive the road and traffic conditions differently based on their experience, skills, and their usual purpose of travel. The following three categories of cyclists were identified.

Experienced Commuter Cyclist
Largest percentage of trips (60 %) for commuting to or from school or work
Rides more days per week then others, longer distances, more trips or week
Uses major streets a lot

Experienced Recreation Cyclist
80 % of trips for recreation or exercise
Ride fewer days per week, trips per week, distances per week than experienced commuters
Ride more days per week, trips per week, distances per week than casual recreational cyclists
Less likely to ride on major streets
More likely to ride on bike paths

Casual Recreational Cyclist
70 % trips for exercise or recreation
Rides fewer days per week
Rides fewer trips per week
Rides fewer distances per week
Rides least amount on major streets

3. SURVEY DATA AND ANALYSIS

For the purpose of this paper, results from six representative intersection clips are presented. The responses to only three of the geometric/operational factors are provided. These include traffic volumes, traffic speeds and available space at the approach. The objective is to illustrate the application of the videotape technology. Data on the geometric and operational features for all study intersections have been obtained from the Main Roads Department in Cairns and the Townsville City Council. Traffic volumes for the video survey were estimated from the clips. Actual traffic speeds are assumed to be the posted speed (or the 85^{th} percentile, where available). The estimated volumes and the data on available space and speed are related to the respondents' perception of cycling comfort at these intersections. The intention is to demonstrate the application of the methodology for the development of the Bicycle Comfort Index at Intersections. The results are presented and discussed in the following sections.

3.1 SELECTED INTERSECTIONS

The six selected intersection video clips include two intersections on the Bruce Highway (National Highway 1), two city intersections with traffic lights and two non-signalised intersections. Table 3 shows the location and some of the characteristics of the selected video clips. Labels 1,2, and 3 have been used to represent low, medium and high value of the parameter.

3.2 CYCLISTS PERCEPTION OF COMFORT LEVEL

The responses obtained from the survey have been analysed and the distributions of comfort levels have been presented in Figures 1 to 3. Figure 1 shows the distribution of comfort level as influenced by traffic volumes while the influence of traffic speeds is portrayed in Figure 2. Figure 3 shows the comfort levels as a function of the available space on approach to the intersection. The distributions are shown for each of the three respondent groups listed in section 2.5.

These results are also tabulated and summarized in Tables 4 and 5. Table 4 is a summary of perception by various respondent groups while Table 5 gives a summary for all respondents combined. This Table also shows how perceptions of comfort level are linked to geometric and operational factors.

Table 4 shows that, in general, casual recreation cyclists perceive lower comfort levels for the same conditions compared to experienced cyclists. Available space on approach appears to influence the level of comfort more than other factors. In Table 5, it is obvious that the narrow range of traffic speeds has masked the effect on perceived comfort level as influenced by traffic speeds but the effect of available space on approach is clearly evident.

The study does not attempt to model the absolute or real safety but only the perception of different respondent groups. It should be remembered that different groups perceive cycle safety and comfort differently. The results of this study must be viewed with these qualifications.

4. SUMMARY AND CONCLUSIONS

A comprehensive research effort on modelling the comfort level at intersection for the cyclists (BCII) is in progress. A selection of 12 intersections from the two major North Queensland cities of Cairns and Townsville has been made for this study. These intersections include highways as well as urban and suburban intersection. Cross and T- intersections as well as signalised and unsignalised intersections are represented in this survey. Peak and off-peak conditions have been included. The diversity of traffic and geometric characteristics have been captured in 38 video clips made from photographs taken on the ground level and those available from overhead cameras linked to the Cairns Traffic Control Centre.

A sample of participants representing various age groups, experience, and the amount of cycling have viewed the 38 intersection situations captured on videotapes. Each clip is about 40 s in duration. At the end of the tape, the participants are asked to rate these intersections with respect to how comfortable they would feel manoeuvring the intersection under the geometric and operational conditions shown. These perceptions are related to the geometric and operational features to capture the effect of these factors on the comfort level and safety of cyclists.

Results from a selection of six clips in respect of traffic volume, traffic speed and available space at approach to the intersection are presented to illustrate the use of videotape technology and to explain the methodology for collecting and using the data on perception of comfort levels. Some preliminary results show that casual recreation cyclists perceive lower comfort levels for the same conditions compared to experienced cyclists. Available space on approach appears to influence the level of comfort more significantly than other factors.

Table 3: Features of Selected Video Clips

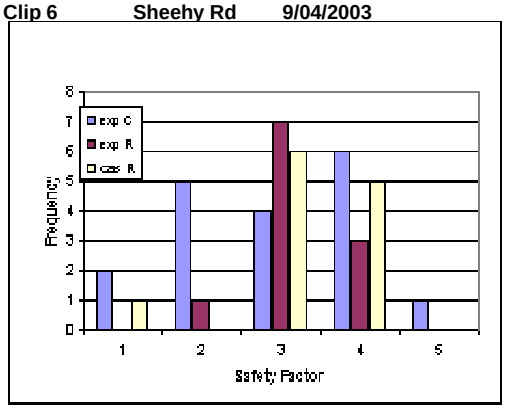
Video Clip				Factors									
No.	Location	date/ time	features	Left turn traffic	traffic volume	traffic speed	available space approach	available space through	available space on exit	Heavy veh.	lane marking	Vis. Lanes	SD approach
6	Sheehy	9/4/2003	Marked road	2	2	1	3	3	2	2	2	6	3
	Rd.	14:59	Marked Bike lane										
			Off peak traffic										
11	Portsmith	8/4/2003	Marked road	2	1	1	2	3	2	1	2	4	3
	Rd.	6:44:20	No appr. bike lane										
			Through bike lane										
			Turning traffic (lots)										
			Off peak traffic										
17	Swallow	11/4/2003	Facing view	1	1	1	2	2	1	2	2	3	2
	Rd.	10:45	going west										
19	Forest Gdn	11/4/2003	Facing view	1	1	1	1	2	1	1	2	3	2
	Blvd.	11:20	going west										
			Progress Rd/Bruce Hwy										
34	Denham	20/05/2003	Walker/ Denham St int	1	1	3	3	3	3	2	2	2	3
	St.	16:37	Unsignalised										
			T-intersection										
35	Denham	20/05/2003	Walker/ Denham St	1	1	3	2	1	3	1	2	2	2
	St.	16:44	Unsignalised										
			T-intersection										

Note: 1 refers to low, 2 to medium and 3 to high value of the factors considered.

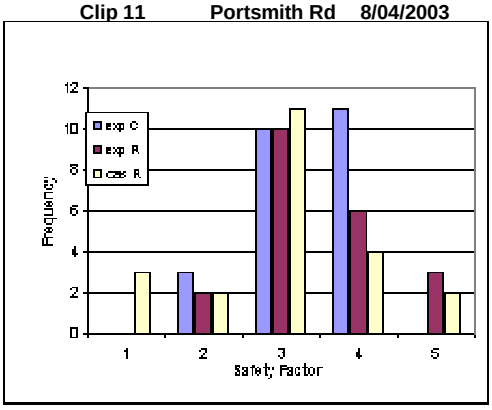
COMFORT LEVEL AND TRAFFIC VOLUMES

HIGHWAY

Clip 6 Sheehy Rd 9/04/2003

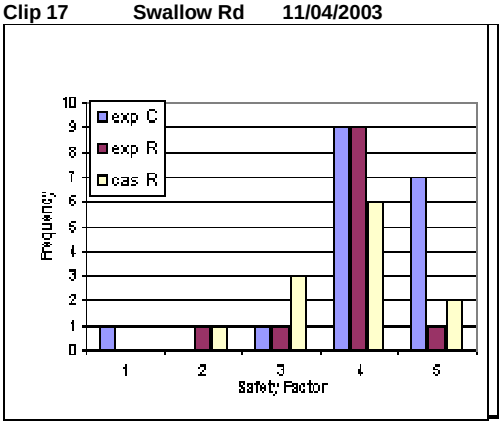


Clip 11 Portsmith Rd 8/04/2003



CITY WITH TRAFFIC LIGHTS

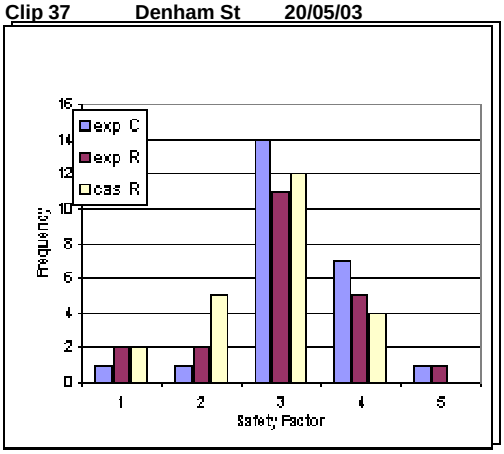
Clip 17 Swallow Rd 11/04/2003



Clip 19 Forest Gdn Blv 11/04/2003

CITY WITHOUT TRAFFIC LIGHTS

Clip 37 Denham St 20/05/03



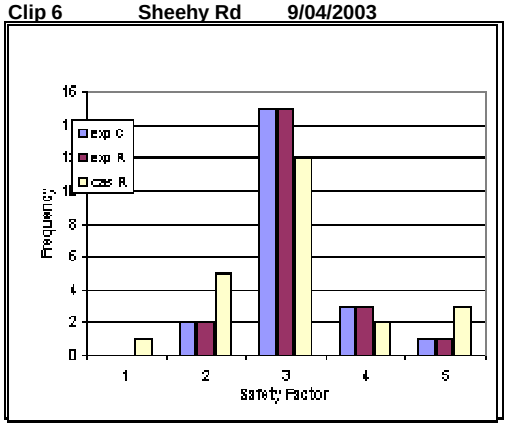
Clip 38 Denham St 20/05/03

Figure 1: Comfort level as influenced by traffic volume

COMFORT LEVEL AND TRAFFIC SPEED

HIGHWAY

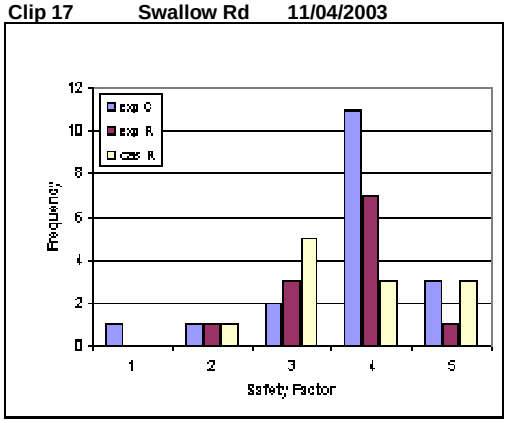
Clip 6 Sheehy Rd 9/04/2003



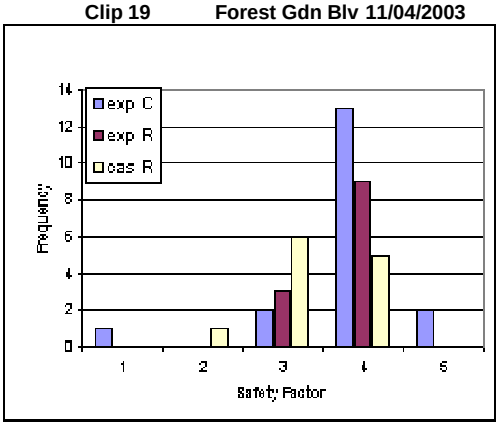
Clip 11 Portsmith Rd 8/04/2003

CITY WITH TRAFFIC LIGHTS

Clip 17 Swallow Rd 11/04/2003

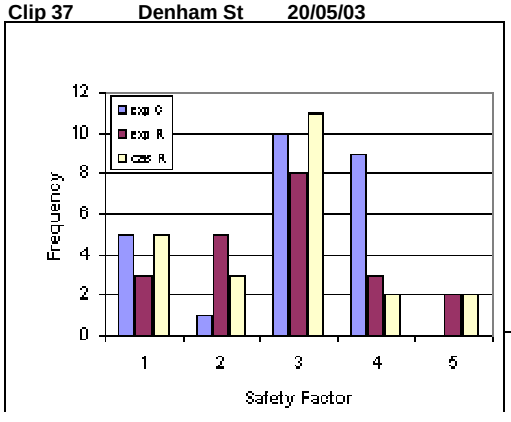


Clip 19 Forest Gdn Blv 11/04/2003



CITY WITHOUT TRAFFIC LIGHTS

Clip 37 Denham St 20/05/03



Clip 38 Denham St 20/05/03

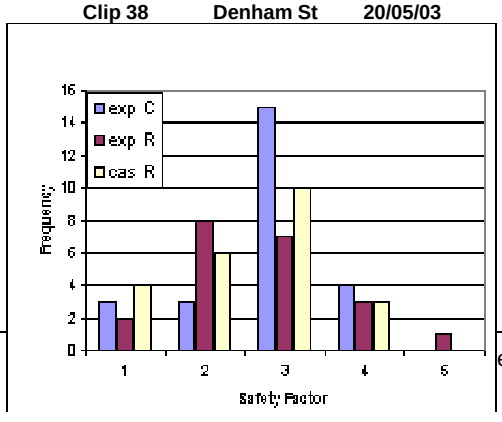
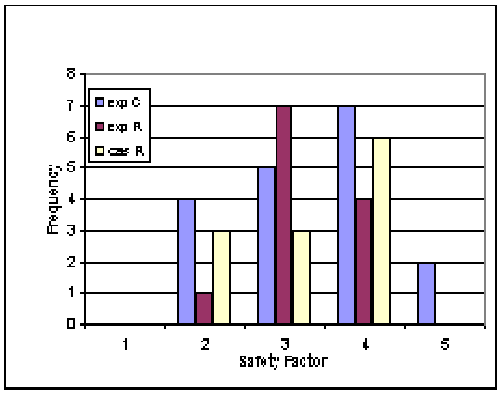


Figure 2: Comfort Level as influenced by traffic speed

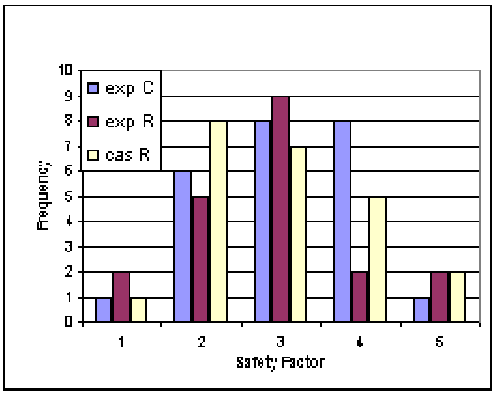
COMFORT LEVEL AND AVAILABLE SPACE ON APPROACH

HIGHWAY

Clip 6 Sheehy Rd 9/04/2003

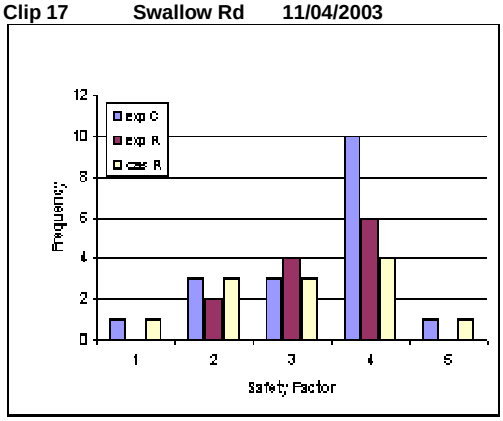


Clip 11 Portsmith Rd 8/04/2003

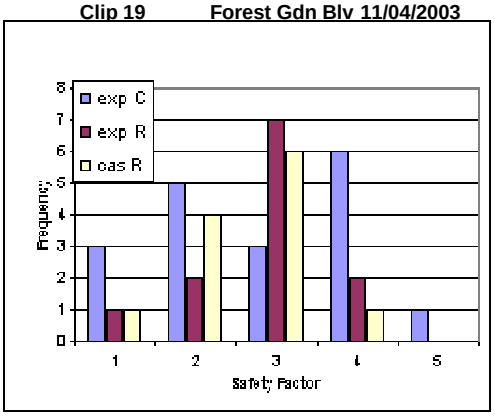


CITY WITH TRAFFIC LIGHTS

Clip 17 Swallow Rd 11/04/2003

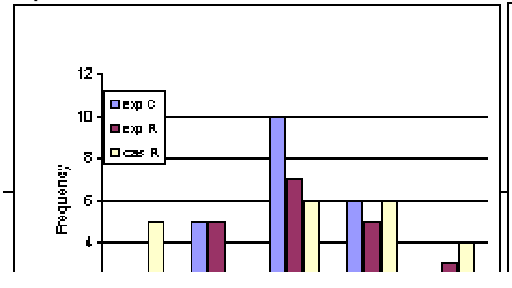


Clip 19 Forest Gdn Blv 11/04/2003



CITY WITHOUT TRAFFIC LIGHTS

Clip 37 Denham St 20/05/03



Clip 38 Denham St 20/05/03

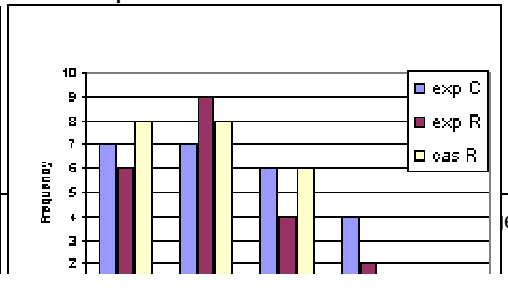


Figure 3: Comfort Level as influenced by available space on approach

Table 4: Responses from different respondents groups

Variables	Experienced Commuter	Experienced recreation	Casual recreation	Overall
Clip # 6; Sheehy Road				
Traffic volume	4	3	3	3.5
Traffic speed	4	3	2	3
Available space	4	3	4	3.5
Clip # 11; Portsmith Road				
Traffic volume	4	3	3	3.5
Traffic speed	3	3	3	3
Available space	3	3.5	2	3
Clip # 17; Swallow Road				
Traffic volume	4	4	4	4
Traffic speed	3	3	2	3
Available space	4	4	4	4
Clip # 19; Forest Garden Blvd.				
Traffic volume	3	3	3.5	3.5
Traffic speed	4	4	3	4
Available space	4	3	3	3
Clip # 37; Denham St.				
Traffic volume	3	3	3	3
Traffic speed	3	3	3	3.2
Available space	3	3	3.5	3
Clip # 38; Denham St				
Traffic volume	3	3	3	3
Traffic speed	3	2	3	3
Available space	1.5	2	2	2

Table 5: Summary of respondents' opinion of comfort level for selected intersections

Intersection clips	Space on Approach, (m)	Respondents opinions	
6	1.9	neutral to safe	(3 to 4)
11	2	neutral to safe	(3 to 4)
17	no space	unsafe	(rate 2)
19	no space	unsafe	(rate 2)
37	2.1	neutral to safe	(3 to 4)
38	no space	unsafe	(rate 2)
Intersection clips	Traffic speed, km/h	Respondents opinions	
6	80	unsafe to neutral	(2 to 3)

11	80	neutral	(rate 3)
17	60	neutral to safe	(3 to 4)
19	60	neutral to safe	(3 to 4)
37	58	unsafe to neutral	(2 to 3)
38	58	unsafe to neutral	(2 to 3)
Intersection clips	Traffic volume, AADT	Respondents opinions	
6	17279	neutral	(rate 3)
11	18550	neutral	(rate 3)
17	4215	safe	(rate 4)
19	5269	neutral to safe	(3 to 4)
37	6758	unsafe to neutral	(2 to 3)
38	6339	neutral	(rate 3)

The data has been analysed to develop correlation between comfort index (represented by respondents' ratings) and the data on physical dimensions of various lanes and approaches, traffic counts, turning movements, 85th percentile of vehicle speeds (actual or estimated to be 0-5 km/hr greater than the posted speed), traffic composition, pedestrian and cyclists counts, adjoining land-use and control.

It is proposed to match the video ratings of the comfort level to field rating, i.e. to compare the rating given by the respondent when watching videotape and the rating given when seeing the same location on site.

The BCII model being developed in this study can be used to determine the geometric and operational requirements for any new facility to achieve a desired level of comfort or service for the cyclists at intersections. The model can be used for the evaluation of measures for improving the feeling of comfort and safety at intersections**.** The model provides a useful instrument for evaluating trade-off's between various intersection treatments, conducting cost-effectiveness studies, and determining the relative contribution of each geometric, traffic and operational factor to cyclists comfort and the level of service at an intersection. In a parallel study, the Bicycle Comfort Index for Roundabouts is also being developed. The methodology developed in this study will enable the determination of roundabout features that contribute to cyclists comfort index and level of service and thus provide a powerful management tool.

5. ACKNOWLEDGEMENTS

The survey and data analysis has been conducted by a final year engineering student, Ed Kulpa as a part of his thesis project under the supervision of the author. The co-operation and help provided by Mr. David Hamilton and Helius Visser of the Department of Main Roads in Cairns is gratefully acknowledged.

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APPENDIX A

Video Survey Form

In this survey you will be observing a number of intersections in approximately 40 sec. clips. While observing these clips, you can rate how you feel, with respect to the categories below, about riding through the intersection. The clips will be a mixture of overhead views and ground level views, allowing you to see all aspects of the intersection.

Please rate each category from 1 to 5 where:
1 - very unsafe; 2 – unsafe; 3 – neutral; 4 – safe; 5 - very safe

Inter-section	Left turning traffic	Traffic Volume	traffic speed	Available space on approach	through	exit	Heavy vehicles	Lane markings	No. of Lanes	Sight distance on approach	Safety of turning right	Parked cars	Comments about the intersection
Int 01													
Int 02													
Int 03													
Int 04													
Int 05													
…													
…													
Int 36													
Int 37													
Int 38													

APPENDIX B

Cyclist questionnaire

Date:
Sex: M F (please circle)
Age: (please circle relevant group)
5 – 12 13 – 18 19 – 25 26 – 40 41 – 55 56 +

1. How often and how far do you ride a bicycle each week (please tick)?
   _____1 – 4 times a week _____1 – 10 km a week
   _____5 – 9 times a week _____11 – 50 km a week
   _____10 + times a week _____51 + km a week

2. .On which of the following do you usually ride (Select as many categories as necessary. Answers should add up to 100%):
   a) Major streets _____ e) Footpath _____.
   b) Residential streets _____ f) Highway _____.
   c) Bicycle paths/ trails _____ g) Other
   d) Rural Roads _____ _____

3. What time of day do you ride (please tick which apply)
   Before 6:00 am _____ 6:00 – 7:30 am ____
   7:30 – 9:00 am _____ 9:00 – 12:00 pm ____
   12:00 – 3:00 pm _____ 3:00 – 4:30 pm ____
   4:30 – 6:00 pm _____ After 6:00 pm _____

4. What is purpose of bike trips (Select as many categories as necessary. Answers should add up to 100%):
   a) recreation/ exercise _____ e) visiting _____.
   b) commuting to/ from work _____ f) other
   c) shopping _____
   d) commuting to/ from school _____.

5. a) With respect to intersections, do you feel that the same road rules should apply to cyclists that motorists obey? yes _____ no .
   If no, under which circumstances.

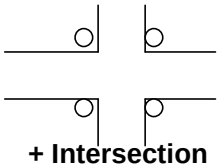
   b) How would the rules applying to cyclists be different?

   c) Do you believe some cyclist's behaviour annoys some motorists?
   yes_____no_____.
   If yes, which part of cyclist's behaviour causes the most irritation with motorists?

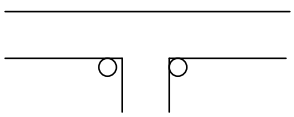
6. At intersections with traffic lights, to register your presence, would you prefer a bicycle detector pad in the road that changes the lights or an easy to reach push button facility?
   Bicycle detector _____ Push Button_____

7. Considering your safety and convenience, please rate the importance of each factor to you when riding a bike through an intersection as you turn left, right or go straight through.

1 – very unimportant	2 – unimportant	3 – neutral	4 – important	5 – very important



+ Intersection

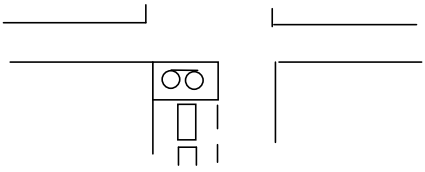


T Intersection

Please rank factors from 1 to 5.

Factor	+ Intersection			T Intersection		
	Left turn	Straight through	Right Turn	Left turn	Straight through	Right Turn
Number of lanes						
Traffic volume						
Speed of traffic						
A dedicated bike lane						
Clearly marked road lines and markings						
Presence of heavy vehicles						
Vehicles crossing bike lane to turn left						
Maintenance of road						
A dedicated left turn lane						
Good visibility around intersection						
Crossing traffic to turn right						
Parked cars close to intersection						
Drivers attitudes towards bikers						
Traffic lights						
Other_____.						

8. Would you use a dedicated waiting area, for bikes only, at the start of traffic queues at intersections with a space allowance for riders to merge into a bike lane once past the lights?



yes _____ no _____.
Why/ Why not? _____

9. Do you ever choose not to ride your bike due to adverse weather conditions?
yes _____ no _____.
If yes, when (check all that apply):
Threat of rain _____ Drizzle _____ Steady Rain _____.
Heavy rain _____ Fog _____.
Cold weather _____(below what temperature _____°C)
Hot weather _____(above what temperature _____°C)
Windy weather _____(above what _____Km/ hr)

10. Any other issues about your sense of safety when riding through intersections._____. _____

Please use blank space over to provide more information if necessary.