Benefits of new and improved pedestrian facilities – before and after studies

May 2011

S Turner, R Singh, P Quinn, T Allatt
Beca Infrastructure Ltd, Christchurch

NZ Transport Agency research report 436

ISBN 978-0-478-37167-3 (PDF)
ISBN 978-0-478-37168-0 (paperback)
ISSN 1173-3764 (PDF)
ISSN 1173 3756 (paperback)

NZ Transport Agency
Private Bag 6995, Wellington 6141, New Zealand
Telephone 64 4 894 5400; facsimile 64 4 894 6100
research@nzta.govt.nz
www.nzta.govt.nz

Turner, S, R Singh, P Quinn and T Allatt (2011) Benefits of new and improved pedestrian facilities – before and after studies. *NZ Transport Agency research report 436*. 142pp.

Keywords: Before and after studies, delay, directness, kea crossing, pedestrian facility benefits, pedestrian facilities, pedestrian perceptions, safety, signalised pedestrian crossing, walking, zebra crossing

An important note for the reader

The NZ Transport Agency is a Crown entity established under the Land Transport Management Act 2003. The objective of the Agency is to undertake its functions in a way that contributes to an affordable, integrated, safe, responsive and sustainable land transport system. Each year, the NZ Transport Agency funds innovative and relevant research that contributes to this objective.

The views expressed in research reports are the outcomes of the independent research, and should not be regarded as being the opinion or responsibility of the NZ Transport Agency. The material contained in the reports should not be construed in any way as policy adopted by the NZ Transport Agency or indeed any agency of the NZ Government. The reports may, however, be used by NZ Government agencies as a reference in the development of policy.

While research reports are believed to be correct at the time of their preparation, the NZ Transport Agency and agents involved in their preparation and publication do not accept any liability for use of the research. People using the research, whether directly or indirectly, should apply and rely on their own skill and judgement. They should not rely on the contents of the research reports in isolation from other sources of advice and information. If necessary, they should seek appropriate legal or other expert advice.

Acknowledgements

The research team would like to acknowledge the efforts of Zoe Douglas-Jones and Susanne Eckes (former project researchers) for assisting with developing a methodology for this research.

We would also like to thank Peter Rivers and Brian Boddy (Christchurch City Council), Ryan Dunn (Hamilton City Council) and Irene Tse (Auckland City Council) for their assistance with identifying pedestrian facility improvements in their respective regions and providing the research team with the relevant information.

Special mention must also be made of Tim Hughes (NZ Transport Agency) and Fergus Tate (MWH, New Zealand) for their able guidance and technical support in their role as peer reviewers for this research. Their help and advice has been much appreciated.

Abbreviations

ACC	Auckland City Council
CBD	central business district
CCC	Christchurch City Council
COV	coefficient of variance
EEM	Economic Evaluation Manual
GPS	Government Policy Statement
HCC	Hamilton City Council
NZTA	NZ Transport Agency
NZTS	New Zealand Transport Strategy
OLA	Our Lady of the Assumption School

Contents

Executive summary

Walking is an essential mode of transport. New and improved pedestrian facilities enable greater access and mobility within our communities. A pedestrian-friendly environment plays an important role in encouraging walking as a mode of travel, and this has proven health and environmental benefits. Supporting and promoting the option to walk for short distances is also listed as a key objective of various national, regional, and local transport and community plans.

The NZ Transport Agency (NZTA) has recently updated the procedures for the evaluation of pedestrian improvement projects. The benefit factor applying to new pedestrian trips was increased from $0.50 to $2.70/km, making pedestrian facility improvement projects more worthwhile. Thus, estimating the increase in pedestrian flows (as opposed to simply recording existing pedestrian flows) is now important in the economic evaluation of new or improved facilities.

This research, conducted between 2005 and 2009, aimed to investigate whether the implementation of new pedestrian facilities (or the improvement of existing facilities) led to increased pedestrian rates, and to record these changes in a standardised format that could be used in transport planning and project funding. This study also tried to develop an expected pedestrian-usage model, based on before and after data analysis, for planners and funding agents to use when planning new or improved facilities and evaluating projects. The final part of the project involved developing a monitoring database containing before and after pedestrian count data for various new and improved pedestrian facilities, along with a list of accompanying factors such as safety, delay and directness.

The study evaluated eight New Zealand sites where pedestrian facility improvements were being undertaken. The investigation included collecting information on the site location and characteristics, the facility development and consultation process, and before and after pedestrian counts and perception surveys for each of the sites. In addition, a cross-analysis across all the sites was conducted to identify trends in pedestrian numbers and perceptions before and after implementation of the facilities. The sites investigated in this study are listed in the table below. Please note that this research was undertaken before the earthquakes occurred in Christchurch in September 2010 and February 2011. The descriptions of some of the sites in Christchurch may no longer be accurate in the current conditions.

Table 1 Selected study sites

Location	Type of improvement
Moorhouse Ave, Christchurch	Signalised pedestrian crossing
Hereford St, Christchurch	Raised zebra crossing with warning light system
Sparks Rd, Christchurch	School-patrolled zebra crossing
Hoon Hay Rd, Christchurch	Kea crossing
Ensors Rd, Christchurch	Refuge island and kerb extension
Collingwood St, Hamilton	Kerb extensions
Tristram St, Hamilton	Refuge island
Margot St, Auckland	Kea crossing

Data collection was an important part of this research study. In addition to 'before' and 'after' pedestrian count surveys, pedestrian perception surveys were also conducted at each of the eight study sites. These looked at changes in the perception of pedestrians towards certain key factors (eg safety, delay and directness) that have a bearing on the decision about where to cross the road.

The research team experienced significant problems in identifying enough suitable sites to build up the monitoring database. To address this problem and to ensure that the study's findings would be presented in a coherent way, additional work was undertaken to present detailed case studies on the eight pedestrian crossing facilities that were analysed during the study.

Results from the before and after pedestrian count surveys and analysis of the individual case studies showed that the implementation of improved pedestrian facilities resulted in increased usage at seven out of the eight sites analysed. The magnitude of these changes varied between sites, from 7% for the Moorhouse Ave signalised pedestrian crossing to 90% for the kerb extensions at Collingwood St. The reasons for the increases in flows were analysed in each of the individual case studies, and were found to be a mix of factors such as safety, delay and directness. Overall, it was observed that the construction of kerb extensions/refuge islands resulted in the largest increase in pedestrian numbers, followed by the installation of kea crossings.

The pedestrian counts were also used to plot pedestrian crossing desire lines in both the 'before' and 'after' scenarios. Although the actual desire lines were found to remain the same, after the improvements there were increases in the proportion of pedestrians crossing at the desire line that was used for the location of the new (or improved) facility. The magnitude of these changes varied from site to site.

The before and after perception surveys conducted at the study sites assessed key factors that influenced pedestrians' crossing preferences. Safety was rated as the most important factor considered by pedestrians when choosing where to cross the road, and pedestrians at all the eight study sites reported feeling safer while crossing the street after the implementation of the facility improvement – at five of the eight study sites, the average 'after' safety rating was 2.5 or more on a 7-point scale (-3 to +3), indicating that these facilities had been successful in providing the perception of an extremely safe crossing environment.

However, it was found that an increase in perceived levels of safety did not guarantee an increase in pedestrian numbers. This was the case for the Ensors Rd kerb extensions and refuge island, where even though the rating for safety increased significantly, a corresponding increase in pedestrian numbers was not observed.

Delay and directness were other important criteria assessed that affect pedestrians' choice of crossing location. At six out of the eight study sites, the implementation of new (or improved) facilities led to a reduction in pedestrians' perceived waiting times. However, for five out of the eight analysis sites, the importance of delay during the 'after' survey was found to be lower than, or equal to, the importance of delay during the 'before' survey, suggesting that the importance of delay became secondary once other criteria, such as levels of safety, were improved. Also, six out of the eight study sites were either situated directly on the most common path used by pedestrians, or provided a more direct crossing path that was subsequently adopted by pedestrians.

The improved facilities varied in their level of performance in the criteria of safety, delay and directness. In terms of safety, kea crossings performed the best, followed by signalised crossings, zebra crossings and kerb extensions/refuge islands. On the other hand, after completion of the improvement, zebra crossings scored the best average ratings for levels of delay (implying the lowest perceived waiting times) and directness. Signalised crossings scored the worst rating for delay, while kerb extensions/refuge islands had the worst average 'after' rating in terms of directness.

To enable easier monitoring of pedestrian facilities, the study team set up a template for a facility-monitoring database, and populated it with information from the case studies analysed during this study. At the time of writing, the database had a provision for entering site-specific data regarding location, road classification and traffic volume, type of improvement, pedestrian usage, survey details, level of publicity, proximity to schools, social context, etc. The database can be easily modified to include any additional data fields that may be required at a future date. It is envisioned that local and national authorities and their consultants will continue contributing to the database in the future.

The study team noted a shortage of research, both within New Zealand and internationally, that studied the before and after effects of improving pedestrian facilities, and the induced pedestrian demands generated by them. This points to a need for further research investigating the effects of the implementation of pedestrian treatments. Research examining the effects of wider-area treatments for pedestrians also needs to be undertaken, to give further insight into the network-wide effects of the implementation of pedestrian facilities. Considerable benefits could also be derived from the use of crash prediction models for identifying sites that are likely to have a high rate of crashes involving pedestrians. These models could be used to predict the existing crash risk and calculate the reduction in crash risk following the implementation of various kinds of pedestrian amenities.

Abstract

Walking is an essential mode of transport. New and improved pedestrian facilities promote walking and provide greater access and mobility within our communities.

The NZ Transport Agency has recently updated the procedures for the evaluation of pedestrian improvement projects. The benefit factor applying to new pedestrian trips was increased from $0.50 to $2.70/km, making pedestrian facility improvement projects more economically viable. Thus, estimating the increase in pedestrian flows (as opposed to simply recording existing pedestrian flows) is now important in the economic evaluation of new or improved facilities.

This research analysed case studies at eight New Zealand sites where the implementation of new pedestrian facilities (or the improvement of existing facilities) led to increased pedestrian usage and improved perception of the sites. The study recorded pedestrian rates both before and after facility implementation, and analysed accompanying factors such as safety, delay and directness. It also tried to develop an expected pedestrian-usage model, based on before and after data analysis, for planners and funding agents to use when planning new or improved facilities, and for use in project evaluation.

Finally, a monitoring database containing before and after pedestrian count data for various new and improved pedestrian facilities, along with a list of the accompanying factors mentioned above, was developed for future use.

1 Introduction

1.1 Background

Walking is an essential mode of transport. Most journeys, even if mainly by car, bus or bike, include walking as a component. New and improved pedestrian facilities enable greater access and mobility within our communities. A pedestrian-friendly environment plays an important role in encouraging walking as a mode of travel, and this has proven health and environmental benefits.

Supporting and promoting the option to walk for short distances is a key objective of national, regional, and local transport and community plans.

The current government policy objectives set out in the Government Policy Statement 2 (GPS2) are focused on improvements in the provision of infrastructure and services that enhance transport efficiency and lower the cost of transportation. This should be achieved by:

- improving journey time reliability
- easing severe congestion
- more efficient freight supply chains
- better use of existing transport capacity.

Walking has a major part to play in achieving many of these objectives.

The Getting There – On Foot, By Cycle strategy, released in February 2005, also aims to advance walking and cycling within the wider transport system, and recognises the importance of walking and cycling beyond recreation and as an important mode of transport. This strategy seeks to promote:

- community environments and transport systems that support walking and cycling
- more people choosing to walk and cycle more often
- improved safety for pedestrians and cyclists.

The NZ Transport Agency (NZTA) has procedures for the development and evaluation of pedestrian improvement projects. Research to investigate the performance of pedestrian facilities is required to continually improve the processes for developing and implementing appropriate facilities for pedestrians.

This research looked at the various factors that influence people's willingness to walk, such as the availability of road crossing facilities, and the surrounding environment and safety issues in the area of the crossing. The research also investigated pedestrians' perception of their environment and the expectations they have of pedestrian facilities, and sought to identify the benefits that can result from new or improved pedestrian facilities.

The goal of this study was to prove that pedestrian numbers would increase in a certain location, or at a certain crossing facility, if pedestrians had the perception that the level of safety, delay, or other aspects that are important to them, had been improved at that location.

1.2 Objectives

The objectives of this research study, which was conducted from 2005 to 2009, were to:

- establish the pedestrian rates at various facilities or crossing locations before their improvement, and analyse factors such as safety, delay and directness
- establish the pedestrian rates at a facility after the implementation of improvements, and analyse factors such as safety, delay and directness
- develop a pedestrian-usage monitoring database of all collected data.

It was envisioned that local and national authorities and their consultants would continue contributing to the monitoring database after this research study ended.

1.3 Scope and limitations

This research aimed to:

- investigate pedestrian behaviour at new or improved pedestrian crossings
- record this in a standardised format that could be used in transport planning and project funding
- establish a monitoring database that was available for ongoing addition of data in the future.

However, the research team had significant problems in identifying sufficient suitable sites to build up the monitoring database. To address this problem and to ensure that the study's findings would be presented in a coherent way, additional work was undertaken to present detailed case studies on the eight pedestrian crossing facilities that were analysed during the study. The evaluation of the pedestrian crossings included collecting information on the facility development process, site assessments, before and after counts, and perception surveys.

Presenting each site as a case study was intended to help inform facility selection and design. Although this format did not match the original research proposal, it supported the objectives of the study as it presented the research material in a way that was consistent with providing evidence-based analyses of pedestrian facilities to enhance decision making.

1.4 Final report format

This report discusses:

- studies undertaken in the field of pedestrian facility research
- the development of a data collection and survey methodology to undertake before and after studies of new pedestrian improvements
- in-depth case studies of eight new pedestrian facilities
- the development of a pedestrian-usage monitoring database with a data entry template for additional sites.

The case study model that was chosen to present the research findings is a useful and practical technique for presenting before and after study findings. Transport planners and engineers will benefit from this ‘rich’ data-presentation approach, as it provides a detailed analysis of each case study, therefore giving the practitioner a wealth of information about the site, type of facility installed, and an analysis of likely impacts on pedestrian activity that result from different pedestrian crossing treatments.

The development of research techniques for gathering before and after data is discussed. As data collection was a key aspect of this study, it was important to ensure that suitable survey methods were chosen and properly employed. Work was also undertaken to understand the best way to carry out the surveys to minimise problems such as survey bias, and to obtain robust data sets.

The pedestrian-usage monitoring database, with suitable data entry templates, was based on these survey methods. This database can be built on, using data from future studies employing similar survey techniques to collect pedestrian facility usage data.

2 Literature review

2.1 Introduction

This research included an international literature review that collected information related to the methodologies, results and background information that has been established in similar studies. Sources included relevant internet websites, research papers, journals and previous and ongoing Beca research reports.

It was observed that although a significant amount of research has been conducted on subjects such as pedestrian behaviour, pedestrian safety and facility design, the availability of research examining the effects of pedestrian facility improvements on pedestrian usage was extremely limited.

Of the studies that were reviewed, those that were found to be most relevant to this research form the basis of the following literature review.

2.2 Background

In spite of its obvious benefits, walking is still undervalued as a mode of transport. Walton and Sunseri noted in *Impediments to walking as a mode choice* (2007) that despite recognition of the importance of walking to multi-modal travel, and government strategies to encourage this, there appeared to be a worldwide decline in the number of walking trips. In Britain, the number of walking trips decreased by 16% between 1995/97 and 2005 (Department for Transport 2005); a similar trend has been observed in the US (McCann and DeLille 2000). In New Zealand, it is estimated that walking trips as part of multi-modal travel decreased from 21.2% of all walking trips in 1990 to 14.8% in 2004 (Walton and Sunseri 2007), approximately matching the trend observed elsewhere.

Because of the numerous economic, physical and environmental benefits of walking, it is imperative that commuters are encouraged to adopt walking as a means of travel. This can be achieved by providing a safer and more inviting pedestrian environment, to encourage more people to undertake walking trips and to facilitate modal shift from other means of transport. In this context, the provision of new and improved crossing facilities to make pedestrian journeys safer and more convenient is important.

2.3 Relevance to New Zealand policy guidelines

The provision of safer and more attractive walking facilities helps to achieve a number of national policies. The national transport policy is currently set out in the Government Policy Statement (GPS2), published in 2009. It provides the framework and funding direction for the New Zealand Land Transport Funding Programme for the period 2009/10 to 2018/19. The focus of the current GPS is for the investment in land transport to increase economic productivity. The focus of transport funding in the short to medium term are to provide:

- improvements in the provision of infrastructure and services that enhance transport efficiency and lower the cost of transportation through: improving journey time reliability; easing severe congestion; more efficient freight supply chains; and better use of existing transport capacity

- better access to markets, employment and areas that contribute to economic growth
- a secure and resilient transport network
- reductions in deaths and serious injuries from road crashes
- more transport choices, particularly for those with limited access to a car, where appropriate
- reductions in adverse environmental effects from land transport
- a contribution to positive health outcomes.

In addition, the Getting there – on foot, by cycle strategy, released in February 2005, aims specifically to increase walking and cycling within the wider transport system, and is designed to maximise the contribution of walking and cycling towards achieving the targets set out in the NZTS. It provides recognition of the importance of walking and cycling beyond recreation as an important mode of transport. It identifies a vision for 'a New Zealand where people from all sectors of the community walk and cycle for transport and enjoyment'.

It includes the following goals to support this vision:

- community environment and transport systems that support walking and cycling
- more people choosing to walk and cycle, more often
- improved safety for pedestrians and cyclists.

2.4 Summary of studies

This section identifies studies involving before and after comparisons of pedestrian facility improvements that have been conducted in other parts of the world. Existing research in this area was extremely limited, which highlights the need for monitoring of pedestrian facilities to assess the benefits provided by them. The literature reviewed that was directly relevant to this project is detailed below.

2.4.1 Pedestrian crossing improvements: Before and after study – Everett St (SR 500) at 19th Ave (City of Camas 1999)

Location: Washington, USA

Date: June 1999

This study evaluated a crossing treatment that aimed to increase the visibility and safety of pedestrians crossing Everett St in Washington, USA. The treatment consisted of construction of a crosswalk on Everett St (see figure 2.1), with passive infrared sensors that could detect when pedestrians were present at the landing of the crossing and when they had crossed the street[1]. A raised island was also constructed in the middle of the street to assist pedestrians while crossing, and to calm the traffic. Kerb cuts were provided in the median.

1 Traffic regulations in the US require motorists at intersections to give way to pedestrians, whether or not crosswalks are marked.

Figure 2.1 – Site plan showing the location of the crosswalk on Everett St (City of Camas 1999)

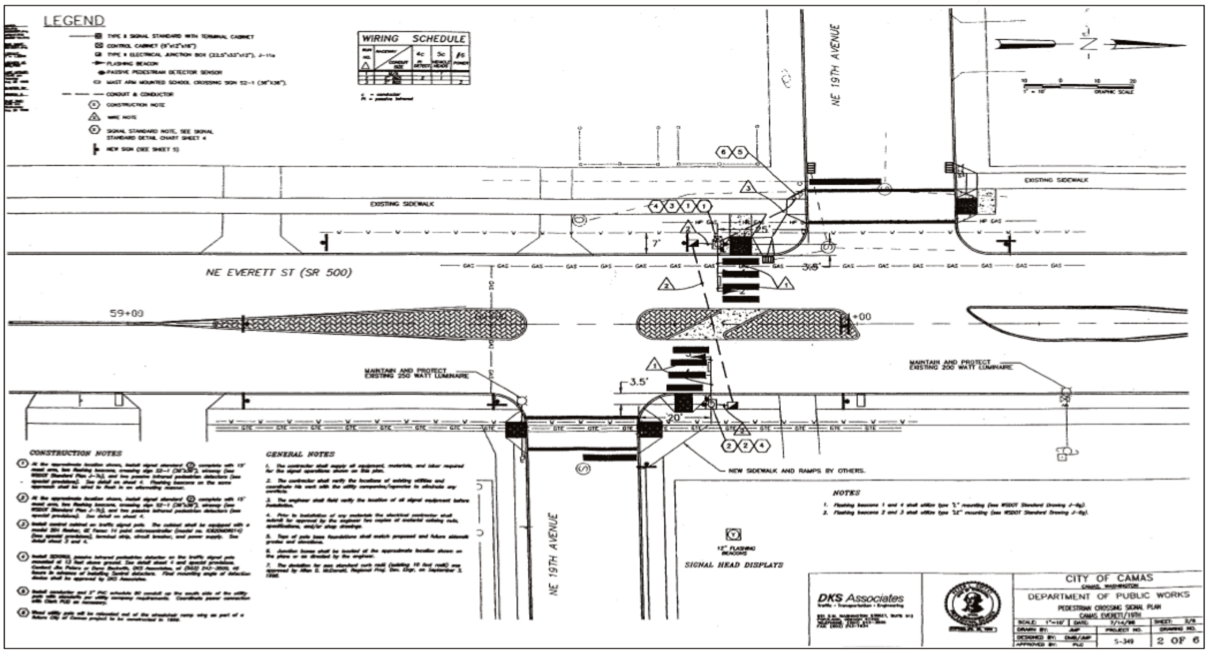


Table 2.1 shows the results from a before and after comparison survey undertaken at the site. The study found that construction of the crosswalk led to an increase in the number of pedestrians using the facility. A decrease in the percentage of people crossing at other locations on Everett St was observed, although the number of pedestrians crossing at adjacent intersections was found to increase.

Table 2.1 Percentage of pedestrians crossing Everett St: before and after improvements (City of Camas 1999)

Crossing location	Before	After
19th Ave/Everett St (within crosswalk)	78%	83%
19th Ave/Everett St (outside crosswalk)	9%	7%
Everett St: Mid-block (17th to 19th and 19th to 21st)	9%	3%
Everett St: Adjacent intersections (17th and 21st)	4%	7%

A survey of motorists' behaviour at the site also found that more cars slowed down or stopped for pedestrians crossing at the improved facility.

2.4.2 Pedestrian crosswalk case studies: Richmond, Virginia/Buffalo, New York/Stillwater, Minnesota (Knoblauch et al 2001)

Location: Virginia/New York/Minnesota, USA

Date: August 2001

Knoblauch et al (2001) undertook a before and after study in three American cities that examined the effect of crosswalk markings on driver and pedestrian behaviour at unsignalised intersections. The researchers collected data on a number of parameters, including vehicle and pedestrian volumes, vehicle speeds, and the behaviour of drivers and pedestrians.

The study produced useful data. However, it did not discover any meaningful changes in the volume of pedestrians before and after the improvements were made. Table 2.2 presents a summary of the study's findings.

Table 2.2 Study conclusions (Knoblauch et al 2001)

Hypothesis	Measurement of effectiveness	Conclusions
Before/after differences are due to the installation of the crosswalk markings and not other factors.	• Vehicle volumes • Traffic gaps • Pedestrian volumes	• No meaningful before/after changes were found in either vehicle volumes or traffic gaps. • No meaningful before/after changes were found in pedestrian volumes. • Lack of before/after changes in overall vehicle and pedestrian activity meant that changes could be more confidently attributed to the installation of the marked crosswalks.
Crosswalk markings do not affect the way drivers respond to pedestrians.	Vehicle speed (approaching and at crosswalk)	Although the magnitude of the observed speed changes was small, drivers appeared to respond differently (eg to drive slower when approaching a pedestrian on a marked crosswalk).
Crosswalk markings disrupt traffic flow because some drivers will stop and yield to crossing pedestrians.	Driver yielding behaviour	No changes in driver yielding were observed. Drivers were not either more or less likely to yield to a pedestrian on a marked crosswalk.
Pedestrians feel protected by marked crosswalks and act more aggressively when crossing.	Aggressive behaviour by pedestrians (behaviour that causes the driver to slow or stop)	No change in blatantly aggressive behaviour by pedestrians, indicating that pedestrians did not feel overly protected by crosswalk markings.
Pedestrians will not use marked crosswalks.	Percentage of crossing pedestrians on the crosswalk	• Pedestrians walking alone tended to use marked crosswalks, especially at busier intersections. • Pedestrians walking in groups did not tend to use marked crosswalks. • Overall, crosswalk usage increased after the installation of the crosswalk markings.

2.4.3 Pedestrians' perceptions of road crossing facilities (Sharples et al 2001)

Location: Scotland, UK

Date: 2001

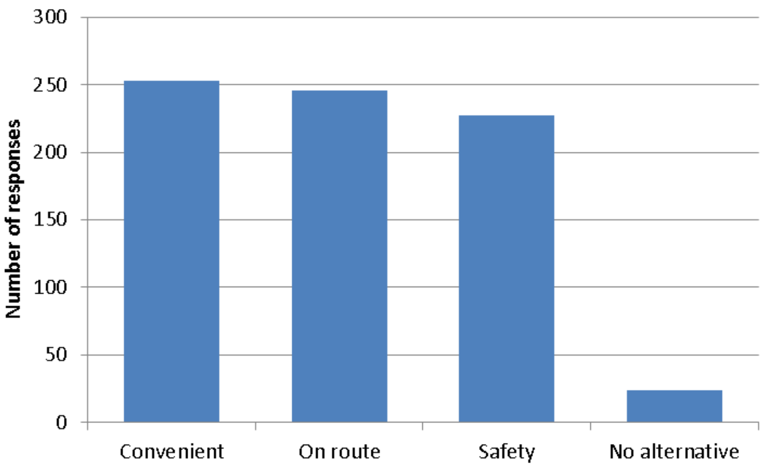
Sharples et al conducted research to identify factors associated with a range of pedestrian crossing facilities that might encourage or discourage walking in urban areas. A number of surveys were conducted at 10 different crossing types at 30 sites in 6 towns and cities in Scotland. The surveys consisted of:

- an on-street survey of the general public
- a self-completion survey of school children

- surveys of pedestrians with a range of mobility impairments.

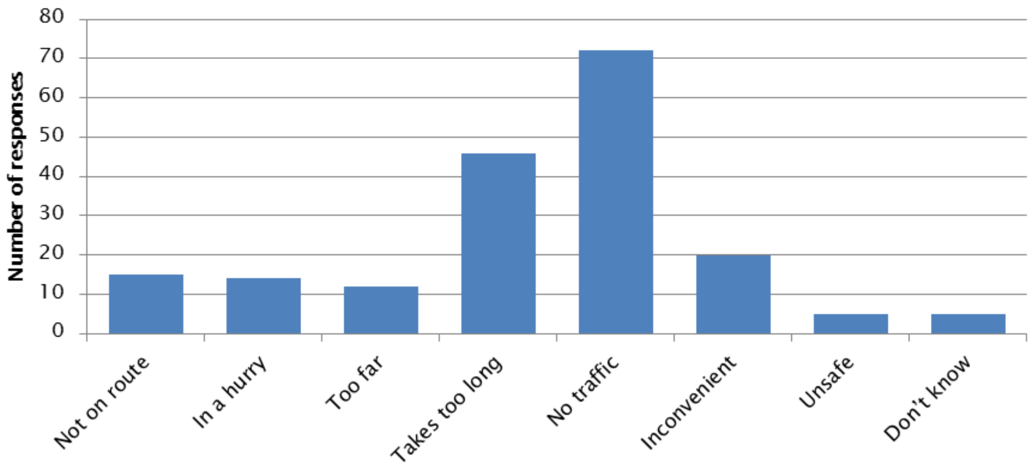
The research found that the main reasons pedestrians used formal crossing points, in broadly equal proportion, were convenience, directness of the route, and safety.

Figure 2.2 Reasons for crossing at a particular location (Sharples et al 2001)



As shown in figure 2.3, the main reasons given for crossing at locations other than at the pedestrian crossing were that the traffic was light or non-existent, or that it would take too long.

Figure 2.3 Reasons for not using a pedestrian crossing (Sharples et al 2001)



The research also found that the two most important factors in deciding to use a particular crossing facility were road safety (rated as important by 96% of the sample) and volume of traffic (91% of the sample) – particularly for those crossing at puffins[2], toucans[3] and zebra crossings. The majority of

2 Puffins (pedestrian user-friendly intelligent crossings) utilise sensors to detect the presence of waiting or crossing pedestrians. In a puffin crossing, the lights controlling the pedestrians are located on the near side of the road, rather than on the opposite side.

3 A toucan crossing is a type of pedestrian crossing that allows both pedestrians and bicycles to cross at the same crossing location. Since both pedestrians and cyclists cross together, the name toucan (two-can) was chosen.

pedestrians tended to prefer signalised crossings to pedestrian islands and zebra crossings. Zebra crossings were preferred over traffic islands when considering traffic-calming schemes.

An interesting conclusion of this research suggested that provision of crossings was probably a minor factor in maintaining a population's level of walking. Pedestrians were generally satisfied with current provision and no great increase in trips would be achieved by increasing the number of crossings.

2.5 Other relevant literature

Because there was little research analysing the effects of pedestrian facility improvements on induced pedestrian numbers, the scope of the literature review was widened to cover other aspects related to this research study. Some of the additional studies that were reviewed are outlined in the following sections.

2.5.1 Pedestrians' behaviour and the walking environment

Knoblauch et al (2001) analysed pedestrian facilities in three US cities and found that the individual characteristics of pedestrians, such as age, gender, travel path, gait, occurrence, and looking behaviour often dictated the likelihood of them using a pedestrian facility. They also suggested that these characteristics could be used to determine a pedestrian profile for a particular site which, when combined with the on-site facilities such as lighting, carriageway width and the presence of parked vehicles, could provide a measure of the probability of pedestrians going out of their way to use a formal crossing.

Their research also discovered that although the results from before and after studies were often inconclusive, there were some examples of before and after analysis that provided useful results. Their study showed that marked crossings at priority-control intersections had several positive effects and no adverse consequences. The major findings were as follows:

- Pedestrians walking alone tended to use the marked crossings, especially at busier intersections.
- Pedestrians walking in groups tended not to use the crossings provided.
- There was no evidence that pedestrians felt protected when using formal crossing points.

Data from the *New Zealand Household Travel Survey* (MoT 2007) shows that journeys to and from home and social or recreational outings are the most common reason for pedestrian trips. Shopping is also a popular reason for travelling on foot. For these reasons, pedestrian facilities near local shopping areas, recreational activities and residential areas need to be of an adequate standard.

Shortfalls in the physical environment of an area, especially those that compromise pedestrian safety, can deter people from considering walking as an alternative mode of transport. The construction of new pedestrian facilities and the upgrade of existing facilities are key methods by which the quality of the pedestrian environment can be improved, and it is important that consideration of the pedestrian environment is taken into account during the design and implementation of these facilities.

The LTNZ *Pedestrian planning and design guide* (2007) also notes that land use, urban form, connections to transport and personal security are important when developing walking routes in an area. Additionally, determining pedestrian desire lines and making allowances for appropriate path widths, clearances, cross-fall, surfaces, landscaping and furniture improve the appeal of a route to pedestrians.

In their research study *Measuring the benefits of pedestrian improvements* (2004), Buchanan and Heuman outline a series of 'good-practice' pedestrian resources that are designed to influence the number of pedestrians using a particular route.

These include:

- good on-site signage
- provision of practical maps to key destinations
- accessible footways and paths that are well lit and in good condition
- resting places at appropriate intervals
- road crossings.

Buchanan found that 'All pedestrians value the quality of the walking environment and the time it takes to complete their journey but they vary in the weight they attach to each'.

This implies that a facility that reduces a pedestrian's journey time and creates a safer environment is likely to be used over a previous route.

The *Walkability checklist* prepared by Partnership for a Walkable America (PBIC 2009) suggests that for existing routes and facilities, a rating of the present pedestrian conditions should be established based on the following criteria:

- room to walk
- ease of crossing the street
- behaviour of drivers
- ease of following safety rules
- pleasantness of the walk.

In their research titled *Modelling the roadside walking environment: a pedestrian level of service* (2001), Landis et al aim to develop a quantifiable measure of pedestrians' perception of safety and comfort in the roadside environment. They note that pedestrians' response to the roadside environment is based on a number of factors including, but not limited to:

- perception of safety and security
- conditions at the crossing or intersection
- sidewalk capacity
- quality of the walking environment
- provision of lighting and other amenities
- pathway or sidewalk shade
- architectural interest.

In New Zealand, safety is one of the most important influences on the quality of the walking environment. Recent statistics released by the Ministry of Transport (2010) show that although walking is one of the safest modes of travel, in 2009, 31 pedestrians were killed, 233 pedestrians were seriously injured, and 681 pedestrians suffered minor injuries in police-reported crashes on New Zealand roads (see figure 2.4). Since not all pedestrian injuries are reported to the police, these figures will underestimate the true number of injuries.

Figure 2.4 Pedestrian fatalities 1995–2009 (Ministry of Transport 2010)

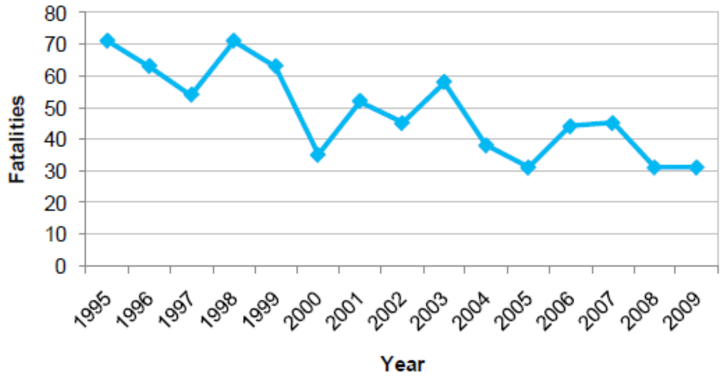
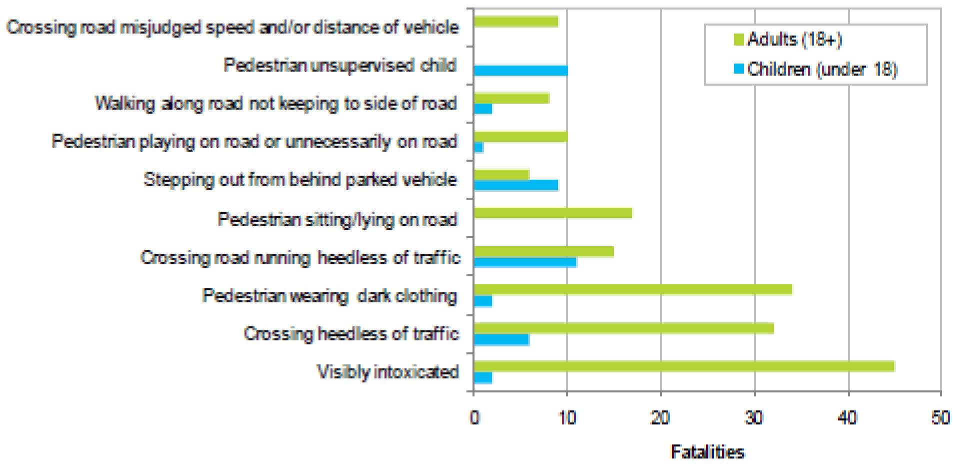


Figure 2.5 shows the 10 most frequent causes of pedestrian fatalities in New Zealand during 2005–2009.

Figure 2.5 The 10 most frequent pedestrian factors contributing to a fatal crash (2005–2009) (Ministry of Transport 2010)



Landis et al (2001) identified the following as the factors that had the most significant effects on pedestrians' perception of safety:

- the presence of a sidewalk
- lateral separation from motor vehicle traffic
- a barrier between pedestrians and motor vehicles
- traffic volume and composition
- motor vehicle speed
- driveway frequency and access volume.

2.5.2 Economics and funding

Calculating the monetary value of user benefits can be the most effective method of analysing the benefits provided by pedestrian projects, and also forms a basis of comparison with projects focusing on other modes of transport.

Buchanan and Heuman (2004) undertook three case studies along the Strategic Walking Network in London. The objective of this work was to persuade the UK government to allocate additional funding to walking facilities, by trying to quantify and value a range of user benefits derived from the proposed expenditure. The results were found to be reasonably complex, since benefits vary according to location and demand, and so do the costs of particular measures. A summary of the results from all three case studies is outlined in table 2.3.

Table 2.3 Benefits from proposed improvements – average results from three case studies (Buchanan and Heuman 2004)

Measure	Spend	Years of benefits	Benefit (NPV)	BCR
Signage/way marking and links	£10,300	5	£26,080	2.53
On-site information (panels/map boards/interpretation panels)	£11,100	10	£52,599	4.74
Off-site information	£4,000	10	£13,952	3.49
Improvements to the walked surface (including accessibility standards)	£166,125	10	£168,612	1.01
Improved safety and security	£62,000	10	£68,072	1.10
Resting places	£8,500	10	£13,641	1.60

In the New Zealand context, the NZTA's *Economic evaluation manual* (EEM) (last updated in January 2010) provides the underlying tools and factors for quantifying the benefits of pedestrian facilities and improvements. Volume 2 of the EEM was updated in January 2009 and includes revised cost limits and health-benefit values for use in simplified procedures aiming at walking and cycling and travel behaviour change. Volume 2 of the EEM also provides a worksheet (Worksheet SP11) for estimating the economic value of implementing walking schemes and pedestrian facilities. This worksheet was updated as part of the January 2009 update to the EEM and takes into account the health and environmental benefits, capital and maintenance costs, and travel time costs, and the accident cost savings of pedestrian facility improvements.

In addition, as part of the update, the benefit factor applied to new pedestrian trips was increased from $0.50 to $2.70. This has resulted in making pedestrian facility improvement projects more favourable from a benefit–cost perspective, giving these projects a greater chance of being approved for funding.

Construction and upgrade of pedestrian facilities In New Zealand is funded by the respective local authorities and councils through a Long-Term Council Community Plan (LTCCP), which is reviewed every three years. Local authorities submit funding applications for projects identified in their 3-year LTCCP through Land Transport Programmes (LTP) Online. These applications are subsequently reviewed by the NZTA and a decision on the allocation of funding is made.

2.5.3 Monitoring of pedestrian facilities

The publication *Non-motorised user review procedure – guidelines* (LTNZ 2006) sets out procedures for undertaking reviews of roading projects with special regard to the travel needs of non-motorised users (NMUs) such as pedestrians, cyclists and equestrians. The procedures aim to promote the consideration given to NMU interests, and their application is recommended during the planning and design phase of all new roading projects.

The *Transport monitoring indicator framework*, developed by the Ministry of Transport in 2008, provides a national and regional framework for the consistent monitoring of New Zealand's transport system. The framework, which was updated in 2009, is focused on monitoring the following 'themes':

- transport volume
- network reliability
- freight and the transport industry
- access to the transport system
- travel patterns
- transport safety and security
- the public health effects of transport
- infrastructure and investment
- the environmental impact of transport
- transport-related price indices.

The framework is useful for collecting and measuring pedestrian statistics across several of the key topic areas.

However, despite the above-mentioned frameworks and guidelines, funding constraints often lead to little monitoring of pedestrian facilities after construction is completed. The NZTA has procedures for the development and evaluation of pedestrian improvement projects. However, monitoring and research to investigate the performance of pedestrian facilities is also required to continually improve these procedures, which aim to ensure that appropriate facilities are created for pedestrians.

2.5.4 Site investigation

The *Pedestrian planning and design guide* (LTNZ 2007) specifies the information about a site that should be understood before a pedestrian study is undertaken. It suggests defining areas that have common elements for the preparation of community walking plans. The elements useful for developing a profile of the study areas are defined as:

- geographic areas
- land use
- administrative boundaries

- planning designations
- scale of pedestrian activity
- types of pedestrians present and/or expected.

The Guide also suggests that the following information about the site should be collected during a site visit, to achieve consistency along typical pedestrian routes:

- trip origins and destinations
- locations and extent of community severance
- extent of pedestrian infrastructure provided
- types of pedestrians present
- public transport stops
- areas of high pedestrian use
- footpath condition
- informal routes used
- walking hazards and barriers
- signage (and lack of signage)
- pedestrians' behaviour
- opportunities for improving public spaces
- anomalies between mapped facilities and actual provision.

The Guide recommends that a desktop study should be undertaken, during which the following data should be identified to analyse the current use of an area:

- pedestrian crash data
- traffic surveys
- pedestrian demand/surveys
- key trip origins and destinations
- likely points of severance
- social/demographic population data
- public transport routes/service frequency
- land uses
- maintenance records
- existing pedestrian facilities letters of complaint
- community satisfaction surveys.

2.5.5 Pedestrian surveys

Previous studies have frequently involved the use of pedestrian surveys to assess the degree of usage of a particular pedestrian facility. Knoblauch et al (2001) identified the following as an example of potential parameters that could be collected during on-site surveys to understand pedestrian usage and behaviour, which is especially significant in comparison studies:

- vehicle volumes
- available gaps in traffic
- vehicle speeds
- number of pedestrians before and after implementation
- behaviour of drivers and pedestrians.

The following procedures were followed during a similar study in Washington (ibid.):

- The data collection form consisted of plans of the site with marked zones.
- The proposed location of the crosswalk zone was also marked on the plans.
- Data was recorded using coloured pencils.
- Observers placed tick marks where pedestrians stepped off the kerb and entered the carriageway.
- If a group crossed the road together, a number of ticks would be placed and then circled to indicate the group.
- Babies being carried by their mothers were excluded from the counts.
- All pedestrians entering the carriageway were counted, even if they aborted their crossing.
- New data sheets were started every 10 minutes.
- At the end of the day all tick marks were counted for each zone and recorded in a summary table.

Pedestrian attitude surveys provide another useful method of assessing pedestrian perception. This method involves the use of questionnaires, where people are asked direct questions on how they would rank various types of facilities in terms of personal preference. These questions often ask how the individual would respond if various improvements were made at a particular site. Such surveys have been widely used, as they are easy to design and conduct. However, surveys of this type are more suitable for the evaluation of relative preferences than for the prediction of travel-demand shifts, as they often overestimate actual demand (Porter et al 1999).

The *Guidebook on methods to estimate non-motorized travel* (US Federal Highway Administration 1999) notes that while pedestrian attitude surveys are useful tools for analysing pedestrians' relative preference for different crossing facilities, they often significantly overestimate the response to a bicycle or pedestrian improvement, since in such cases people often state they will change their behaviour, but few of them actually make any changes.

Statpac Inc (2006) identified the following general design advice for developing a questionnaire:

- Questionnaires should be kept as short as possible to encourage people to participate in the survey.
- Questions should ask for an opinion or perception about only one item at a time.
- Questionnaires should include a short introduction, a statement about the confidentiality policy of this survey, and clear instructions on how to complete the questionnaire.
- Space should be allowed in the questionnaires to give people the opportunity to comment on questions and/or answers.
- The demand on the person being surveyed should be as low as possible, to allow as many people as possible to participate, and to generally encourage people to complete the questionnaire – people tend to stop completing the questionnaire halfway through if it is difficult.
- The rating scale should allow for a 'don't know' answer only if the question asks for factual information instead of an opinion.
- An odd-numbered scale can be used if people are to be given the option of choosing a neutral opinion.
- Questions should be grouped into logically coherent sections, and each question should follow comfortably from the previous question.
- Multiple-choice questions should be used for general questions on walking behaviour and demographics, as they are easy to understand and to respond to if options cover all possible responses.
- Rating scales are suitable for opinion-based questions, as they are commonly used for these types of questions and analysis of them is simple.

2.6 Summary of literature

The following is a summary of the key points from the literature review that proved to be useful inputs into this study.

- **Before and after studies:**
  - The before and after study conducted on Everett St in Washington, US (1999) concluded that the construction of a crosswalk led to an increase in the number of pedestrians crossing at the facility and a reduction in the percentage of people crossing at other locations on Everett St.
  - Before and after studies conducted in three American cities by Knoblauch et al (2001) did not find any significant changes in pedestrian volumes or attitudes after implementation of the improvements. However, they did observe that drivers seemed to drive more slowly while approaching pedestrians on a marked crosswalk.
  - Research conducted by Sharples et al (2001) at 30 sites in 6 towns and cities in Scotland found that convenience, directness on route, and safety were the main reasons that pedestrians used formal road-crossing points. Road safety was rated to be the most important factor in deciding to use a particular crossing facility.

- **Pedestrian behaviour and walking environment**
  - The quality of the walking environment plays a significant role in influencing pedestrians' willingness to undertake walking trips. The *Pedestrian planning and design guide* (LTNZ 2007) noted that land use, urban form, pedestrian desire lines, connections to transport and personal security were important factors to consider while developing walking routes in an area.
  - Buchanan (2004) found that the quality of the walking environment and time taken to complete a journey were important factors valued by pedestrians, although the weight given to each varied.
- **Site investigation**
  - The *Pedestrian planning and design guide* (LTNZ 2007) noted that information on various characteristics of an area should be collected before undertaking a pedestrian study. These included, but were not limited to, land use, administrative boundaries, scale and type of pedestrian activity, extent of pedestrian infrastructure, signage, public transport stops, and trip origins and destinations.
  - The Guide also suggested undertaking a desktop study covering pedestrian crash analysis, traffic surveys, social demographic data, key trip origins and destinations, land use, and community satisfaction surveys, to analyse the current use of an area.
- **Pedestrian surveys**
  - During on-site surveys to understand pedestrians' usage and behaviour, Knoblauch et al (2001) collected data on vehicle volumes, vehicle speeds, gaps in traffic, number of pedestrians before and after the implementation of new facilities, and the behaviour of drivers and pedestrians. Data collection forms consisted of marked plans of the sites clearly showing the location of the proposed pedestrian facility.
  - Statpac Inc (2006) also suggested the use of rating scales for conducting opinion-based surveys, because of their widespread use and ease of analysis.

3 Methodology

3.1 Selection of facilities

Based on guidance from the research project's steering group and the size of the budget available for the surveys, it was decided that in order to collect a sample of data sufficiently large for meaningful analysis, the original study brief should be narrowed down to cover only three types of pedestrian facilities. The facilities needed to be due for implementation during the two years of the study period, and were selected from information provided by a questionnaire that had been completed by local authorities and discussed at the first steering group meeting (19 September 2005). The types of facilities were:

- pedestrian refuges (with or without kerb extensions)
- zebra crossings
- signalised crossings (mid-block and at intersections).

The two study regions initially selected were Auckland and Christchurch, chosen because of the commitment of their respective councils to this project, and the likely range of facilities being implemented in these areas. However, the research team had significant problems in identifying enough suitable sites with facility improvements being implemented during the study period, so two further sites in Hamilton were added.

A total of eight suitable sites were selected for this study, as listed in table 3.1.

Table 3.1 Selected study sites

Site	Location	New/improved facility
Moorhouse Ave (at Science Alive!)	Christchurch, New Zealand	Pedestrian signal
Hereford St (at Westpac Lane/National Mutual Arcade)	Christchurch, New Zealand	Zebra crossing with slightly raised median and warning light system
Hoon Hay Rd	Christchurch, New Zealand	Kea crossing
Sparks Rd	Christchurch, New Zealand	Zebra crossing (school patrol)
Ensors Rd	Christchurch, New Zealand	Refuge island and kerb build-out
Collingwood St, East of Tristram St	Hamilton, New Zealand	Kerb extension
Tristram St (at Gary Keith Motors)	Hamilton, New Zealand	Refuge island
Margot St, Grey Lynn	Auckland, New Zealand	Kea crossing

3.2 Site characteristics/influences

The following sub-sections describe the types of data collected and the method of measurement and analysis for each of the sites analysed in this research report.

Given the difference in sites, induced pedestrian demand was considered separately for each site and an analysis carried out to determine whether provision of the facility had resulted in greater numbers of pedestrians.

- **Site characteristics:** Site visits were undertaken to observe relevant characteristics of the selected sites. These included:
  - the quality of the footpaths, including lighting, condition of surface and level of maintenance
  - the characteristics of the surrounding area, including cleanliness and the condition of buildings
  - the level of signage
  - the availability of resting places
  - other crossing facilities in the immediate vicinity
  - types of pedestrians in the area.

  Observations related to the behaviour of pedestrians and factors that might influence the pedestrian environment in the area were also recorded, and formed the basis of an initial assessment of the quality of the pedestrian environment and number of pedestrian movements.
- **Land use:** The predominant land use, both in the general area and that fronting the pedestrian facility, was determined using aerial photos or site visits. Significant pedestrian generators/attractions were identified and recorded. This information was used to analyse trends in the pedestrian desire lines in the vicinity of the facilities.
- **Traffic flows:** Traffic flow information was collected from local authorities.
- **Road classification:** Roads were classified in accordance with the local authority's district plan (eg Strategic Roads, Regional Arterial Roads, Collector Roads, Local Roads and Service Lanes).
- **Road cross-sections:** Information on the road cross-section at the location was collected, such as:
  - number of lanes of each type
  - median types
  - seal width
  - crossing distance for pedestrians.
- **Weather:** Because adverse weather conditions can reduce the number of people who are out walking, pedestrian surveys were only conducted on fine days whenever possible. The weather conditions during the survey were recorded.
- **Accident statistics:** A summary of accident history over a five-year period (2003–2007) within 50m either side of the facility was collected from the NZTA Crash Analysis System (CAS) database. This provided an indication of the relative crash risk for pedestrians at a particular location.
- **Promotion and community consultation:** Promotion of the facilities by the local authorities (eg a local promotion campaign or similar marketing strategy) was noted. Any community consultation

conducted by the local authorities during the design and consultation phase of the project was also recorded.

- **Driving factors for the construction of new facility, or its improvement:** Information was collected on the following factors:
  - the site presenting problems eg delays or safety issues for pedestrians
  - road construction eg drivers distracted by temporary diversions and not focused on pedestrians
  - being part of an area-wide strategy
  - other (details specified).

3.3 Pedestrian count surveys

Given that the objective of this research project was to determine the effect of new and improved pedestrian facilities on the number of pedestrians, pedestrian count data was one of the most important factors assessed in the study.

3.3.1 Survey consistency

It is recognised that pedestrian volumes fluctuate from day to day, owing to factors such as weather conditions, day of the week, time of the year and whether it is school/university term time. To reduce the effects of these fluctuations, it was proposed that the before and after pedestrian counts would be conducted:

- during similar (preferably fine) weather conditions
- at a similar time of the year.

To maintain survey consistency, counts would be measured:

- on the same day of the week
- at the same time of day
- at a consistent time with respect to school/university holidays.

When selecting a time and day to carry out the count, peak hours were a key consideration, but certainly not the only one. The other main consideration was variability in pedestrian numbers, over the same period, from week to week. The key measure of this variability and input into statistical calculations was the coefficient of variance (standard deviation/mean) between counts.

Generally, outside of the time period 8am–6pm, pedestrian counts were extremely variable, with the coefficient of variance (COV) exceeding 500% at some times. To reduce variability, it is usually best to survey within this time period; however, we found that some times within this period were better than others, as outlined below.

To evaluate the quality of the pedestrian count methodology, base data from a control site established for the research paper 'Predicting accident rates for cyclists and pedestrians' (conducted by Beca for Transfund NZ, between 2002 and 2005) was used. The control site was located at a signalised crossing located near Christchurch Hospital, and used pressure detectors that counted pedestrians as they stood on them. Continuous pedestrian flow count data, reported in quarter-hour periods, was collected over one year from December 2003 to November 2004. To assist in determining the best survey time, data from this control site was used to produce two graphs showing the COV for weekdays and weekends (see figures 3.1 and 3.2).

Figure 3.1 Coefficient of variance between quarter-hour counts on weekdays

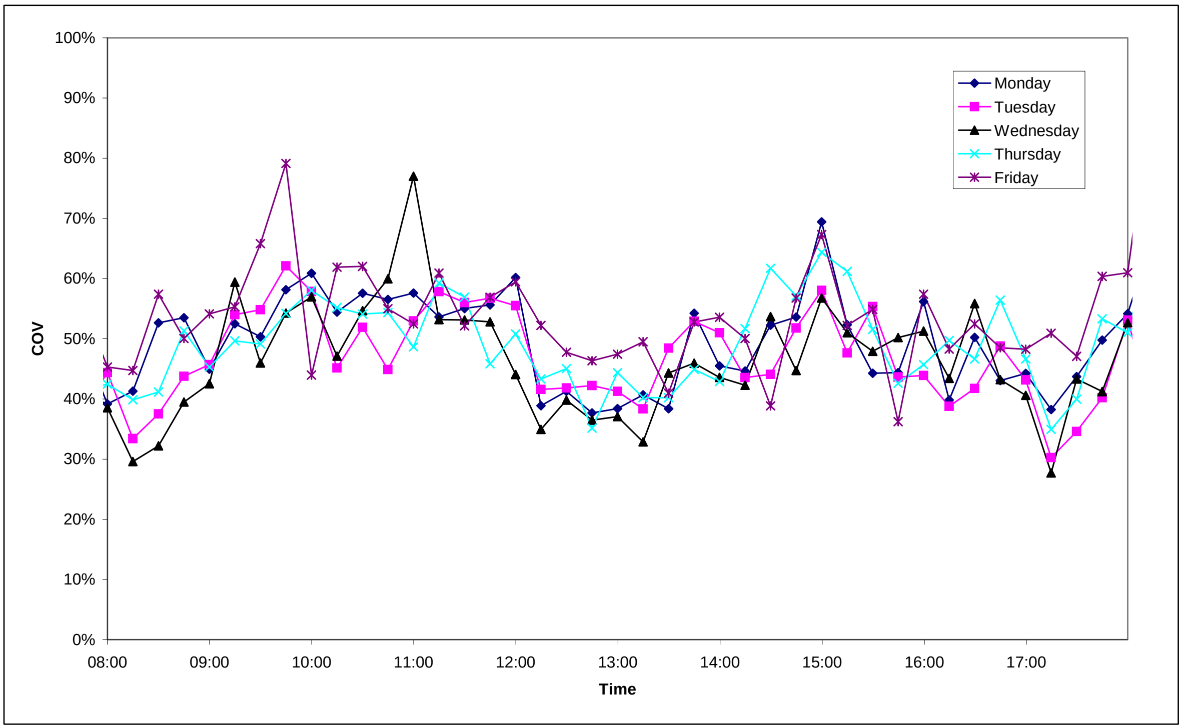


Figure 3.2 Coefficient of variance between quarter-hour counts on weekends

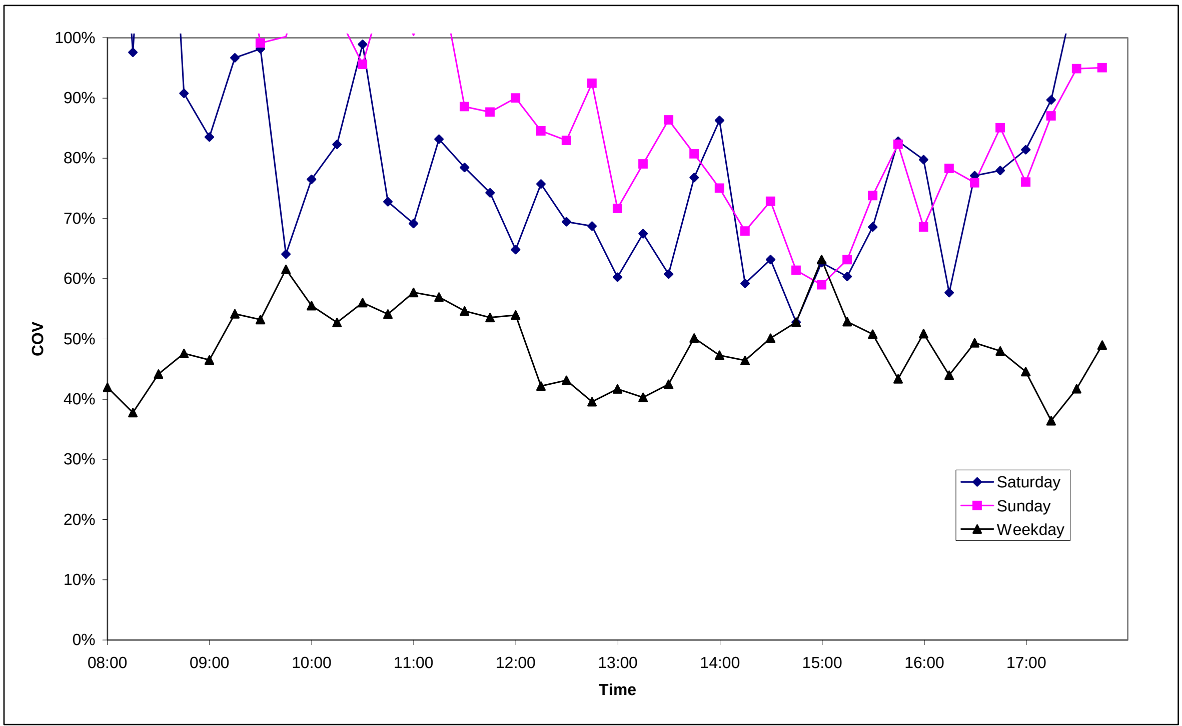


Figure 3.2 shows that the COV of pedestrian counts on different weekdays was similar, and was generally between 40% and 60%. It is important to note that figure 3.2 does not indicate that it was suitable to use counts collected on different weekdays during the same week. Although no analysis was carried out for this scenario, it is likely that the COV of counts obtained using such a technique would have been quite high.

Figure 3.2 suggests that the COV was lowest around noon, and this was therefore potentially the best time to survey. Higher variability around the afternoon and morning peaks was possibly because the analysis did not allow for school holidays. If school holidays had been avoided, the afternoon and morning peaks would appear to have also been a suitable time to conduct pedestrian counts.

Figures 3.3 shows a much higher variability in pedestrian counts at weekends, which ruled out surveying at that time.

3.3.2 Survey count duration

The original proposed methodology suggested that a two-hour period should be used for most sites. It also suggested that only the peak hour should be considered in the analysis. After further analysis, the project team considered this inappropriate and decided that a longer count period should be considered. It was also decided that counts should be recorded in 15-minute intervals.

To investigate the benefits of increasing the count duration, three scenarios were considered:

- a 2-hour continuous count (as proposed)
- a 4-hour continuous count
- two separate 1.5-hour counts on adjacent weeks.

The results of this analysis are reported next.

3.3.3 Estimate of variability of pedestrian counts

Using the data on pedestrian rates for Mondays from the previously mentioned control site, mean variabilities for a number of different time periods were calculated for each scenario (see table 3.2). The increase in total mean pedestrian volumes before and after the installation that were required for a statistically significant sample was then calculated.

Table 3.2 Increase in pedestrian volumes required for statistical significance

Scenario	Mean COV	n (number of 15-minute survey intervals)	% change required
2-hr continuous count (as proposed)	50%	8	77%
4-hr continuous count	56%	16	52%
Two separate 1.5-hr counts on adjacent weeks	47%	12	51%

The analysis found that the variability between a series of adjacent quarter-hour counts (for a two-hour continuous count) was similar to the variability between counts that were taken at the same time of the same day, but during different weeks. The level of variability needed to be considered when assessing the statistical significance of any change in pedestrian flow between the before and after pedestrian counts.

However, the estimate of variability between adjacent 15-minute counts typically increased as the count duration increased, because of fluctuating flows, and decreased if the count was separated into two adjacent weeks. The key influences on the statistical analysis were the estimate of this variability and the sample size (ie number of 15-minute intervals).

Table 3.2 shows the benefits of increasing the survey duration by collecting counts on adjacent weeks. In general, collecting counts over a period of two adjacent weeks is highly recommended, as it reduces the influence of factors that affect a particular day, such as weather changes and local events. If counts are collected on a single day, then it is more likely that the before and after analysis will not be comparing the effect of the new facility, but will indicate the effects of certain one-off factors such as weather differences or a discount sale at a nearby shop. This would defeat the point of the study.

3.3.4 Survey day and time

In accordance with the above recommendations, the study team undertook pedestrian counts using the following method:

- Pedestrian counts were undertaken on Wednesdays over three consecutive weeks.
- Surveys were conducted for a duration of 1.5 hours, starting from 12pm (Note: For school kea crossings, the surveys were undertaken from 8–9am, and 2.30–3.30pm, to coincide with pedestrians using the crossing at the times of school opening and closing).
- Data was recorded at 15-minute intervals.
- Pedestrian desire lines, indicating the locations where pedestrians crossed the road most frequently, were recorded.

In addition, it was decided that:

- wheelchair-bound persons would be counted as a pedestrians
- children being carried and cyclists pushing their bikes at the crossing would not be counted.

Given that six hours had been allocated for each before and after count, it was suggested that a count of longer duration, split over three weeks, could be undertaken within budget. This was also expected to significantly improve the likelihood of understanding how counts varied from day to day and from week to week, and therefore better understand whether there was a significant increase in the numbers of pedestrians using the crossing.

The duration of the before and after surveys was kept consistent. For sites that were located near schools, care was taken not to hold the pedestrian count surveys during school holidays. Although the intention was to undertake the before and after surveys in the same season if possible, time constraints meant this was not feasible in all cases.

Analysis of count data was used to identify pedestrian desire lines and changes in pedestrian use, both before and after the facility was installed or improved.

3.4 Pedestrian attitude surveys

3.4.1 Survey questionnaire

The overall objective of undertaking pedestrian interviews was 'to investigate pedestrians' perceptions of crossing locations before and after the improvements had been implemented, and the effects of perceived improvements on their road-crossing behaviour.'

The steering group believed that a pedestrian's perception of safety, rather than the actual impact of the improvement, would influence the decision on whether or not to use a particular facility; that is, even if the *actual* level of safety at a crossing location had improved, pedestrians might not change their crossing behaviour unless they *perceived* that safety had been improved. We wanted to get a better perspective on this issue via the surveys.

The steering group also acknowledged that delay and safety have an impact on people's choice of where and when to cross a road, and are often major drivers for the implementing of new pedestrian facilities, or improvement of existing facilities, by councils.

It was therefore decided to include questions on the perceived level of safety and delay in the survey questionnaire. Questions were designed to gather views on the crossing facility for the three key attributes of perceived safety, delay and directness. For each of these attributes, an additional question asked about the importance the respondents placed on each key attribute, rated on a seven-point scale from -3 (poor/not important) to +3 (excellent/very important). Respondents who had used the crossing before it was improved were asked to also rate the questions based on their views of crossing the road *before* the improvement. Therefore, a set of user perception responses was gathered on crossing experiences both before and after the improvement. The format of the questions is set out in table 3.3 below.

Table 3.3 Format of survey questions

Safety	• Please rate how safe you feel crossing at this facility. • Are safety aspects important to you when deciding on a location to cross the street?
Delay	• Please rate how much delay you experience when crossing at this facility. • Are delay aspects important to you when deciding on a location to cross the street?
Directness	• Please rate how directly this crossing facility is on your route. • Is the directness of crossing facilities important to you when deciding on a location to cross the street?

A copy of the questionnaire is attached as appendix B of this report.

3.4.2 Target population/sample size

The target population of this survey generally included all pedestrians who crossed the street at a certain facility. As there was only one person conducting the survey, not all people crossing at the facility under investigation could be surveyed, particularly at busy locations. This was especially the case when a group of people crossed the street at the same time. Therefore, there was a need for participants to be selected carefully to get responses from a range of pedestrians.

Children over the age of 11 were included in the surveys. The literature suggests that children below this age will have difficulty completing a survey (Borgers et al 2002). Also, at a younger age they may not be able to differentiate between safe and unsafe situations, and do not have a good understanding of the concepts of time and dangerous situations. Children younger than 11 were normally accompanied by a parent, and therefore the parent was interviewed.

If a person in a wheelchair was crossing the street, the surveyor attempted to survey this person if possible. If the person did not agree or could not be surveyed for any reason, the person pushing the wheelchair was surveyed, with an emphasis on issues related to crossing the street in a wheelchair.

3.4.3 Survey bias

The questionnaire and survey approach were designed to avoid survey bias as much as possible. For example, the interviewer was asked to approach any person of the target population, disregarding their outward appearance, gender, and age. However, while it was not the interviewer's intention, bias in participant selection could still have occurred and it is possible that the people participating in this survey did not reflect the target population.

Older people could be over-represented in the sample, as older people tend to walk more slowly and often have more time available than younger people, and might therefore be easier to approach. On the other hand, the surveys conducted at facilities near a school might have over-represented younger people.

While the intention was to conduct the survey in fine weather only, there was the potential for unexpected weather changes that could influence the outcome of a survey, as unfavourable weather could lead to some people postponing their trip.

The issue of people being unwilling to participate in the survey was a concern. Research has found that single males are less likely to respond to surveys than other groups, resulting in a 'non-response' survey bias (Statpac Inc 2006). However, literature sources (such as Statpac) suggest that the group of people who are unwilling participants tend to provide less-reliable responses and can therefore cause biased data. As people could not be forced to participate in this survey, this issue could not be mitigated.

3.4.4 Sampling error

It was expected that extending the before and after survey period for each site to three survey periods in three consecutive weeks, and on the same day of the week and at the same time of day, would result in a considerable reduction in sampling error.

3.4.5 Survey method

The survey method used involved interviewing a pedestrian once they had completed crossing the pedestrian facility. The surveyor would identify the pedestrian as they made their way across the facility, approach them once they had safely reached the footpath, and ask if they would agree to complete a questionnaire on the facility. Surveyors were instructed to interview as many pedestrians as possible during the survey period.

The study team were aware that this survey method would not capture the views of pedestrians in the general area who did not use the crossing. While the views of pedestrians who avoided the crossing for some reason were valid, budget and time constraints meant it was not possible to extend the survey area to include them.

3.5 Case study analysis

A case study research approach was chosen to present the research findings, as a practical and effective technique for presenting before and after study findings. The case study approach emphasises detailed contextual analysis of a limited number of sites, and seeks to understand the dynamics within a single setting, using multiple types of analysis. Information collected on each site is analysed and presented in a narrative form. The aim is to build a knowledge base around context-based information.

The use of case studies to build knowledge is well recognised. Flyvbjerg notes that:

> *... context-dependent knowledge and experience are at the very heart of expert activity. Such knowledge and expertise also lie at the centre of the case study as a research and teaching method or to put it more generally still, as a method of learning* (Flyvbjerg 2006, p222).

The case study analysis therefore provided a detailed assessment that gave us a wealth of information about the site, type of facility installed, and an insight into the likely impacts of different pedestrian crossing treatments on pedestrian activity. The conclusions from each case were compiled to provide a holistic database for the whole study, but each case was also analysed separately.

3.6 The case study approach

3.6.1 Case study format

The following sections contain individual case studies detailing the characteristics of each of the eight sites analysed in this study, along with results of the pedestrian surveys undertaken at these sites.

A consistent format has been adhered to for each individual case study, to ensure that a comparative analysis could be undertaken. Information for the sites has been grouped into the following subheadings:

- **Case study site summary table** – summarises the type of facility, project cost, road category and traffic volumes
- **Introduction** – gives a brief overview of the site and describes the location of the facility
- **Site characteristics** – describes road categories, surrounding land use, road environment
- **Crash history** – gives details of crashes for the period 2003–2007
- **Facility design and consultation** – gives details of the proposed improvement, along with construction plans and details of the consultation process
- **Data collection and analysis** – provides results of the before and after pedestrian count surveys
- **Behaviour at the site** – depicts pedestrian desire lines and crossing behaviour
- **Pedestrian survey findings** – reports the results of the pedestrian-perception questionnaire surveys.

4 Case study data collection and analysis

4.1 Using the case studies

Table 4.1 gives a brief overview of various characteristics of the different sites examined in this study, such as road category, average daily traffic volume, and the number of pedestrians before implementation (or improvement) of a pedestrian facility. Please note that this research was undertaken before the earthquakes occurred in Christchurch in September 2010 and February 2011. The descriptions of some of the sites in Christchurch may no longer be accurate in the current conditions.

Table 4.1 Overview of study sites

Location	Type of improvement	Road category	AADT	'Before' survey (ped/hr)	Survey period	Section of report
Moorhouse Ave at Hoyts 8/ Science Alive!, Christchurch	Signalised crossing	6-lane median divided arterial	40,000	75	12–1:30pm	4.2
Hereford St, Christchurch	Raised zebra crossing with warning light system	Collector	9500	628	12–1:30pm	4.3
Sparks Rd, Christchurch	School-patrolled zebra crossing	Minor arterial	10,700	148	8–9am, 2:30–3:30pm	4.4
Hoon Hay Rd, Christchurch	Kea crossing	Minor arterial	7000	43	8–9am, 2:30–3:30pm	4.5
Ensors Rd, Christchurch	Refuge island and kerb extension	Minor arterial	8200	7	12–1:30pm	4.6
Collingwood St, Hamilton	Kerb extensions	Collector	6500	30	12–1:30pm	4.7
Tristram St, Hamilton	Refuge island	Minor arterial	21,000	25	12–1:30pm	4.8
Margot St, Auckland	Kea crossing	Local road	2200	69	8–9am, 2:30–3:30pm	4.9

The information in this table may be useful in identifying the site most similar to the reader's requirements, and the respective case study may then provide an indication of the degree of success that implementation of a particular pedestrian facility could have in that environment.

4.2 Case study 1: Moorhouse Ave at Hoyts 8/Science Alive!, Christchurch

4.2.1 Site summary

- Crossing type: Signalised pedestrian crossing
- Road: Six-lane median divided arterial – 40,000 vehicles/day
- Project cost: $148,000

4.2.2 Introduction

This Christchurch site is located near Hoyts 8/Science Alive! on Moorhouse Ave, between Manchester St and Madras St. Moorhouse Ave is a six-lane median-divided arterial road that carries approximately 40,000 vehicles/day and is located about 1km south of Cathedral Square (the city centre). The crossing length is approximately 20m, with 10m across three lanes on each side of the median. There is a significant amount of pedestrian traffic in the general area, and Moorhouse Ave acts as a barrier to pedestrian movements between the South City area of central Christchurch and the Hoyts 8/Science Alive! facility.

A 2003 'Crash reduction study' recommended installing a safer, signalised pedestrian crossing facility at this site, which at that stage consisted of a clear raised median directly in front of the entrance to Hoyts 8/Science Alive!. This became one of the upgrade components in the Moorhouse Ave/Barbadoes St: Traffic Management and Safety Improvements project.

Figures 4.1 and 4.2 show the site on Moorhouse Ave and identify surrounding land uses.

Figure 4.1 Aerial photograph showing the location of the case study site at Moorhouse Ave, Christchurch

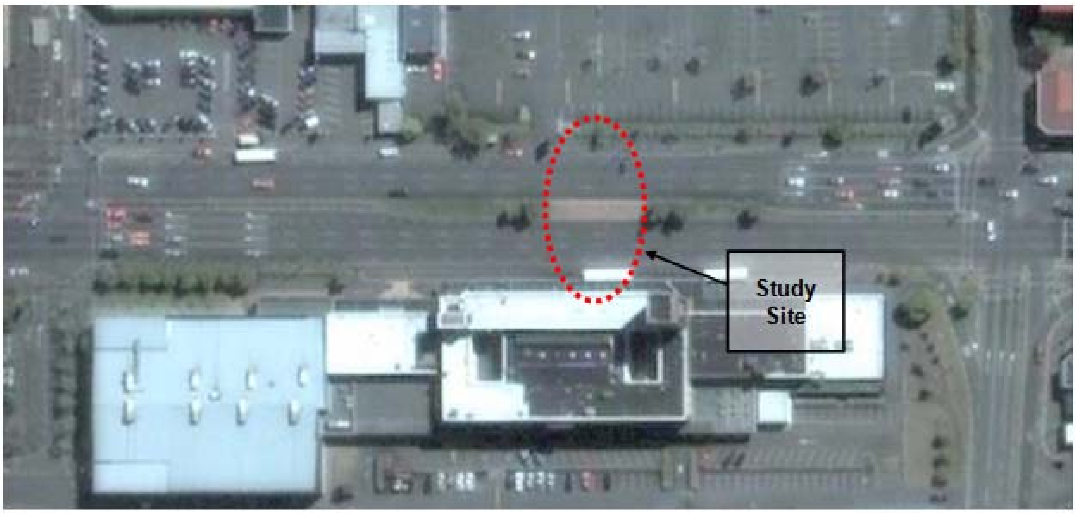


Figure 4.2 Pedestrian attractions in the vicinity of the site

4.2.3 Site characteristics

The site can be described as a major arterial road that separates key pedestrian destinations to the north from the Hoyts 8/Science Alive! facility and a bus stop for scheduled bus services to the south.

This bus stop services a large number of buses and is a route 'timing point', where buses that are running early are required to stop and adjust their service according to set schedules. Shift changes for the bus drivers also occur here. The former Christchurch railway station houses the Hoyts 8 cinema complex and the popular Science Alive! science education centre, along with commercial office space and conference and lecture facilities. The entry and exit points open directly onto Moorhouse Ave.

On the north side of Moorhouse Ave, shopping facilities (eg the Pak 'N Save supermarket) and fast-food outlets (eg Burger King) are high generators of pedestrian trips. Students and staff from the Christchurch Polytechnic Institute of Technology (CPIT), situated within walking distance to the north-east of the site, add to pedestrian activity, especially for access to bus services along Moorhouse Ave.

Figure 4.3 shows the new pedestrian facility and surrounding road environment. Note the overhead traffic signal masts and the Hoyts 8/Science Alive! facility in the background.

Figure 4.3 The new pedestrian crossing facility on Moorhouse Ave

4.2.4 Crash history

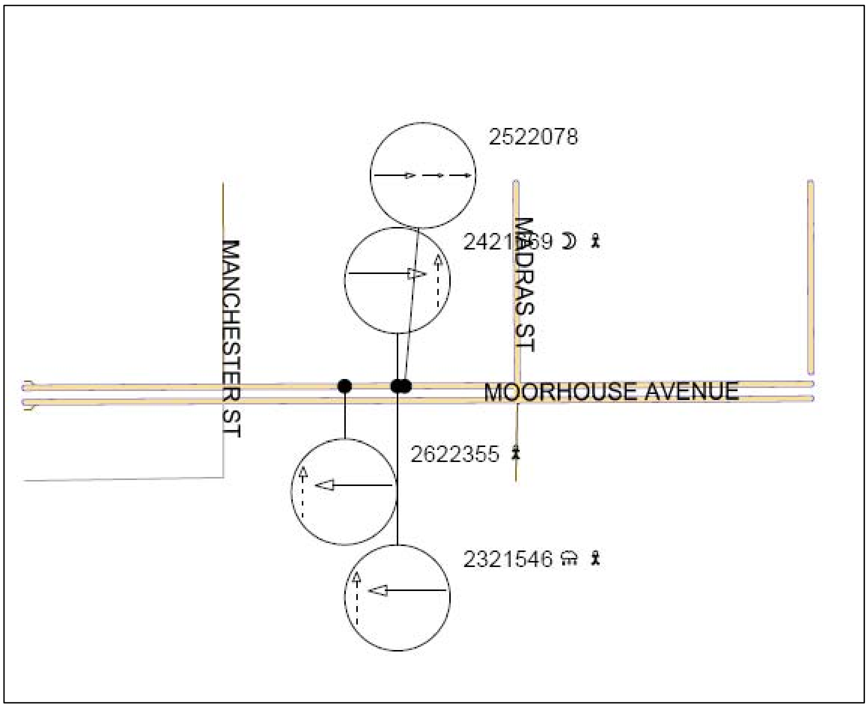
The crash history for Moorhouse Ave was extracted from the NZTA's Crash Analysis System (CAS) database for the period 2003–2007 (see appendix C of this report). There were four crashes within 50m of the study site, all of them being minor-injury crashes. Three of these were NA-[4] and NB-type[5] crashes involving cars travelling along Moorhouse Ave and pedestrians trying to cross the road from either side. The main reasons cited for these crashes was the pedestrians' lack of regard for the volume of traffic going straight through, and error in judging the speed of the oncoming vehicles. A rear-end collision involving two vehicles was also reported, possibly caused by a car slowing down to give way to crossing pedestrians.

Figure 4.4 illustrates the crashes near this site that were reported in the CAS database.

4 NA – pedestrian crossing from the left of a vehicle

5 NB – pedestrian crossing from the right of a vehicle

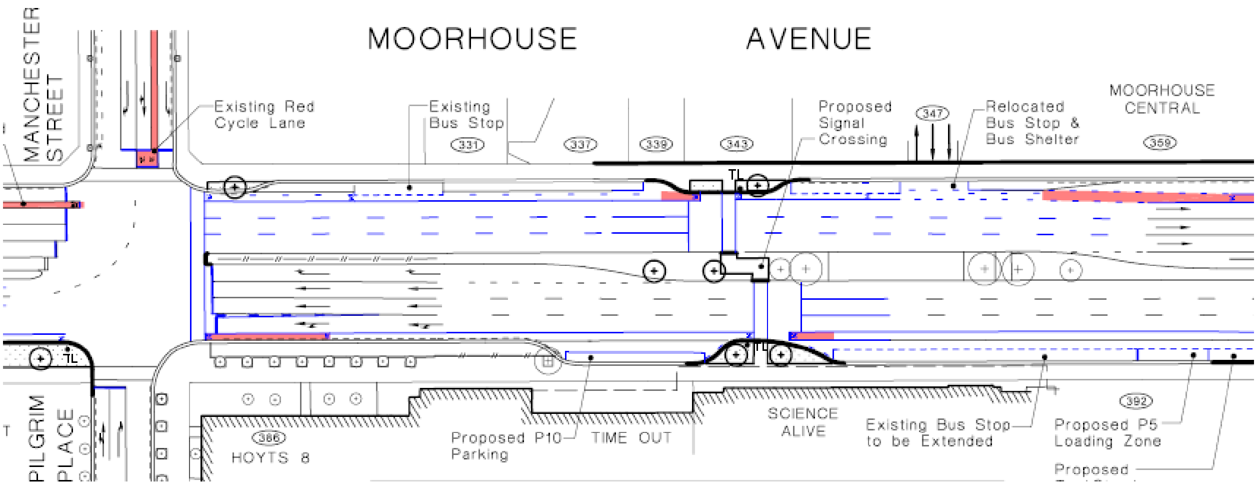
Figure 4.4 Crashes at the Moorhouse Ave/Science Alive! site (2003–2007)



4.2.5 Facility design and consultation

The pedestrian crossing facility at Moorhouse Ave is a signalised pedestrian crossing that utilises overhead traffic signal mast-arm poles. Figure 4.5 shows a layout plan for the facility.

Figure 4.5 Moorhouse Ave pedestrian facility layout plan

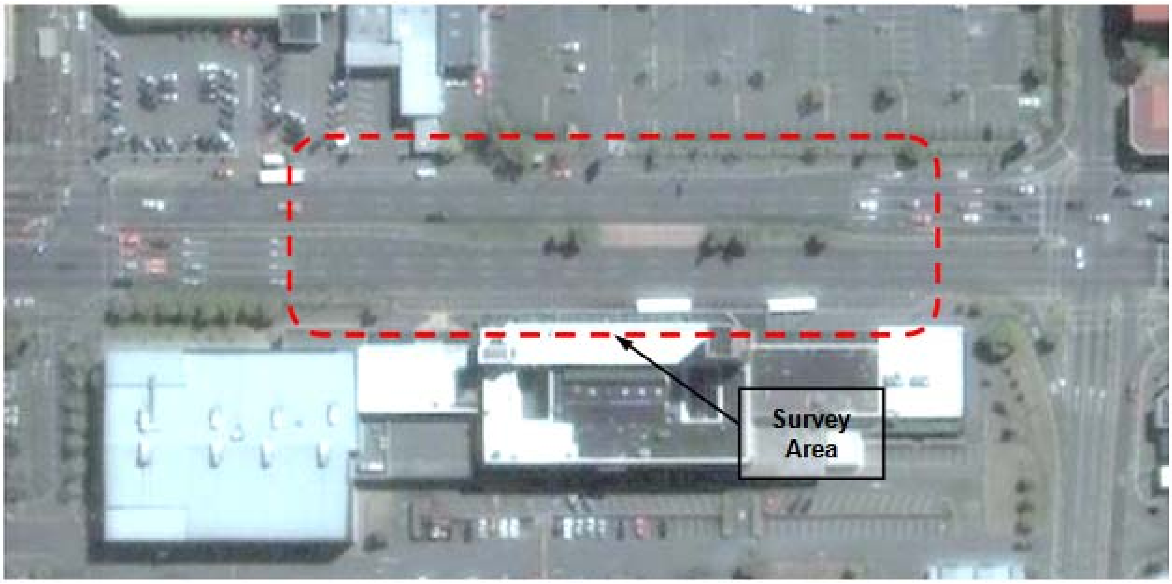


In January 2006, Christchurch City Council (CCC) consulted with the community in the area via a booklet titled *Moorhouse Ave/Barbadoes St traffic management and safety improvements*, which covered various improvements along Moorhouse Ave, including the proposed pedestrian crossing outside the Hoyts 8/Science Alive! facility. Approximately 1500 booklets were delivered to every business along Moorhouse Ave, from Lincoln Rd to Ferry Rd, as well as to the Music Centre, the Catholic Cathedral School, the Catholic Diocese, and CPIT in Barbadoes St.

4.2.6 Pedestrian counts

'Before' pedestrian count surveys were undertaken at the Moorhouse Ave site over a period of three consecutive weeks in February 2007, with the 'after' surveys completed over three weeks in February 2008. As specified in the research methodology, the survey counts were undertaken for a period of 1.5 hours during the midday lunch-time period (12–1:30pm). The survey area is shown in figure 4.6.

Figure 4.6 Pedestrian count survey area



The results showed a small increase in pedestrian numbers – averaging 75 pedestrians/hour before the improvements, and 80 pedestrians/hour after.

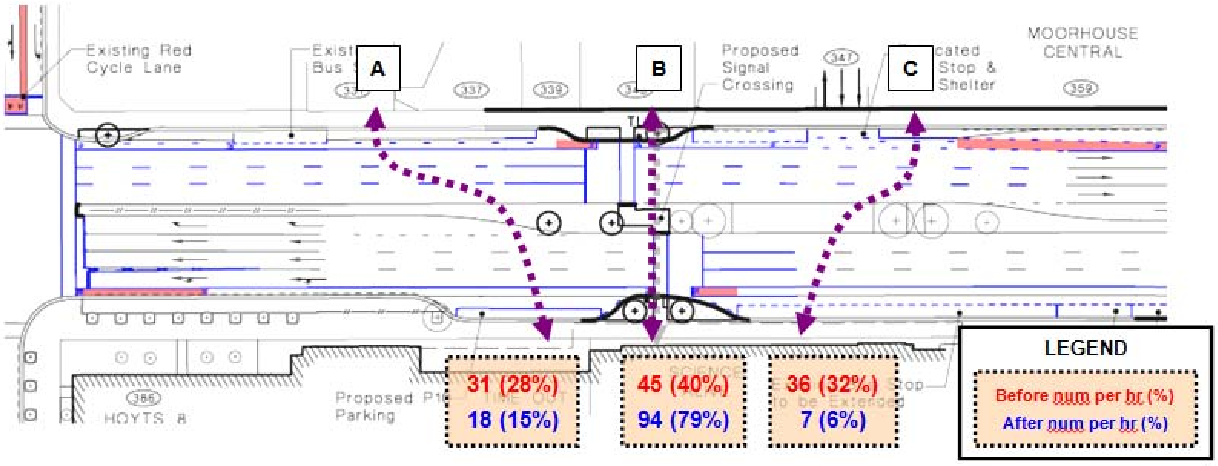
It was difficult to draw conclusions based on these figures. Obviously, the construction of the new facility did not greatly affect the numbers of pedestrians crossing the road, and there was no evidence to suggest that suppressed demand was released by the new facility. Similarly, an assessment of the facility's ability to generate additional pedestrian trips could not be made without knowing if any changes had occurred in the surrounding land use to attract or reduce pedestrian activity. Assuming there was no change in the surrounding land use, the facility attracted a modest number of additional pedestrians and continued to be an attractive crossing option for pedestrians in this area. The attractiveness of the facility was supported by the analysis of the behaviour of pedestrians and the user perceptions that are outlined in the next two sections.

4.2.7 Behaviour at the site

One way to analyse the behaviour of pedestrians is to observe where pedestrians choose to cross the road. Over time, pedestrian desire lines (indicating preferred crossing points on the road) can be established. Desire lines for pedestrians crossing at the Moorhouse Ave site were observed during the before and after surveys, in order to ascertain the impact of the new facility on pedestrians' road-crossing behaviour.

Although it was clear that the new facility had changed the percentage of pedestrians who crossed the road on the identified desire lines (see figure 4.7), the number of pedestrians who used the new signalised crossing (desire line B) approximately doubled, from 30 pedestrians/hour to 63 pedestrians/hour. This represented an increase in the proportion of pedestrians crossing on the central desire line from 40% to 79%, and indicated that a significant proportion of all pedestrians were choosing to use the new facility.

Figure 4.7 Pedestrian desire lines at Science Alive!



4.2.8 Pedestrian survey findings

The third form of assessment undertaken at the site was a user perception survey. A copy of the questionnaire survey that was used is provided in appendix B of this report. To gain insight into user perceptions about the facility, the survey questions were designed to obtain views on the crossing facility for three key attributes: safety, delay and directness.

A graph of the findings for the survey questionnaire is provided in figure 4.8. The rating for each survey question on the vertical axis is an average of the respondents' responses for each question, using the seven-point scale (-3 to +3).

Figure 4.8 Summary of before and after survey responses by question type (average ratings)

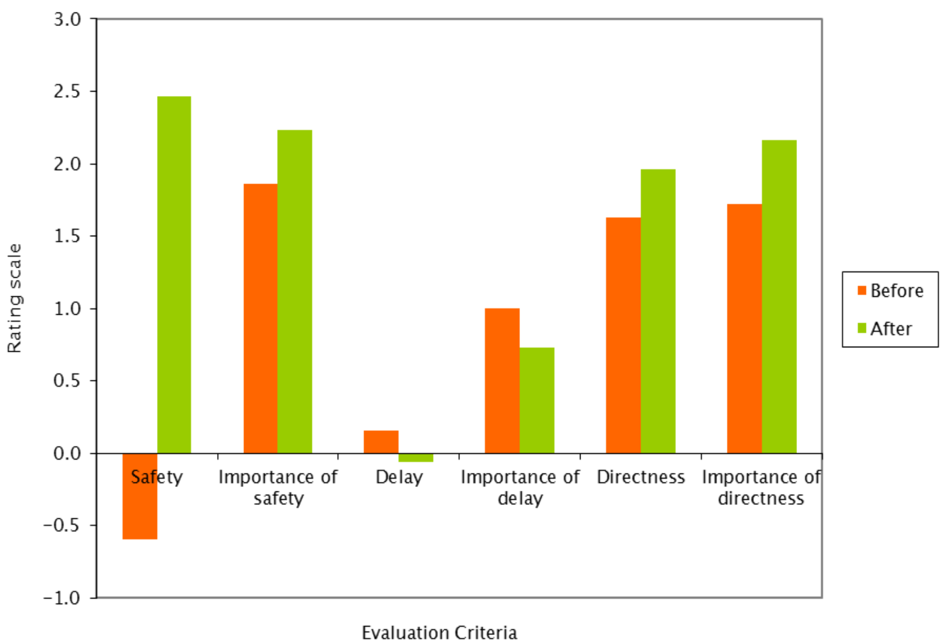


Table 4.2 Before and after perception surveys – average ratings

	Safety	Importance of safety	Delay	Importance of delay	Directness	Importance of directness
Before	-0.6	1.9	0.2	1.0	1.6	1.7
After	2.5	2.2	-0.1	0.7	2.0	2.2

It was clear that respondents experienced only slightly longer delays at the crossing point after the facility was operational, and interestingly, they placed relatively low importance on delay. It is difficult to draw wider conclusions about the importance of pedestrian delays from this type of question, but at the Moorhouse Ave crossing it was obviously not perceived as a significant issue. A possible contributing factor may be that pedestrians generally expect to have longer waiting times at this site because of the high traffic volume and the crossing distance involved.

However, the findings related to perceptions on how safe the road was to cross are significant. As illustrated in figure 4.8, the 'before' rating on 'how safe you feel crossing at this facility' was -0.6, reflecting a slightly negative to neutral attitude. The 'after' findings indicated that most respondents rated the crossing facility as 'safe' to 'very safe'. This was consistent with the change in desire line results outlined above, supporting the notion that when pedestrians perceive a facility as safe, they are more likely to use the facility. The observed change in desire line behaviour, along with a high rating for facility safety, also indicated that the facility was meeting its objective to provide a safer crossing environment, at least from the users' perspective. Not surprisingly, most respondents also rated safety as an important attribute.

The third attribute, directness, received relatively high ratings for both the degree of directness and its importance. Again, this was not unexpected and may have reflected the surrounding environment, with the key destinations (bus stops and Hoyts 8/Science Alive!) located close to the south side of the crossing point.

Even though the before survey showed that many users of this site were originally prepared to accept the less-safe option of crossing the road mid-block (ie the more direct route) instead of making the longer trip to the signalised intersection at either end of this block on Moorhouse Ave, the new facility was successful in providing a crossing that was perceived to be much safer. The new facility also provided an alternative crossing point for CPIT students, who earlier would cross Moorhouse Ave at the location of the Barbadoes St signalised crossing, and has enabled easier access to the Hoyts cinema complex.

4.3 Case study 2: Hereford St at Westpac Lane/National Mutual Arcade, Christchurch

4.3.1 Site summary

- Crossing type: Raised zebra crossing with warning light system
- Road: Collector road – 11,000 vehicles/day (2008)
- Project cost: $140,000

4.3.2 Introduction

This site is located in the heart of Christchurch City CBD on Hereford St, between Colombo St and Manchester St (see figure 4.9). Hereford St is a relatively busy collector road and carries about 11,000 vehicle per/day. The project was identified in 2003, following a request from Christchurch Community House to install a pedestrian crossing to address the significant pedestrian through-movement between destinations on either side of Hereford St.

The site is located at a crossing point that links the Westpac Lane/National Mutual Arcade and the City Mall area, to the south of Cathedral Square. Both locations are significant pedestrian destinations, along with a number of other buildings in Hereford St, such as the BNZ bank to the west, food and retail shops in High St Arcade to the south, and language schools in Westpac Lane (see figure 5.2).

This CCC project included implementing a slightly raised zebra crossing, with kerb extensions and a warning light system that uses a photoelectric detection mechanism to detect the presence of pedestrians using the crossing, and uses flashing lights to warn approaching vehicles. The kerb extensions narrowed the crossing site to 7m. Figures 4.9 and 4.10 show the site on Hereford St and the surrounding land uses.

Figure 4.9 Aerial photo showing the location of the Hereford St pedestrian facility

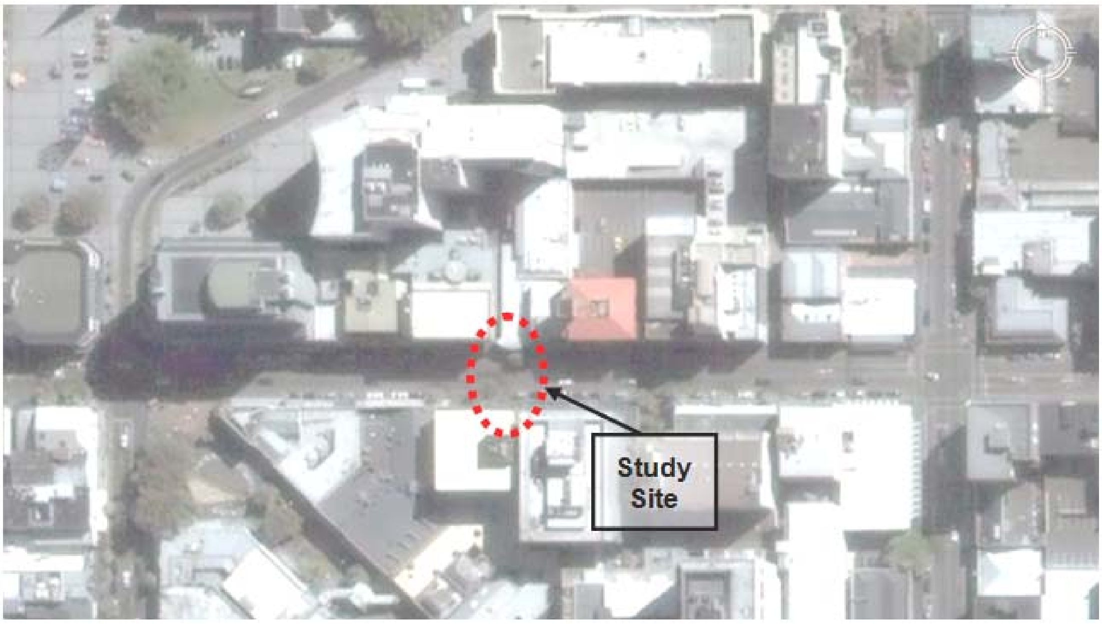
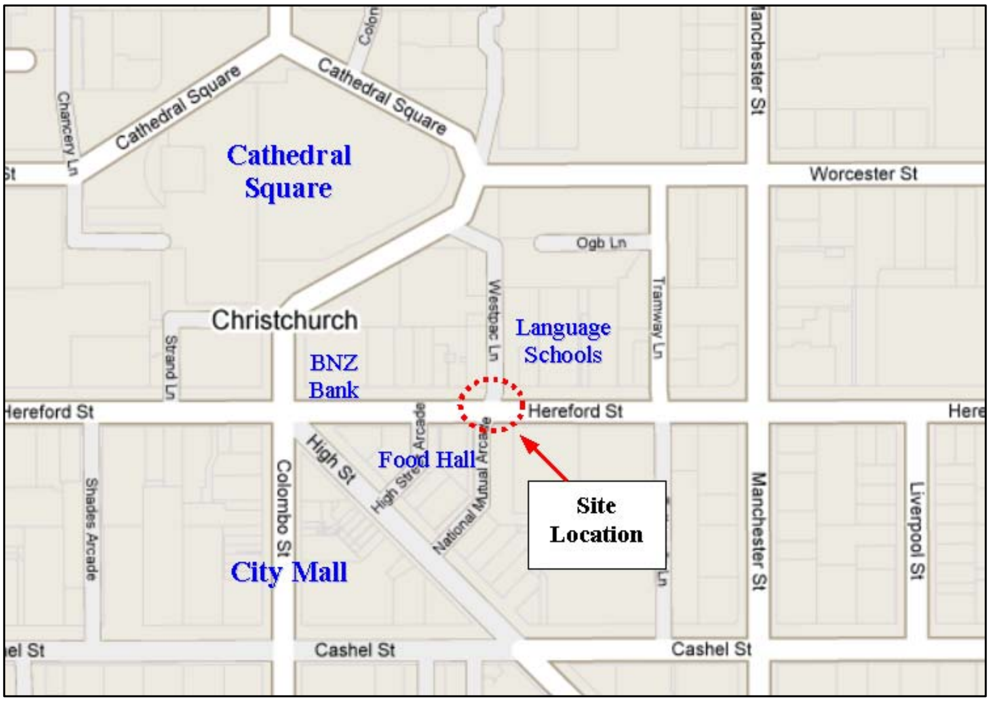


Figure 4.10 Site location and surrounding land use



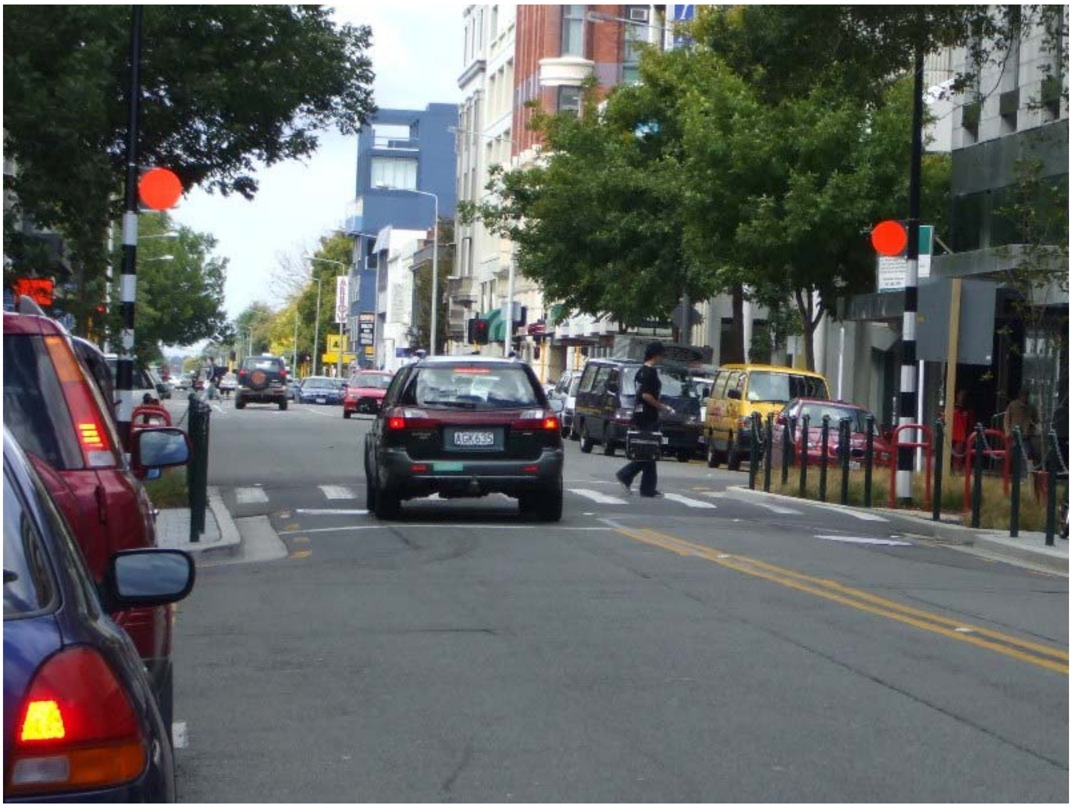
4.3.3 Site characteristics

As the site is located in the CBD, it is only a few minutes' walk from Cathedral Square. It is a busy pedestrian environment, and the surrounding land use includes commercial, retail, office and educational facilities. The route across Hereford St is a 'natural' crossing point for pedestrians. It connects a well-used pedestrian lane and arcade, providing access to local destinations and connectivity for a north–south walking route that bypasses the Cathedral Square to the east, and especially the intersection of Colombo and Hereford Sts, which can be a busy traffic/pedestrian junction.

Hereford St is a collector road that carries a reasonably high volume of vehicular traffic. As expected, the traffic mix is typical for a CBD, with a noticeable number of courier and delivery vans serving local business. Although it is not a high-speed environment, the street environment feels busy, with pedestrians mixing with vehicular traffic that is travelling through, as well as vehicles that are manoeuvring, stopping and parking.

Figure 4.11 shows the new pedestrian facility and surrounding road environment. Note the raised zebra crossing, kerb extensions and busy roadside environment.

Figure 4.11 Picture of the Hereford Rd pedestrian crossing facility

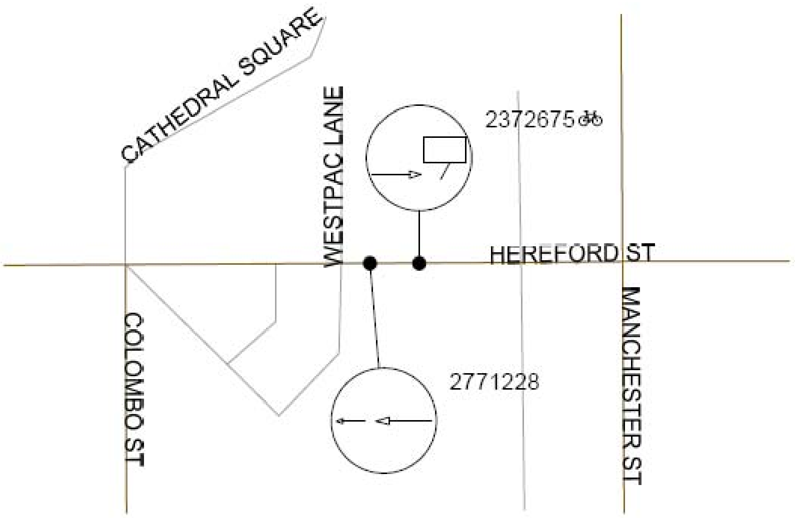


4.3.4 Crash history

The NZTA CAS database provided crash data for the period 2003–2007 for the Hereford St zebra crossing facility. Crashes within 50m of the study site were extracted. Two non-injury crashes were reported during the analysis period. Neither of these involved any direct interaction between pedestrians and motor vehicles – they involved collisions between motor vehicles and motorcyclists/cyclists, which can be attributed to the heavy traffic on Hereford St and the CBD location. The lack of crashes involving pedestrians indicates that the site has traditionally been relatively safe for pedestrians crossing the carriageway.

Figure 4.12 illustrates the crashes near this site that were reported in the CAS database.

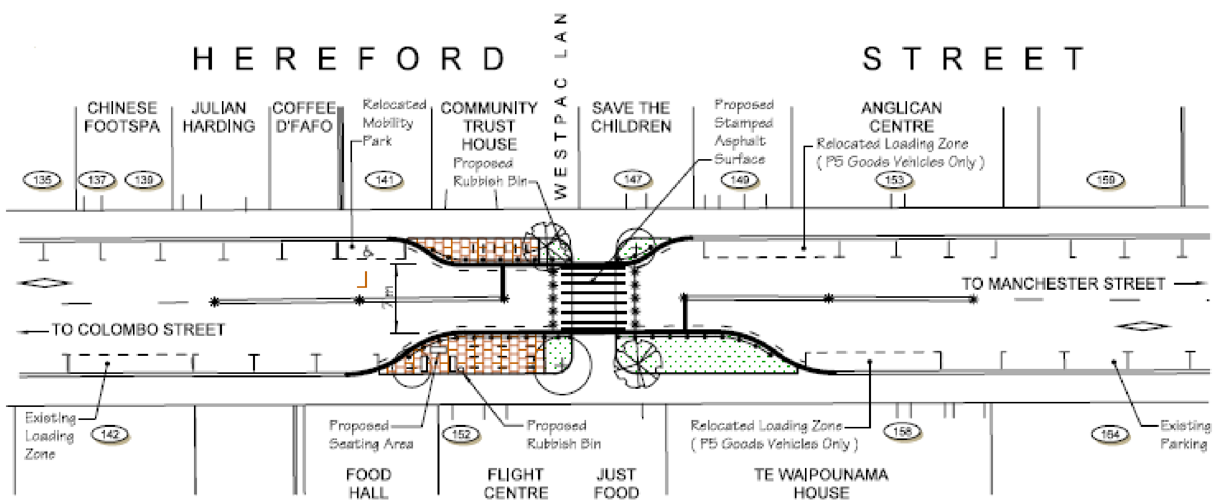
Figure 4.12 Crashes at the Hereford St pedestrian facility (2003–2007)



4.3.5 Facility design and consultation

The pedestrian crossing facility at Hereford St is a raised zebra crossing with a warning light system and kerb extensions that narrow the crossing distance to 7m. The warning light system consists of in-pavement flashing lights that are activated by pedestrians about to enter the pedestrian crossing, warning approaching motorists that the crossing is in use. These flashing lights were part of a pedestrian crossing warning lights trial that was undertaken in 2006 at two sites in Christchurch and one site in Auckland. They were installed one month after the zebra crossing was constructed. Figure 4.13 shows a layout plan of the facility.

Figure 4.13 Hereford St pedestrian facility layout plan



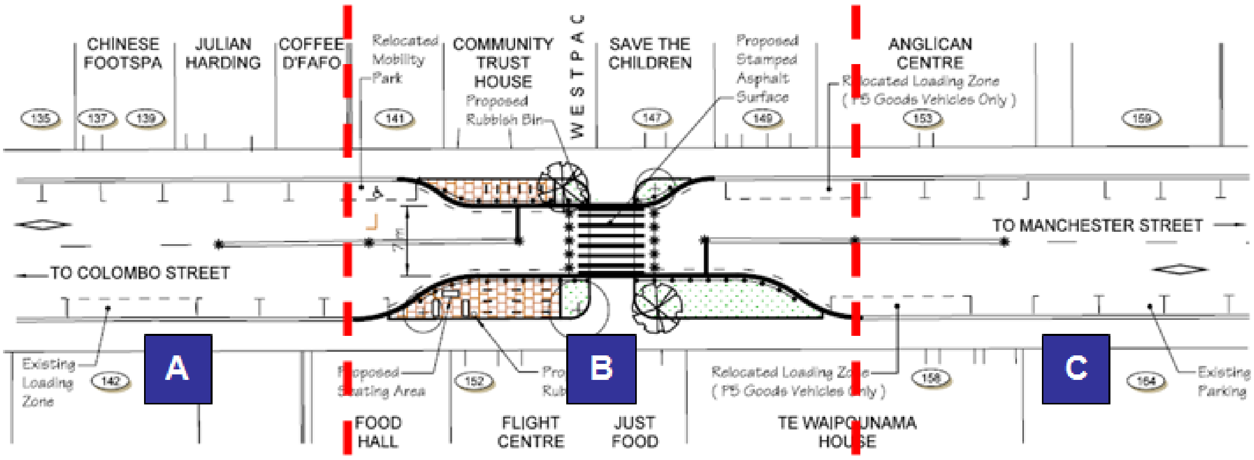
When Christchurch Community House requested a pedestrian crossing facility in 2003, council investigations found that this section of Hereford St met the Ministry of Transport's 'Warrant for pedestrian crossing'. The council consulted with business occupiers and owners on Hereford St about the need for a pedestrian crossing facility, noting that:

> *... feedback to the publicity pamphlet and informal feedback from some businesses has indicated both support and opposition for the project. The opposition largely relates to the potential for the crossing to delay traffic in the street. Some feedback has raised specific issues which can be addressed during the detailed design phase of the project.*
> (Hagley/Ferrymead Community Board Agenda, 12 April 2006)

4.3.6 Data collection and analysis

Pedestrian counts and a questionnaire survey were undertaken at the site in September 2006 and October 2006. As specified in the research methodology, before and after pedestrian counts were undertaken for a period of 1.5 hours over the midday lunch-time period (12–1:30pm). The study area was divided into three zones as shown in figure 4.13, and all pedestrians crossing in the respective zones during this lunch-time period were recorded. The survey was repeated on the same day over the following two weeks.

Figure 4.14 Hereford St study area showing the main zones where pedestrians crossed the road



Unfortunately, because of logistical and timing issues, a midday lunch-time count *before* construction was not undertaken. To address this problem and to ensure that data was collected on this new crossing facility, additional before and after counts to measure changes as a result of the installation of warning lights at the crossing were organised (see table 4.3).

Table 4.3 Dates of the count surveys for the Hereford St pedestrian crossing

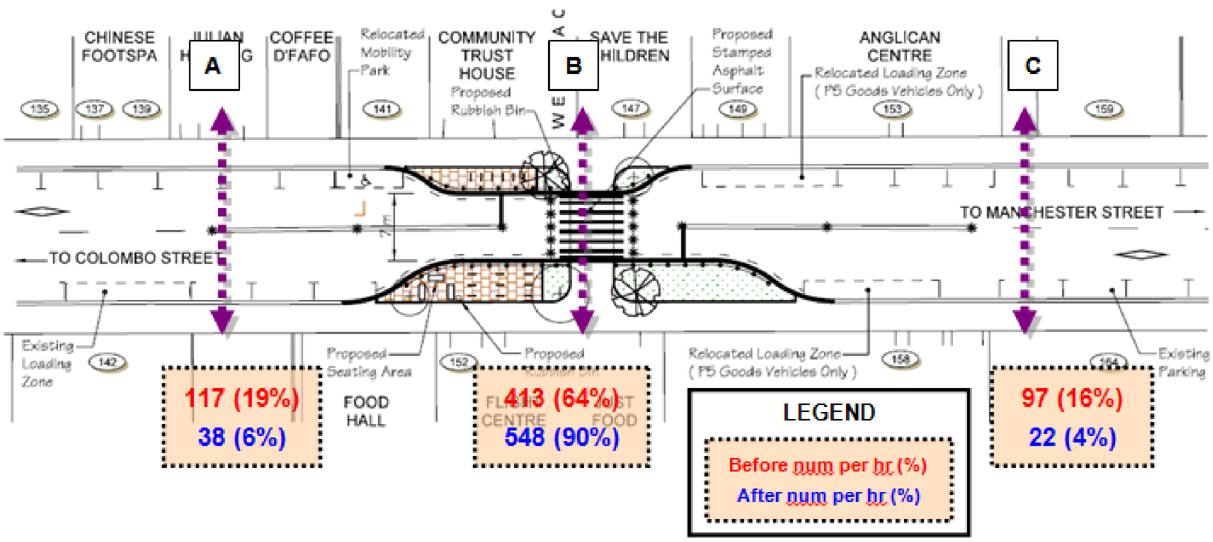
Facility	'Before' survey	Constructed	'After' survey
Zebra crossing and kerb extension	No survey	Sept 2006	Sept 2006
Warning light system	Sept 2006	Oct 2006	Oct 2006

Analysis of the count surveys showed a slight decrease in the number of pedestrians crossing the street in this area after the warning lights were installed, from 628 pedestrians/hour in the September 'before' survey to 607 pedestrians/hour in the October 'after' survey. Although there was an overall increase in the number of pedestrians using the *facility* (see the next section), there was no obvious reason for the slight decrease in the number of pedestrians crossing Hereford St within the study area, and this change seems to be within the range of natural variability in pedestrian volumes and thus not statistically significant, as described earlier in section 3.3.2. The one-month gap between the before and after surveys may not have been enough time for pedestrians who walk in the general area to become aware of the upgraded facility. Based on these survey findings, there was insufficient evidence to suggest the new facility had attracted new pedestrians from outside the study area to use the facility. As with the Moorhouse Ave facility, it was difficult, from analysing the count data in isolation from other factors such as changes in land use, to draw conclusions about how the facility had affected access across the street.

4.3.7 Behaviour at the site

Pedestrian desire lines across Hereford St were rather random on either side of the facility, except through the facility itself, which provided a direct link between Westpac Lane and National Mutual Arcade. The count data was summarised into three main desire lines, two on either side of the facility and one for pedestrians using the facility. Figure 4.15 shows the proportions of pedestrians at the three desire lines to the total pedestrians during the observation periods.

Figure 4.15 Pedestrian desire lines at Westpac Lane/National Mutual Arcade



A key finding from this analysis was that after the implementation of the warning lights, the number of pedestrians within the study area who chose to cross at the facility increased from 413 to 548/hour, ie an increase from 66% to 90%, a significant majority.

4.3.8 Pedestrian survey findings

A copy of the questionnaire survey that was undertaken before and after implementation of the warning light system at the site is provided in appendix B.

A summary of the findings is presented in figure 4.16. The rating for each survey question on the vertical axis is an average of the respondents' responses for each question, using the seven-point scale (-3 to +3).

Figure 4.16 Summary of before and after responses by question type (average ratings)

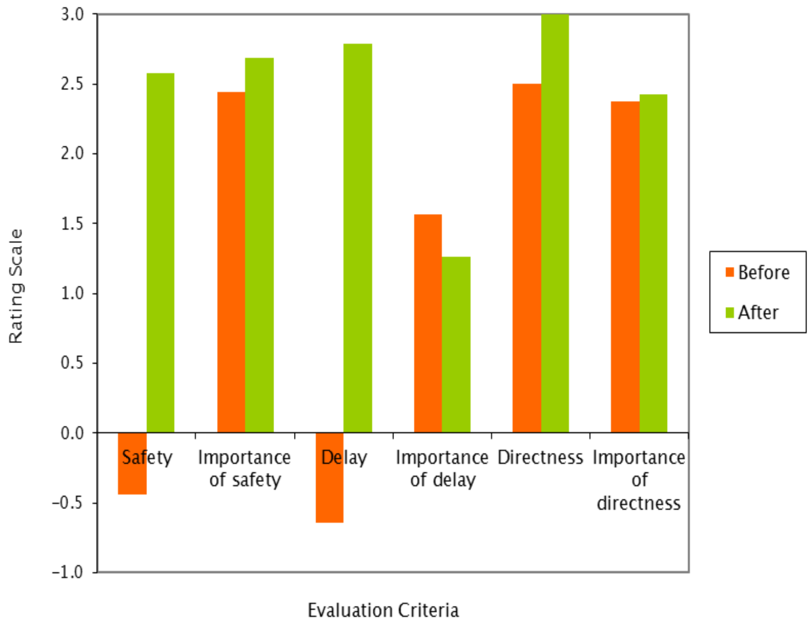


Table 4.4 Before and after perception surveys – average ratings

	Safety	Importance of safety	Delay	Importance of delay	Directness	Importance of directness
Before	-0.4	2.4	-0.6	1.6	2.5	2.4
After	2.6	2.7	2.8	1.3	3.0	2.4

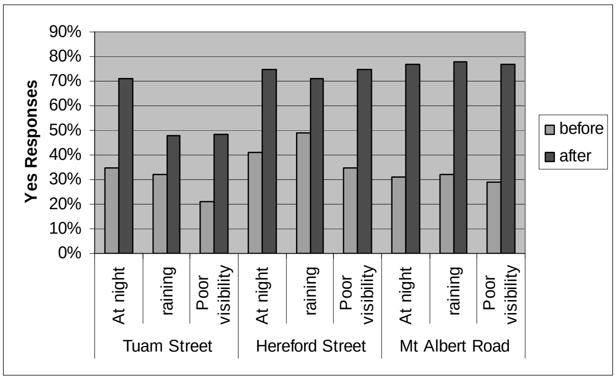
The findings related to delay showed that the facility had had an impact on users. The 'before' questionnaire findings indicated a slightly negative rating on delay, suggesting that most respondents experienced a medium amount of delay when waiting to cross Hereford St. Delay was rated as important, indicating respondents' sensitivity to crossing delays and the high value they placed on reducing the amount of time spent waiting to cross the street. After the facility was installed, the rating on this topic had improved to 2.8, which represented a finding of almost no delay being experienced by users. This finding was further supported by the observed desire-line behaviour discussed above, and suggested that the new facility was attractive to users.

When analysing respondents' perception of safety, a similar picture emerged. Prior to the installation of the facility, respondents rated crossing Hereford St as neutral to slightly unsafe. However, the 'after' responses showed a significant change, from -0.4 to 2.6; ie users believed the warning lights had made the existing facility safer.

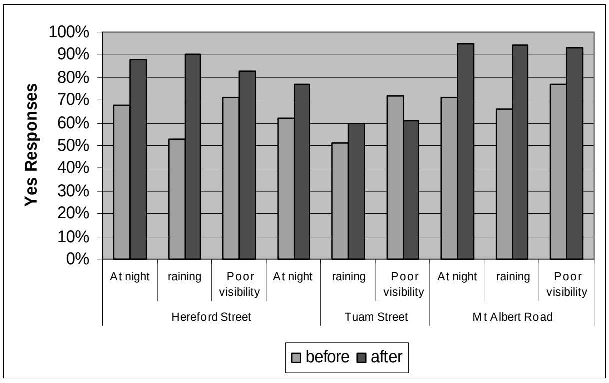
There was a small increase in the number of respondents rating the new facility as a more direct crossing on their route. Given the surrounding environment and natural walking route between a well-used pedestrian lane and arcade, it is unclear how the new facility contributed to a more direct route.

A separate study titled *When flashing is good: pedestrian crossing warning lights trial* (Smith 2008) also looked at this Hereford St crossing as part of a wider study that aimed to assess the effects of installing pedestrian warning light systems at two locations in Christchurch and one location in Auckland. Smith's pedestrian questionnaire surveys at this location indicated that a significantly higher proportion of pedestrians reported feeling safer while crossing at the facility at night, while it was raining, and during conditions of poor visibility (see figure 4.17).

Figure 4.17 Pedestrian and driver perception responses (Smith 2008)



Pedestrian perception of the crossing safety with and without active flashing lights



Driver response to compliance to yield under specified conditions with and without flashing lights

The study reported an increase (ranging from 5%–21%) in the proportion of drivers stopping to give way to pedestrians at the crossings, along with an increase (ranging from 4%–20%) in the proportion of drivers stopping on or before the limit line at the crossing. There was also a reduction in the mean and 85th percentile speeds of vehicles approaching the crossing.

The above results suggested that the reduction in driver speed and the increase in the proportion of drivers giving way to pedestrians had had a positive impact on pedestrians' perceptions of safety at the site, and the questionnaire surveys also indicated that the majority of drivers agreed that the warning lights had assisted them in recognising when a pedestrian was at or on a crossing.

4.4 Case study 3: Sparks Rd, Christchurch

4.4.1 Site summary

- Crossing type: School-patrolled zebra crossing
- Road: Minor arterial – 10,700 vehicles/day
- Project cost: Total cost $117,867 (for both Sparks Rd and Hoon Hay Rd pedestrian facilities)

4.4.2 Introduction

This site is on Sparks Rd within the suburb of Hoon Hay, which is a largely residential area approximately 4km to the south-west of Christchurch's city centre.

Although young children throughout New Zealand indicate that they would like to walk or cycle to school, parents generally perceive walking and cycling routes to be dangerous, especially on busy roads. As a result of the low perceived 'walkability' of these routes, parents often drive their children to school, leading to daily traffic congestion problems. To overcome this, CCC has recently undertaken a number of initiatives to encourage walking and cycling to schools. These include:

- Safer Routes to School
- School Travel Plans
- Walk to School Wednesdays
- Walking School Buses.

Schools typically create significant vehicle and pedestrian activity in their area, and this part of Sparks Rd is home to Our Lady of the Assumption School (OLA) and Hoon Hay School, as well as a large BP petrol station on the corner of Hoon Hay Rd and Sparks Rd.

This project was undertaken by the CCC in response to advice by the OLA School that their pupils were finding it difficult to safely cross Sparks and Hoon Hay Rds on their way to and from school. Following an analysis of the issues at the site and consultation with the schools and local residents, CCC decided to construct a new pedestrian facility in each of these roads (see figure 4.18).

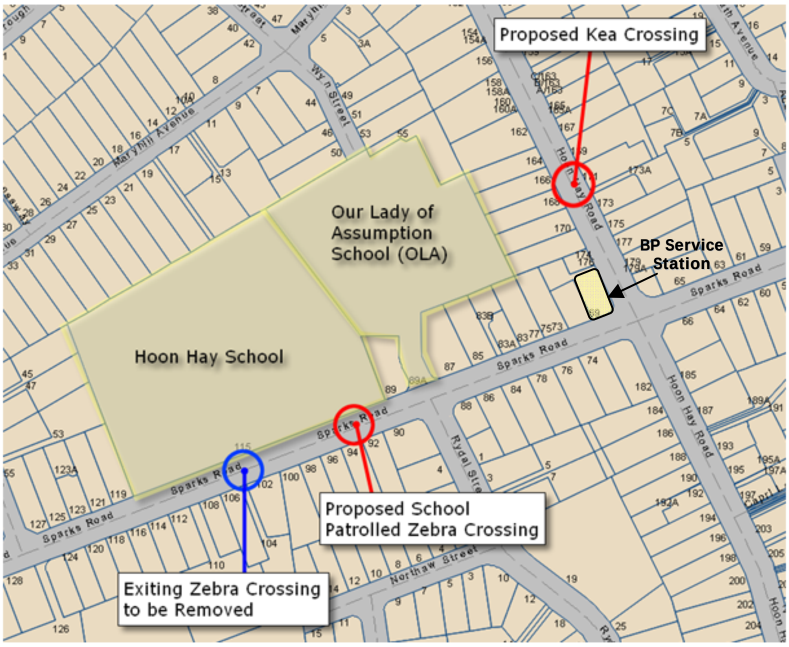
4.4.3 Site characteristics

Sparks Rd is a minor arterial road carrying an average daily traffic of 10,700 vehicles/day (Christchurch City Council traffic count database 2007). Because of the level of pedestrian activity related to the two schools, a 40km/hr part-time school speed zone has been installed on Sparks Rd.

Children who attend Hoon Hay School (which provides education for children from years 1–6) generally live within 3km, and the school also provides the option for children living outside of the home zone to use the school. OLA School, which provides education for primary school children from the Catholic faith, is located next door.

The pedestrian facility improvements on Sparks Rd are described in this case study, and the improvements on Hoon Hay Rd are described in the next case study.

Figure 4.18 Pedestrian facility improvements in Hoon Hay



The improvements made on Sparks Rd involved removal of the existing zebra crossing close to the entrance to Hoon Hay School, and construction of a new school-patrolled zebra crossing midway between the two school entrances.

Figures 4.19 and 4.20 show the crossing facilities on Sparks Rd, before and after implementation of the improvement projects.

Figure 4.19 Before the change – the school-patrolled zebra crossing outside Hoon Hay School

Figure 4.20 After the change – the new school-patrolled zebra crossing

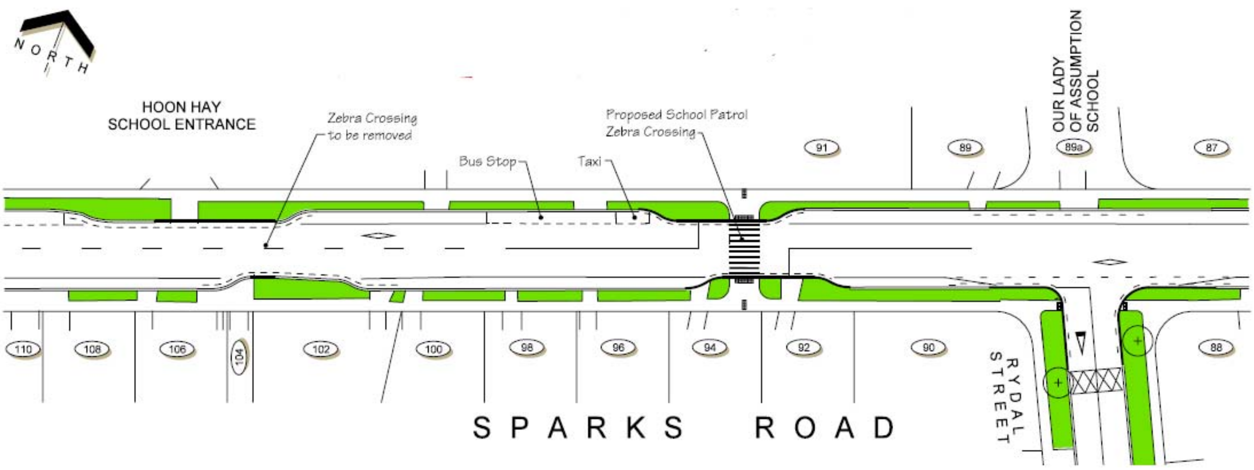
4.4.4 Crash history

No crashes were reported in the study area during the period 2003–2007, which indicates that the site had historically been safe for pedestrians. The lack of crashes may also suggest that motorists generally observe a high degree of caution at this location on Sparks Rd, owing to the presence of the two schools.

4.4.5 Facility design and consultation

Figure 4.21 illustrates the pedestrian facility improvements on Sparks Rd.

Figure 4.21 Relocation of the zebra crossing at Sparks Rd – layout plan



Community consultation on the project was undertaken in February 2008. Two options for crossings were presented for Sparks Rd. Option 1 consisted of two crossing points, one close to each school entrance, and recommended the construction of an additional new kea crossing[6]. Option 2, which was the preferred option, recommended relocating the existing zebra crossing, and adding a school patrol, to a site between the two school entrances.

Approximately 600 pamphlets, titled *Sparks Rd – Hoon Hay Rd traffic safety improvements,* were distributed to households in Hoon Hay Rd and Sparks Rd and their adjoining streets. An additional 500 pamphlets were distributed to schools, and 90 to other interest groups. Three on-site meetings were held. Two hundred and forty-three responses were received, the majority (85%) favouring option 2.

4.4.6 Data collection and analysis

Before and after pedestrian counts were undertaken at the site during June/July 2008 and November/December 2008 respectively. Because of the close proximity of the site to schools, count surveys were conducted for one hour each in the morning (8–9am) and afternoon (2:30–3:30pm) to accurately record the number of crossing pedestrians during the period of maximum usage. The survey area extended from 110m to the west of the proposed school-patrolled zebra crossing, to 80m to its east (see figure 4.22).

Figure 4.22 Survey area for Sparks Rd

The results showed a significant increase in the number of pedestrians crossing within the surveyed area on Sparks Rd after the improvements – from 148 (before) to 228 (after). This represented an increase of more than 50%, and suggested that the removal of the existing zebra crossing and subsequent installation of the school-patrolled zebra crossing made this site more attractive for pedestrians in general, and school students in particular since they derive considerable safety benefits from utilising the patrolled zebra crossing.

6 Kea crossings are school-patrolled crossings aimed at providing school children with a safe road-crossing point. These part-time crossings operate before and after school and sometimes at lunch time, and consist of two fluorescent orange crossing-point flag signs (one on each side of the road). When there's no school patrol and no crossing signs, the crossing point can be regarded the same way as any other section of road.

4.4.7 Behaviour at the site

The count survey data showed that pedestrians crossing the street within the study area (morning and afternoon) had five preferred desire lines (see figures 4.23 and 4.24). Before the improvements, more than 80% of all pedestrians crossing within the study area did so at desire lines B (the original zebra crossing) and D.

The new facility was located on desire line C (figure 4.23). Construction of this school-patrolled zebra crossing resulted in noticeable changes in the proportion of users crossing at each desire line, with a clear trend for pedestrians to cross closer to the new zebra crossing – ie 85% of all crossing movements. The number of pedestrians crossing at desire lines B (the old zebra crossing), D and E (close to the entrance of the OLA School on the other side of the Rydal St intersection) was greatly reduced. There was a slight increase in the number of pedestrians crossing at desire line A, probably because some of the users of the old facility preferred to cross near that location, instead of walking along to the new crossing. Desire lines A and E accounted for 8% (morning period) and 12% (afternoon period) of crossings, representing those pedestrians who still chose to cross directly at the location of the school entrances.

Thus, even though the new school-patrolled zebra crossing was located midway between the two school entrances and was not a direct crossing point for entrance into either of the schools, it was still the most favoured crossing location for pedestrians in the area.

Figure 4.23 Pedestrian desire lines – morning period

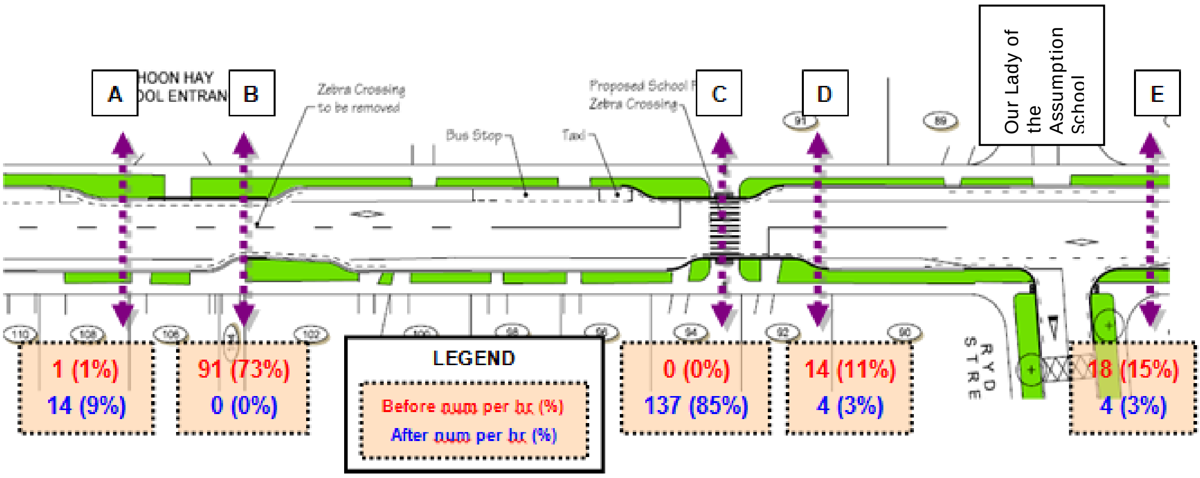
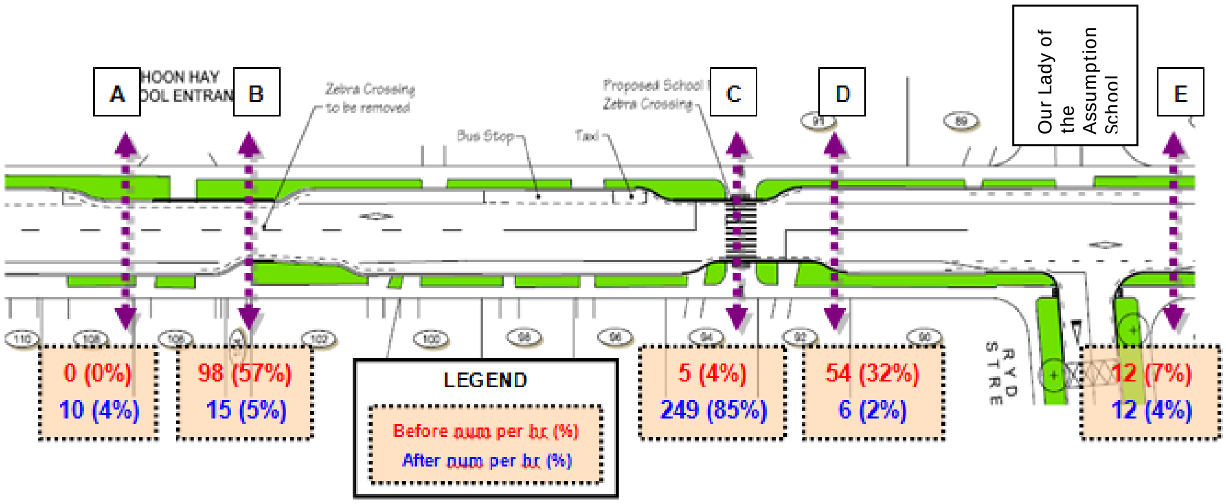


Figure 4.24 Pedestrian desire lines – afternoon period



4.4.8 Pedestrian survey findings

Findings from the questionnaire surveys at the study site indicated that before the construction of the new facility, pedestrian perception of the existing zebra crossing was reasonably favourable, with positive ratings for safety (1.2), delay (1.4) and directness (1.4). The implementation of the new school-patrolled zebra crossing led to even better pedestrian perceptions, with the ratings for safety, delay and directness improving slightly to 1.7, 1.9 and 2.1 respectively in the after survey (see figure 4.25**)**.

Figure 4.25 Summary of before and after survey responses, by question type (average ratings)

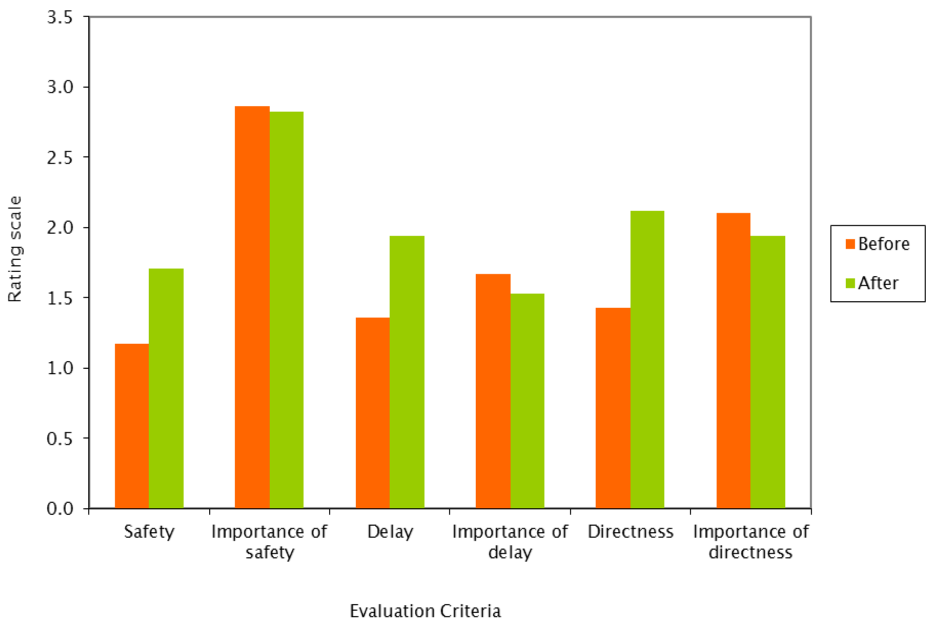


Table 4.5 Before and after perception surveys – average ratings

	Safety	Importance of safety	Delay	Importance of delay	Directness	Importance of directness
Before	1.2	2.9	1.4	1.7	1.4	2.1
After	1.7	2.8	1.9	1.5	2.1	1.9

The results of the perception surveys also suggested that safety was the most important factor for pedestrians crossing Sparks Rd, with the average ratings for importance of safety remaining almost unchanged.

The average ratings for importance of delay also remained more or less the same. The slight increase in the rating for delay implied that pedestrians' waiting times at the site had been reduced after the implementation of the new facility.

The findings for directness were difficult to interpret. Although the *importance* of directness remained approximately the same for both the before and after scenarios, the *average rating* for directness had improved in the after survey – even though the relocation of the crossing to a location midway between the two school entrances would logically mean a less direct route for the majority of pedestrians crossing at the site. The higher rating for directness suggested that users of this facility preferred the new location of the crossing.

4.5 Case study 4: Hoon Hay Rd, Christchurch

4.5.1 Site summary

- Crossing type: Kea crossing and kerb extension
- Road: Minor arterial – 7000 vehicles/day
- Project cost: Total cost $117,867 (for both Sparks Rd and Hoon Hay Rd pedestrian facilities)

4.5.2 Introduction

This site is located on Hoon Hay Rd, within the suburb of Hoon Hay, which is a largely residential area approximately 4km to the south-west of Christchurch's city centre. Our Lady of the Assumption (OLA) School (primary) and a large BP petrol station are located within the study area.

Busy local roads such as Hoon Hay Rd often create barriers for walking trips. The experience of delay or lack of safety while crossing a road often result in people making more car trips than walking trips, because of the low perceived walkability of the crossing area.

Pedestrian crossing facility improvements on Hoon Hay Rd were part of wider facility improvements undertaken by CCC after consultation with the OLA School, Hoon Hay School and local residents – pupils of OLA School were finding it difficult to safely cross Sparks and Hoon Hay Rds on their way to and from school. The improvements undertaken on Sparks Rd were described in the previous case study.

The improvements at the site on Hoon Hay Rd involved the construction of kerb extensions and a kea crossing near the entrance to OLA School (see figure 4.26).

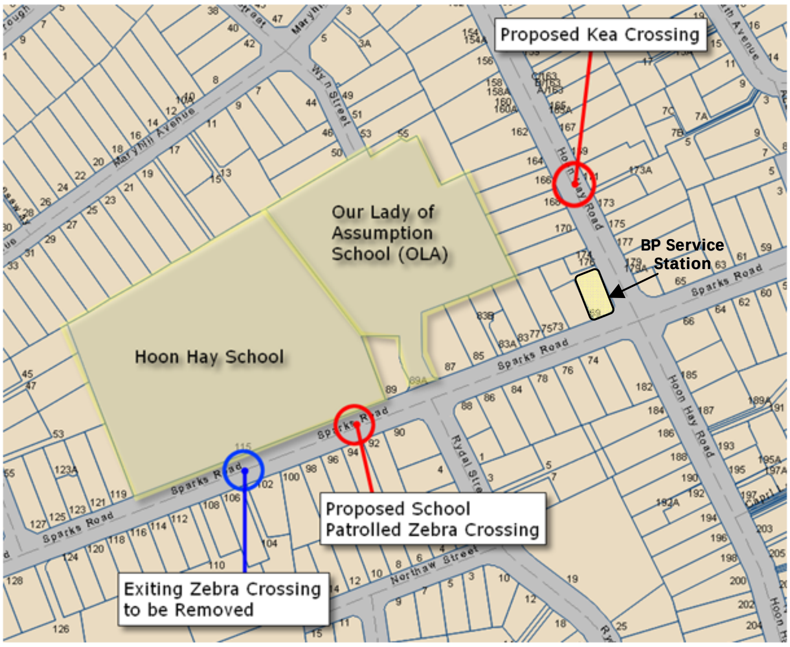
Figure 4.26 Location of the kea crossing facility on Hoon Hay Rd

4.5.3 Site characteristics

Hoon Hay Rd is a minor arterial road carrying an average of 7000 vehicles/day (CCC traffic counts database 2008). The site is located outside a school entrance within a residential suburb, and has significant pedestrian activity, particularly around school start and finish times. There is a large BP petrol station on the corner of Hoon Hay and Sparks Rds.

Figure 4.27 shows the locations of pedestrian facility improvement projects in the wider area on Hoon Hay and Sparks Rds, and the location of the two affected schools.

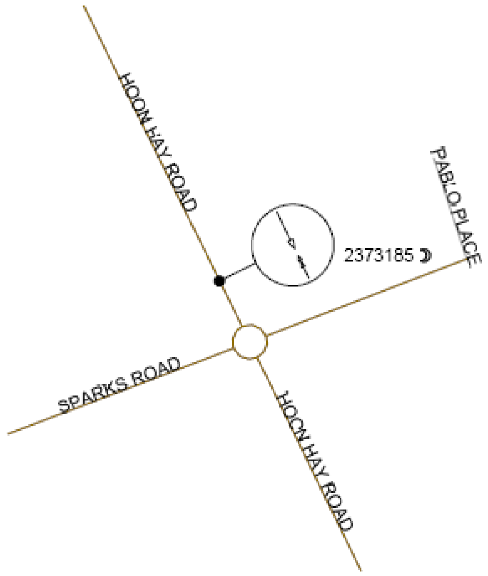
Figure 4.27 Pedestrian facility improvements in Hoon Hay



4.5.4 Crash history

Crash data extracted from the NZTA CAS database for the years 2003–2007 showed only one non-injury crash within 50m of the study site, which occurred when a motor vehicle collided with another vehicle reversing along the road (see figure 4.28). No crashes involving pedestrians were reported for this site during the analysis period.

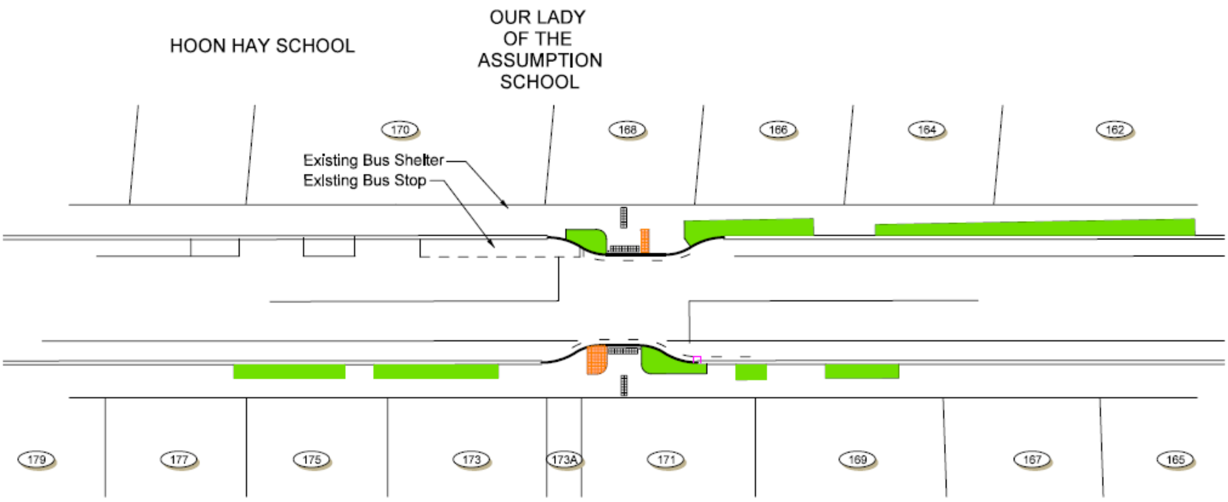
Figure 4.28 Crashes at the Hoon Hay Rd study site (2003–2007)



4.5.5 Facility design and consultation

Figure 4.29 illustrates the construction plan for the new kea crossing on Hoon Hay Rd.

Figure 4.29 Hoon Hay Rd kea crossing layout plan



Community consultation on the project was undertaken in February 2008. Approximately 600 pamphlets, titled *Sparks Rd – Hoon Hay Rd traffic safety improvements,* were distributed to households in Hoon Hay Rd and Sparks Rd and their adjoining streets. An additional 500 pamphlets were distributed to schools, and 90 to other interest groups. Three on-site meetings were also held. Two hundred and forty-three responses were received, the majority of which (79.8%) indicated a general support for the planned improvement; 3.3% of respondents did not support the planned option, and 16.9% did not offer any comments on the scheme.

The consultation process identified the crossing on Hoon Hay Rd as a key facility improvement that would help to overcome the severance the road was creating, and promote walking trips to the school.

4.5.6 Data collection and analysis

Before and after pedestrian count surveys were undertaken at the site during June/July 2008 and November/December 2008 respectively. Since the proposed kea crossing would experience significant usage at school opening and closing times, count surveys were conducted for one hour each in the morning (8–9am) and afternoon (2:30–3:30pm) to accurately record the number of crossing pedestrians during the period of maximum usage. The survey area covered a distance of 60m on both sides of the proposed kea crossing (see figure 4.30).

Figure 4.30 Survey area on Hoon Hay Rd

The results showed a significant increase in the number of pedestrians crossing within the surveyed area after the improvements – from 43 (before) to 64 (after). Although the number of pedestrians utilising this crossing facility was low, compared with the other sites that were analysed for this project, this still represented an increase of approximately 50% and suggested that the construction of kerb extensions and the addition of a kea crossing had made this site more attractive to the predominantly student users of this facility.

4.5.7 Behaviour at the site

The count survey data showed that pedestrians within the study area had six preferred desire crossing lines (see figures 4.31 and 4.32), with lines A, B and C cumulatively representing around 75% of the total crossings before the improvements.

The new facility was located on desire line D. As can be seen in figure 4.31, the proportion of users crossing at each desire line changed after the construction of the kea crossing facility, with a clear preference for the new kea crossing – around 85% of total crossings during both morning and afternoon periods. The consequent decrease in the percentage of pedestrians crossing the road at the other locations is also shown.

Figure 4.31 – Pedestrian desire lines – morning period

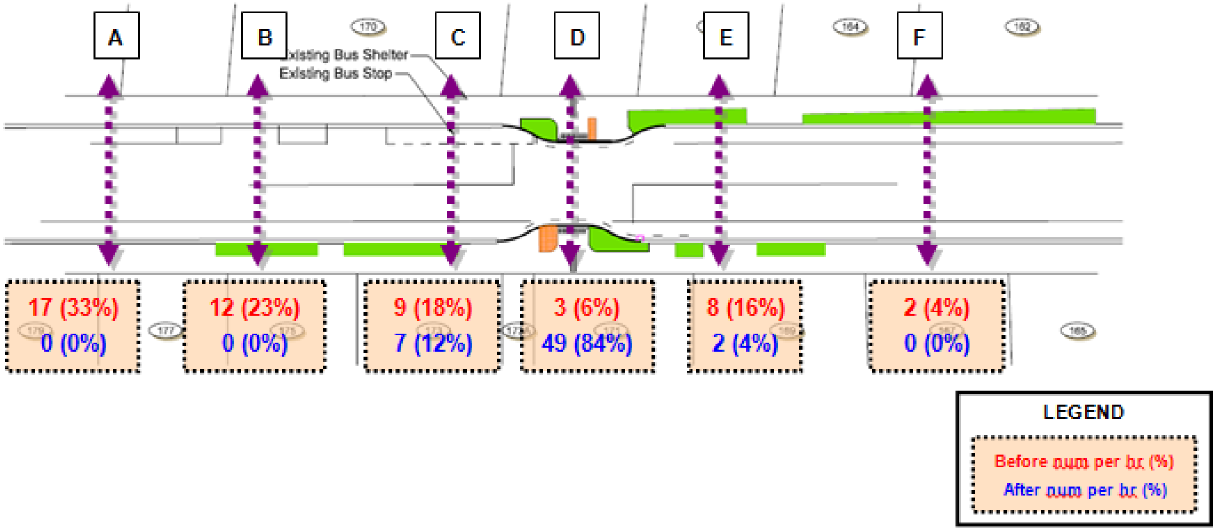
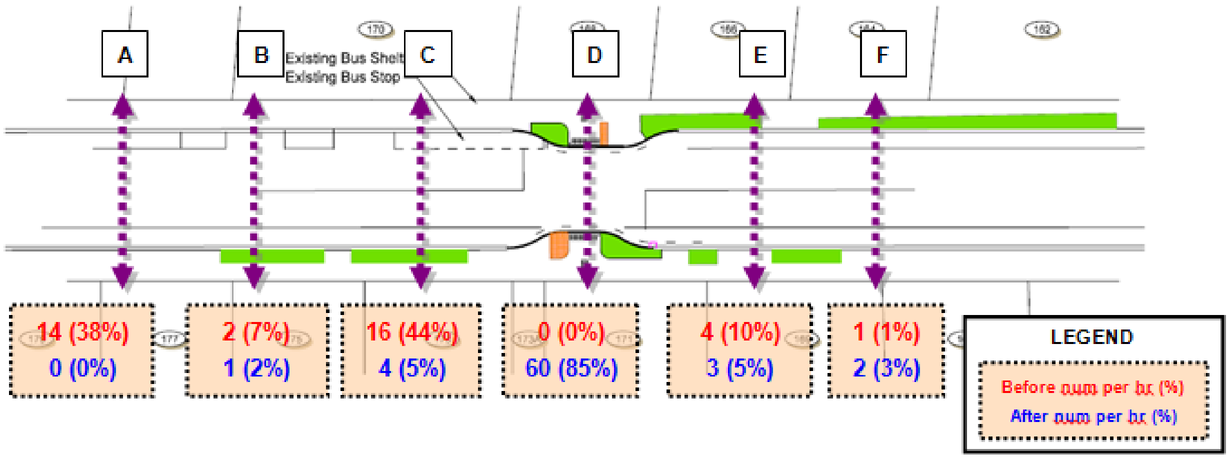


Figure 4.32 Pedestrians' desire lines – afternoon period



4.5.8 Pedestrian survey findings

As with the other cases studies, a questionnaire survey was undertaken, and a copy of this is provided in appendix B.

A graph of the findings for the survey questionnaire is shown in figure 4.33. The rating for each survey question on the vertical axis is an average of the respondents' responses for each question, using the seven-point scale (-3 to +3).

Figure 4.33 Summary of before and after survey responses, by question type (average ratings)

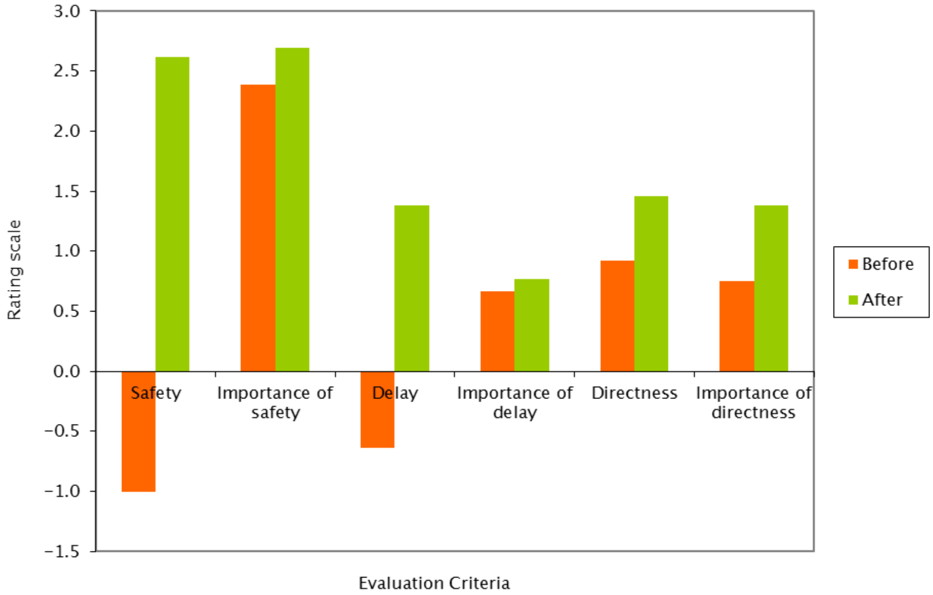


Table 4.6 Before and after perception surveys – average ratings

	Safety	Importance of safety	Delay	Importance of delay	Directness	Importance of directness
Before	-1.0	2.4	-0.6	0.7	0.9	0.8
After	2.6	2.7	1.4	0.8	1.5	1.4

The majority of survey respondents were parents of children who used the crossing for getting to and from school, as well as teachers and other staff working on the school premises. The findings indicated a significant improvement in pedestrians' perception of safety, with the average rating increasing from -1 during the period before construction of the new kea crossing, to 2.6 after its construction. Because of the large number of school children crossing at this site, safety was a particularly important consideration, as shown by the relatively high average ratings for the importance of safety, which increased marginally after the improvement, from 2.4 (before) to 2.7 (after). An interesting observation reported by a few survey respondents was that cars often failed to give way to crossing pedestrians before the improvements.

The new facility also led to a decrease in the amount of delay experienced by pedestrians. Prior to the installation of the facility, respondents were not happy about the level of delay experienced, with an average rating of -0.6. After the installation of the kea crossing, this improved to a positive rating of 1.4. As was the case with safety, the perceived importance of delay remained more or less the same, with a rating of 0.7 before the improvement, and 0.8 after.

Construction of the facility improved the directness of route for people approaching and leaving OLA School (the predominant users of this facility), with the average rating increasing from 0.9 to 1.5. It is also interesting to note that survey respondents rated directness as more important than delay, with an average rating of 0.8 before the improvements increasing to 1.4 after. This highlights the importance that pedestrians place on convenience when deciding on a location to cross the road, as already highlighted in various overseas studies. It can also be inferred that convenience and directness, in addition to safety, gain increased importance in school zones, where parents are often accompanied by children and are thus interested in minimising risk.

4.6 Case study 5: Ensors Rd, Christchurch

4.6.1 Site summary

- Crossing type: Refuge island and kerb extension
- Road: Minor arterial – 8200 vehicles/day
- Project cost: $52,800

4.6.2 Introduction

This site is located on Ensors Rd in the suburb of Opawa, about 3km south-east of Christchurch's city centre.

CCC proposed the construction of a pedestrian facility on Ensors Rd (in the vicinity of Fifield Terrace) in order to provide a safer means for school children from the nearby Te Kura Whakapumau I Te Reo Tuuturu Ki Waitaha School and St Mark's School to cross Ensors Rd. The Ensors Rd Pedestrian Facility – Safety Improvement Project was undertaken in conjunction with street renewal works on the adjoining St Martins Rd. Following investigations and initial consultation findings, the two projects were combined, primarily for efficiency, given their close proximity and relationships.

The new pedestrian facility consisted of a pedestrian island and kerb build-out on Ensors Rd, with an additional traffic island to the north of the Fifield Terrace intersection. Construction of the new facility was carried out during the 2008/09 financial year.

In addition to improving the safety of pedestrians at the site, the council's goals were to

- maintain the existing levels of service for other road users (including cyclists)
- ensure that adequate street lighting was provided
- maintain the minor arterial road function of Ensors Rd.

Figure 4.34 illustrates the location of the pedestrian facility improvements on Ensors Rd, and figure 4.35 shows the surrounding land use and locations of schools in the vicinity.

Figure 4.34 Location of study site

Figure 4.35 Surrounding land use

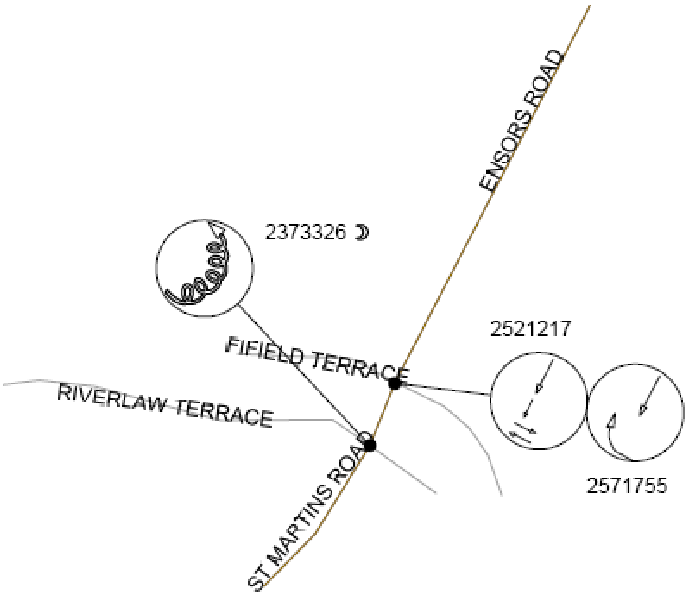
4.6.3 Site characteristics

Ensors Rd is a minor arterial road that carries an average daily traffic of 8200 vehicles/day (CCC traffic counts database 2007). The surrounding area is largely residential, with two schools in the vicinity.

4.6.4 Crash history

Crash records extracted from the NZTA CAS database reported a total of three crashes occurring within 50m of the site during the years 2003–2007. One of these was a minor-injury crash, and the other two were non-injury crashes. There were no records of crashes between motor vehicles and pedestrians during the analysis period. Figure 4.36 shows the location of these crashes.

Figure 4.36 Crashes at the Ensors Rd site (2003–2007)



4.6.5 Facility design and consultation

The improved pedestrian facility at Ensors Rd consisted of a pedestrian island and a 2m wide kerb build-out south of the Fifield Terrace intersection. A flush painted median and traffic island to the north of the Fifield Terrace intersection were provided, along with 1.8m wide on-road cycle lanes that began at a point to the north of the Fifield Terrace intersection, and extended south to 131 St Martins Rd, to link to the proposed St Martins Rd cycle lanes.

Figure 4.37 illustrates the planned pedestrian facility at Ensors Rd, and figure 4.38 is a cross-section plan at the location of the pedestrian island.

Figure 4.37 Ensors Rd pedestrian facility layout plan

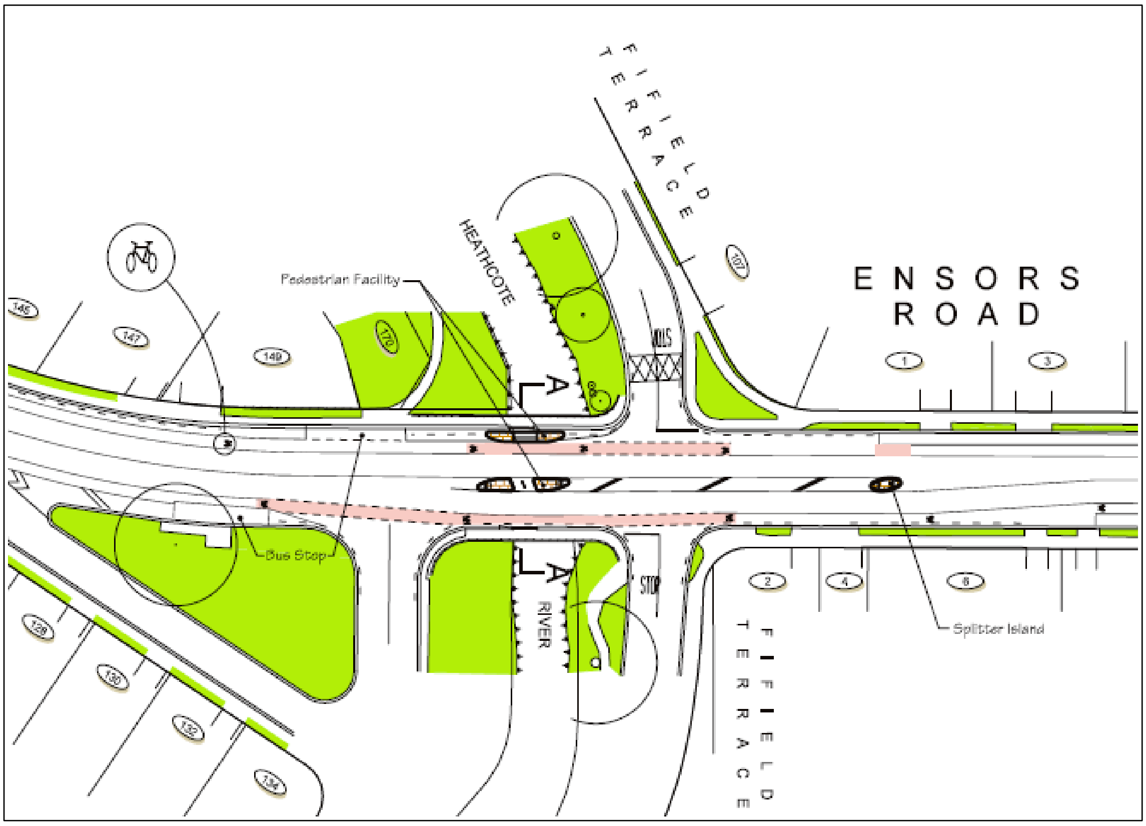
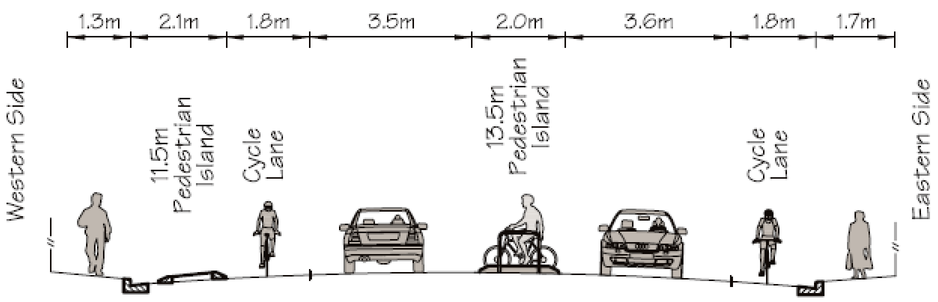


Figure 4.38 Cross section at the pedestrian island



Initial consultation for the Ensors Rd Safety Improvement Project was undertaken in April 2007. Key issues raised during this phase included the need to provide pedestrians, and particularly school students, with a safer means of crossing Ensors Rd in the vicinity of Fifield Terrace.

In February and March 2008, additional consultation on the plan was undertaken with owners, occupiers and interest groups within the affected area, and also city-wide via libraries and the external stakeholders' mailing list. This was mainly via newsletter, but also through other means such as a project information evening at the St Martins Library on 20 February 2008, site meetings, phone calls, emails, and the council's 'Have your say' website. Meetings were held with Hillview Christian School, Te Kura Whakapumau I Te Reo Tuuturu Ki Waitaha School, and St Mark's School.

Approximately 430 consultation newsletters, titled *St Martins Rd – street renewal project and Ensors Rd pedestrian facility safety improvement project – consultation flyer*, were distributed. Forty-seven written responses were received regarding the Ensors Rd Safety Improvement Project: 33 (70%) in general support of the plan, 3 (6%) against it, and 11 (24%) unspecified (probably because those respondents were mainly interested in St Martins Rd issues).

Further consultation was undertaken during February–May 2008, primarily with St Mark's School. While the school did not oppose the Ensors Rd consultation plan, they were concerned that the proposal did not assist them in getting to and from Waltham Pool. The plan was subsequently modified and the traffic-splitter island was moved approximately 20m to the north. On-site meetings were also held with the owners/occupiers of the properties at 1 and 6 Ensors Rd, who indicated their agreement with the project.

4.6.6 Data collection and analysis

Pedestrian counts and a questionnaire survey were undertaken at the site in November 2008 (the before survey) and June/July 2009 (the after survey) for a 1.5 hour period (12–1:30pm). The survey area covered a length of Ensors Rd where pedestrians crossed near the proposed pedestrian facility, covering an area of 80m to the south-west of the Ensors Rd/Fifield Tce intersection, and 60m to its north-east (see figure 4.39).

Figure 4.39 Survey area

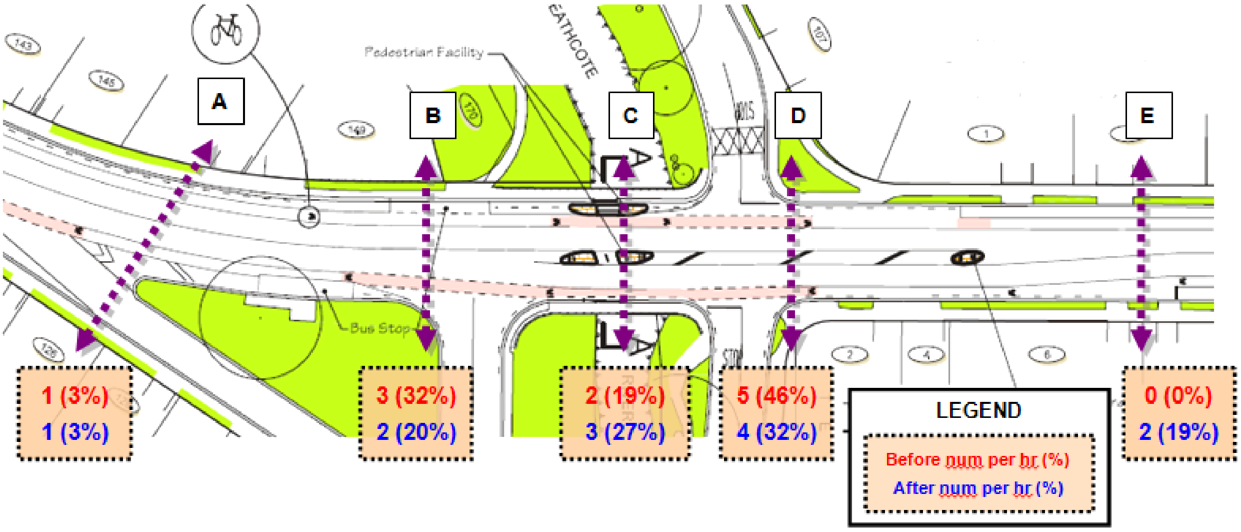
Results of the before and after pedestrian count surveys indicated similar (low) numbers of crossing pedestrians, with seven pedestrians/hour during the before surveys and eight pedestrians/hour during the after surveys.

4.6.7 Behaviour at the site

The count survey data was used to analyse the behaviour of pedestrians at the site, and figure 4.40 shows their preferred crossing desire lines.

The new kerb build-out and refuge islands on Ensors Rd were located on desire line C. A splitter island was also provided at the site between desire lines D and E.

Figure 4.40 Pedestrian desire lines



The before and after surveys showed that although construction of the new facility initiated a shift in where pedestrians crossed the road, it was still not being used by the majority of the people crossing within the study area (19% before, 27% after), with desire lines B and D still accounting for more than half of the pedestrians crossing Ensors Rd here.

A few pedestrians (3%) were also observed to be crossing at desire line A during both the before and the after surveys. No pedestrians were observed to be utilising the splitter island between desire lines D and E. Results from the after survey also showed that 19% of pedestrians started crossing at the location specified by desire line E *after* construction of the new facility.

4.6.8 Pedestrian survey findings

A user perception survey was undertaken via a questionnaire survey during the 'after' count survey. A copy of the questionnaire is provided in appendix B of this report.

Because of the low volume of pedestrian activity at this site, there were only five responses to the questionnaire. A graph of the findings for the survey questionnaire is shown in figure 4.41. The rating for each survey question on the vertical axis is an average of the respondents' responses for each question, using the seven-point scale (-3 to +3).

Figure 4.41 Summary of before and after survey responses by question type (average ratings)

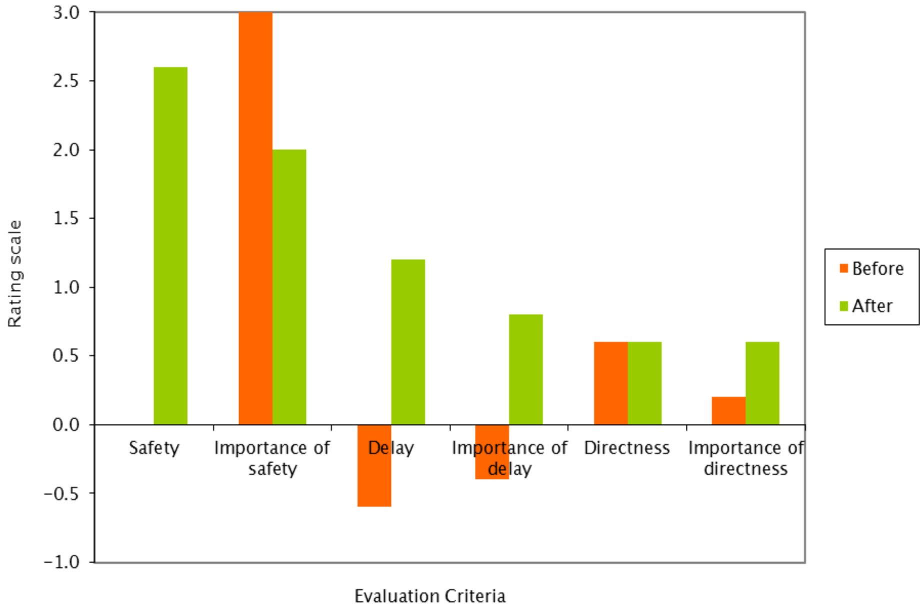


Table 4.7 Before and after perception surveys – average ratings

	Safety	Importance of safety	Delay	Importance of delay	Directness	Importance of directness
Before	0.0	3.0	-0.6	-0.4	0.6	0.2
After	2.6	2.0	1.2	0.8	0.6	0.6

The results of the perception surveys indicated improvements in the perceived values of safety (rated 0 before the improvements, 2.6 after) and delay. However, the average rating for the importance of safety had decreased in the after survey – perhaps because of the small sample size of survey responses. This implied that the implementation of the pedestrian facility had resolved the safety issues experienced by pedestrians, and safety was now less important as a parameter for deciding on where to cross.

Survey respondents also reported a decrease in perceived waiting times while crossing – the average ratings for delay changed from -0.6 (ie unsatisfactory waiting times) to 1.2 (more satisfactory). After the implementation of the new facility, respondents also reported giving more importance to the delay factor when they were choosing a crossing location.

The average rating for directness remained unchanged, indicating that the new facility did not affect the directness of route for people crossing in the vicinity. However, the importance of directness increased slightly from 0.2 to 0.6, suggesting that pedestrians chose to pick the path that provided the most direct route for them, while also seeming to be safe. While the rating for directness had not changed, there were significant improvements in the perceived level of safety and delay, indicating that pedestrians had derived considerable benefits from the installation of the new facility.

4.7 Case study 6: Collingwood (East of Tristram St), Hamilton

4.7.1 Site summary

- Crossing type: Kerb extensions
- Road: Collector – 6500 vehicles/day
- Project cost: $5400

4.7.2 Introduction

This site is located in Hamilton City on Collingwood St, east of Tristram St, close to the Waikato Institute of Technology and Hamilton Girls' High School (see figure 4.42). Collingwood St is a collector road and carries about 6500 vehicles per/day (CCC traffic counts database 2006). The project was identified in 2004 as part of the Hamilton City Pedestrian Crash Reduction Study prepared by Opus International Consultants. Pedestrian facility improvements at this site were part of the pedestrian safety works undertaken by Hamilton City Council (HCC), which also included pedestrian facility improvements on Tristram St (described in greater detail in case study 10).

The project involved the construction of kerb extensions on Collingwood St, effectively narrowing the width of the carriageway to 7m, making it easier for pedestrians to cross. The crossing option also provided a safe crossing point for pedestrians to navigate the roundabout at Tristram St when travelling between the Waikato Institute of Technology (Wintech) campus and a car park.

Figure 4.42 shows the location of the site, and figure 4.43 shows the surrounding land uses.

Figure 4.42 Location of study site

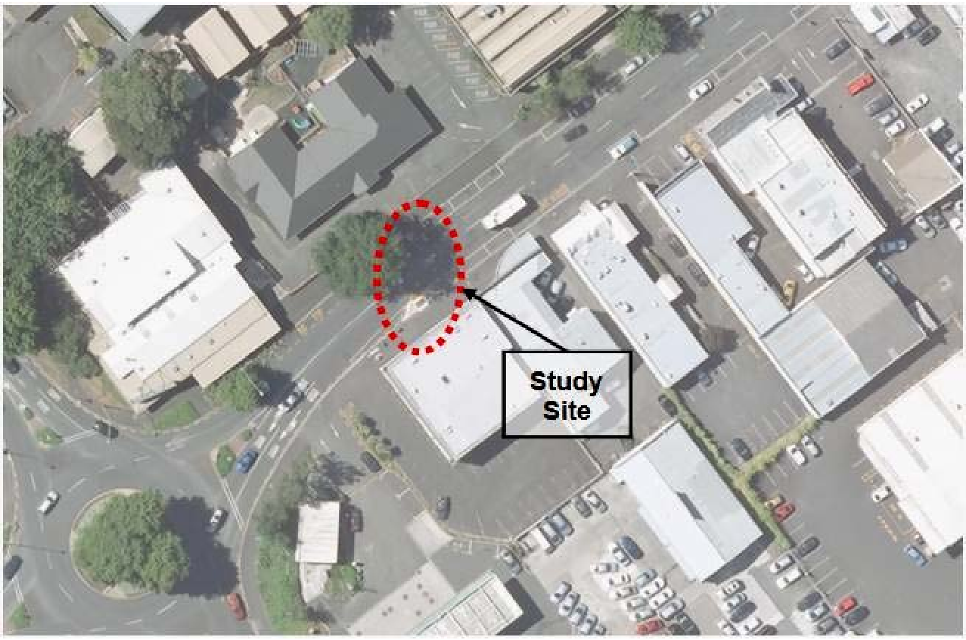
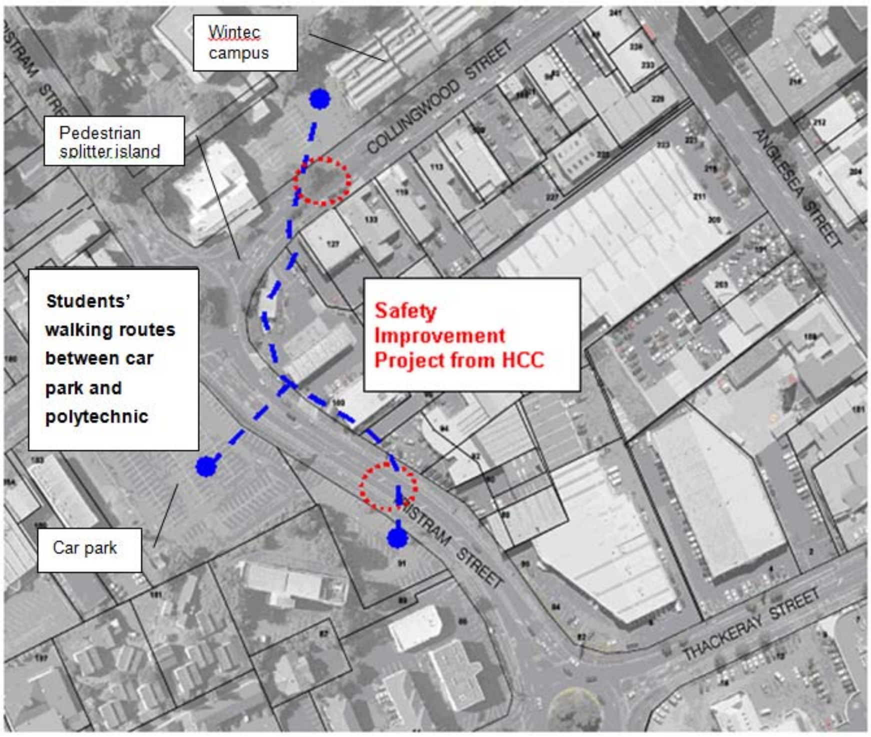


Figure 4.43 Location of the study sites

4.7.3 Site characteristics

The area is a reasonably busy pedestrian environment. Surrounding land uses include education, business, and some residences. Wintech is a key pedestrian destination, and has a large pay-and-display car-parking facility on the south-west corner of the Tristram and Collingwood Sts roundabout intersection. Students walking from the car park to Wintech generally follow a route that crosses Tristram St and leads around the intersection and then across Collingwood St to access the campus, as shown in figure 4.44.

Figure 4.44 Students' general walking route between Wintec campus and the car park at the south-west corner of the Collingwood and Tristram St intersection

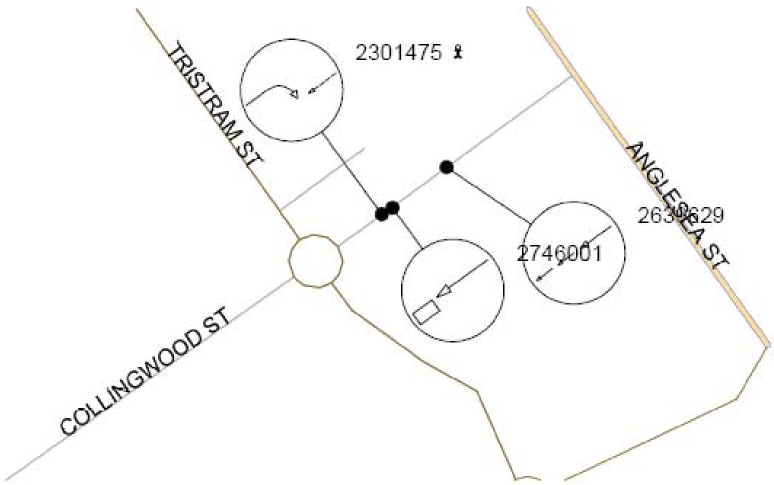


The crash reduction study noted that the speed of vehicles through the roundabout appeared to be excessive. Pedestrians were crossing Collingwood St in an uncontrolled fashion, away from the pedestrian cut-downs located on the splitter islands and close to the circulating traffic using the roundabout. At this crossing point near the splitter islands, pedestrians needed to cross two lanes of traffic.

4.7.4 Crash history

Details of crashes occurring along Collingwood St during the period 2003–2007 were extracted from the NZTA CAS database (see appendix C of this report). Three crashes were reported within 50m of the site – one a minor-injury accident and two non-injury accidents (see figure 9.4). The minor-injury crash, which was the only crash that involved a pedestrian, was attributed to the pedestrian stepping onto the carriageway from between parked cars and thus having reduced visibility of traffic moving along Collingwood St. This was in accordance with the findings of the crash reduction study, which also noted that pedestrians had a tendency to cross away from the traffic-splitter islands located near the roundabout.

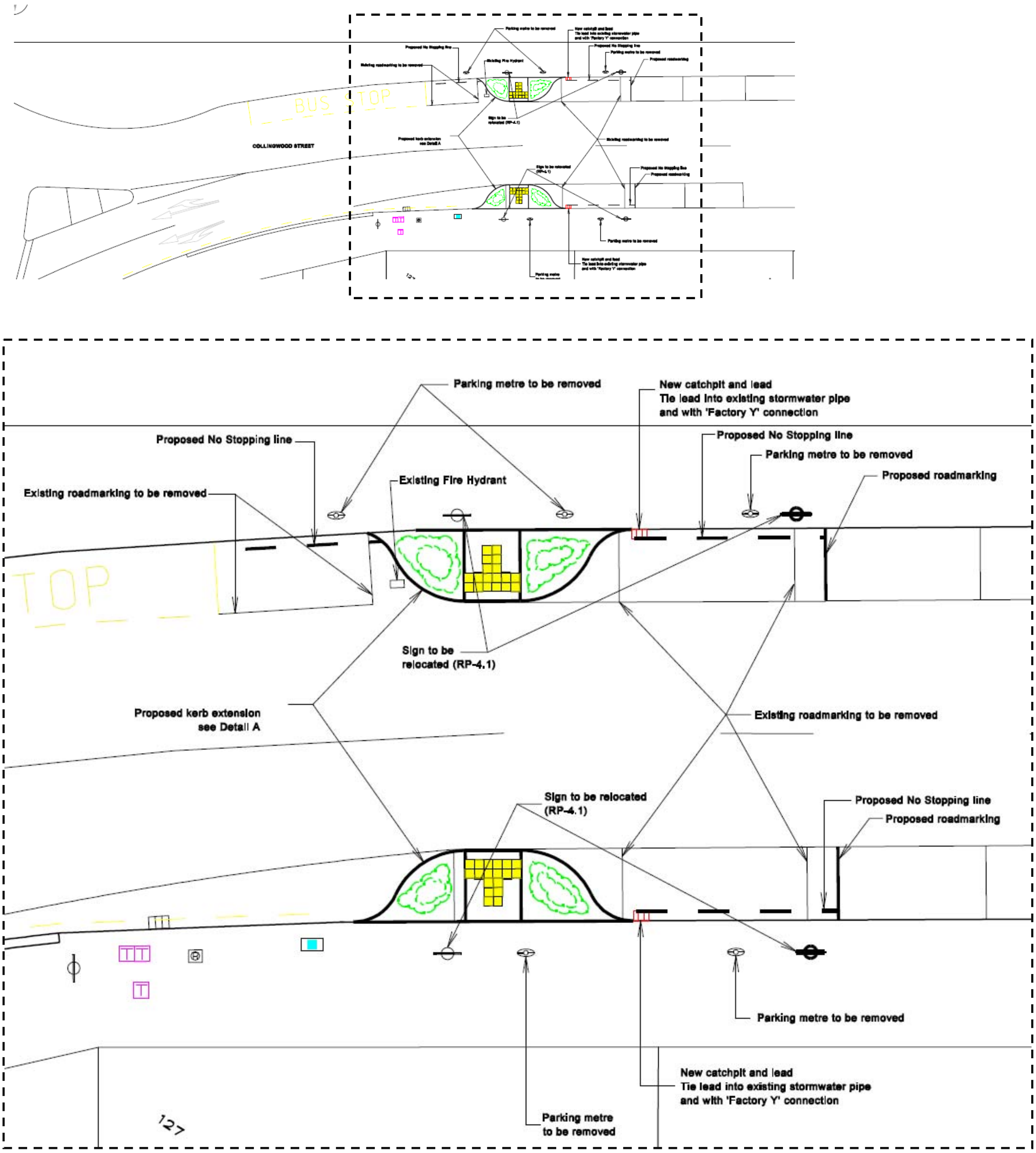
Figure 4.45 Crashes at the Collingwood St study site (2003–2007)



4.7.5 Facility design and consultation

The pedestrian crossing facility at Collingwood St involved the construction of kerb extensions, as illustrated in the layout plan in figure 4.46.

Figure 4.46 Collingwood St kerb extensions layout plan



The need for kerb extensions was identified in the HCC Pedestrian Crash Reduction Study, which aimed to reduce speed problems and the number of crashes between pedestrians and vehicles at specific locations. The Collingwood St improvement project was confirmed through the crash reduction study and HCC's Minor Traffic Improvement warrant system, and was programmed for construction during the 2006–07 financial year.

There was no promotion of the project to the public, apart from notification of the roadworks and consultation with those who were directly affected, such as nearby owners of business properties.

4.7.6 Data collection and analysis

Pedestrian counts and a questionnaire survey were undertaken at the site in February and October/ November 2007. The count surveys were conducted over 1.5 hours during the lunch-time period (12–1.30pm). The survey area covered the length of Collingwood St in the vicinity of the pedestrian facility, and also included the median splitter island (located near the roundabout) that was utilised by some pedestrians while crossing (see figure 4.47). Frequent crossing activity was observed along Collingwood St within 40m to the west and 30m to the east of the crossing facility.

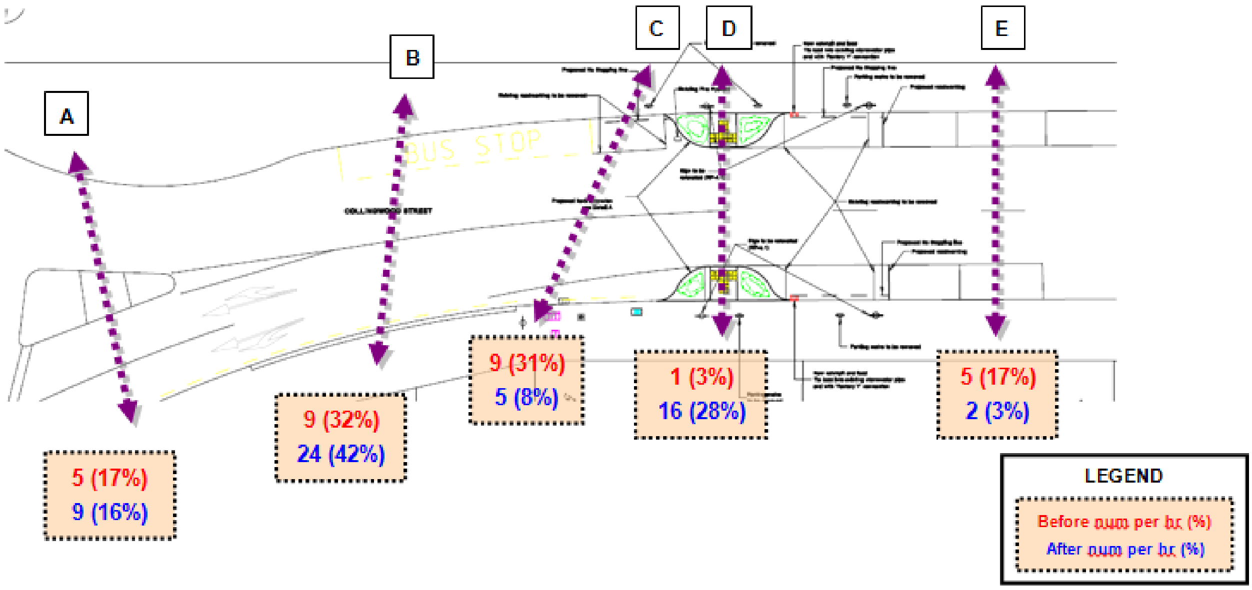
Figure 4.47 Survey area

After construction of the facility, the survey counts showed a significant increase in the number of pedestrians crossing within the observation area – effectively doubling from 30 pedestrians/hour during the before survey (February 2007) to 57 after (October/November 2007). This confirmed that the facility was an attractive crossing for pedestrians.

4.7.7 Behaviour at the site

The construction of kerb extensions at this location was intended to improve the safety of pedestrians crossing to the east of the roundabout. Pedestrians' preferred crossing points (desire lines) were observed and mapped before and after the improvements, and the results showed that the facility had attracted pedestrians away from desire lines C and E, to cross through the facility at desire line D (see figure 4.48). However, the high proportion of pedestrians crossing at desire line B (32% before construction, 42% after construction) indicated that the pedestrian facility had not been constructed on the most desirable path. There were practical and possibly safety reasons for not constructing the facility at desire lines B or C, which were popular crossing points, but the movement of only a small group of pedestrians to the new location suggests that facilities should be located on desire lines, rather than expecting people to move.

Figure 4.48 Pedestrian desire lines at Collingwood St, east of Tristram St



4.7.8 Pedestrian survey findings

A questionnaire survey was undertaken during the 'after' count survey (see appendix B).

A graph of the findings for the survey questionnaire is shown in figure 4.49. The rating for each survey question on the vertical axis is an average of the respondents' responses for each question, using the seven-point scale (-3 to +3).

Figure 4.49 Summary of before and after survey responses by question type (average ratings)

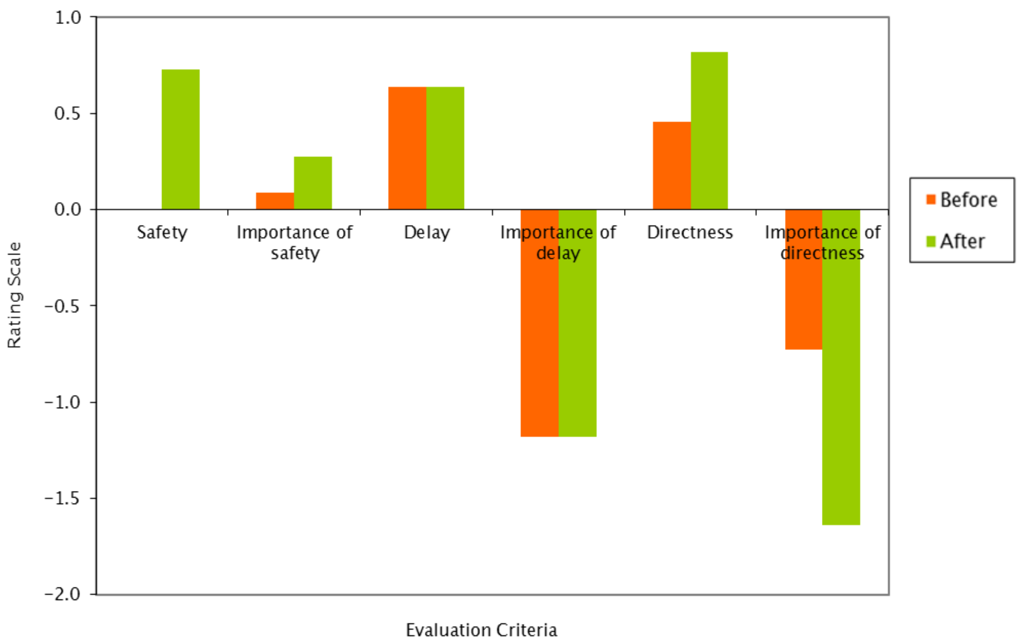


Table 4.8 Before and after perception surveys – average ratings

	Safety	Importance of safety	Delay	Importance of delay	Directness	Importance of directness
Before	0.0	0.1	0.6	-1.2	0.5	-0.7
After	0.7	0.3	0.6	-1.2	0.8	-1.6

The findings indicated that the facility had little to no impact on users' perception of delay, which was rated at a medium level of 0.6 (in the middle of the rating scale) at both before and after surveys. Interestingly, respondents rated the importance of delay as relatively low (-1.2), which is consistent with the finding that delay did not seem to play a big part in choosing where to cross this street. It is worth noting the survey respondents (mostly students) were aged between 18 and 49, with the majority aged 18–29. It appears that active and highly mobile people did not have problems with crossing this street.

The findings on directness were similar, which was not surprising, considering the crossing followed a natural north–south walking route around the east side of the roundabout for students accessing Wintech and its associated car-parking facilities. Although there was a marginal improvement in reported directness, no firm conclusions could be drawn from this. However, the change in respondents' rating of the importance of directness, from -0.7 to -1.6, was difficult to explain – there was no obvious reason for the increase (although it was consistent in that both surveys had a low rating for the importance of directness).

The findings showed that perceptions of safety at the crossing were consistent with the findings from analysing the survey counts. Before the kerb extensions were constructed, respondents rated the crossing as neutral; the after survey findings indicated a minor improvement in respondents' perception of safety at the crossing, which was consistent with the increase in use of the facility.

4.8 Case study 7: Tristram St (near Garry Keith Motors), Hamilton

4.8.1 Site summary

- Crossing type: Refuge island
- Road: Minor arterial – 21,000 vehicles/day
- Project cost: $13,800

4.8.2 Introduction

This site is located on Tristram St in Hamilton West, close to the Waikato Institute of Technology and Hamilton Girls' High School. It was part of the pedestrian safety works undertaken by HCC that included the Collingwood St facility described in the previous case study.

Tristram St is a minor arterial road carrying an average daily volume of 21,000 vehicles. The case for a pedestrian crossing facility at this site was part of an 'area work package' to address an identified street-crossing safety issue for pedestrians. The pedestrian route and street crossings of concern, which are on a popular walking route from the Wintech car park to the campus, are shown in figure 4.50, and figure 4.51 depicts the surrounding land use.

The crossing was listed as a high priority on HCC's Minor Traffic Improvements warrant list for the 2005–06 financial year, and the council constructed a refuge island on Tristram St, opposite Garry Keith Motors, to provide a safe crossing point.

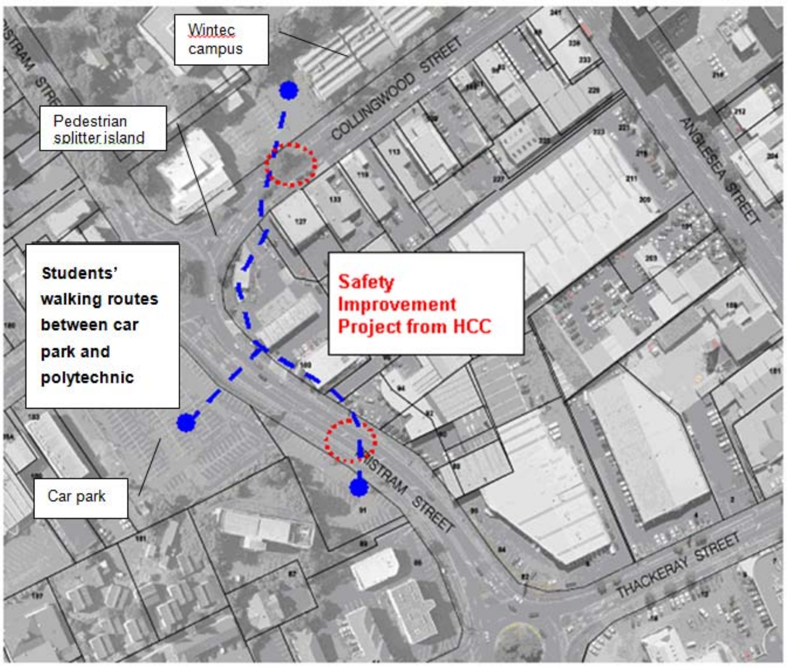
Figure 4.50 Location of study site

Figure 4.51 Location of study sites

4.8.3 Site characteristics

The area is a reasonably busy pedestrian environment. Surrounding land uses include education, business and some residences. The Waikato Institute of Technology (Wintech) is a key pedestrian destination, and has a large pay-and-display car-parking facility on the south-west corner of the Tristram and Collingwood Sts roundabout intersection. As discussed in the Collingwood St case study, students walking from the Wintech car park to the campus generally follow a route that crosses Tristram St at the location shown in figure 4.52, then make their way around the intersection and across Collingwood St to access the campus.

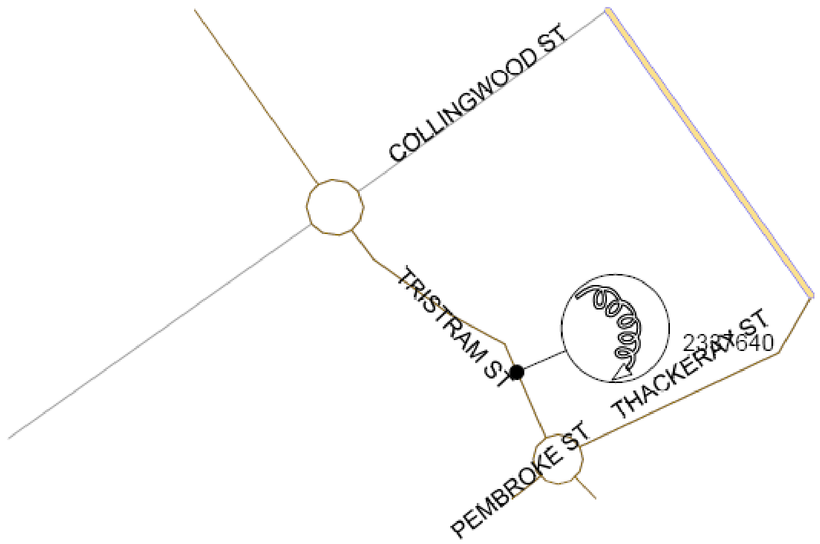
Figure 4.52 Students' general walking route between Wintec campus and the car park at the south-west corner of the Collingwood and Tristram Sts intersection



4.8.4 Crash history

The NZTA CAS database was used to obtain the 2003–2007 records for crashes within 50m of the Tristram St study site (see appendix C of this report). There was only one reported crash during the analysis period, being a non-injury crash involving loss of control of a motor vehicle (see figure 4.53). The low rate of crashes at the site suggests that Tristram St has historically been a safe area for crossing pedestrians – perhaps because of good visibility conditions at the site, and drivers being aware of the relatively large number of students crossing at this location, and therefore cautious.

Figure 4.53 Crashes at the Tristram St study site (2003–2007)



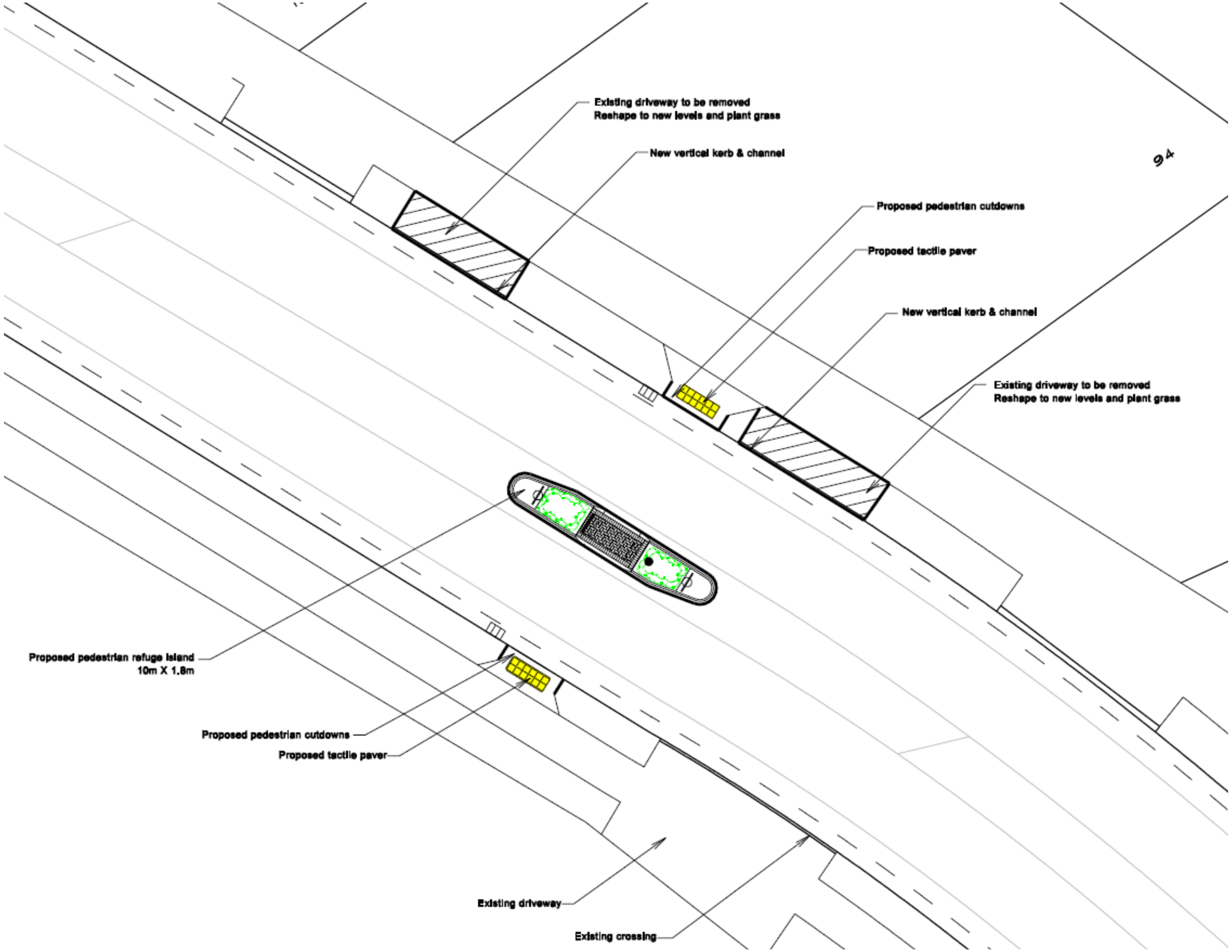
4.8.5 Facility design and consultation

The pedestrian crossing facility at Tristram St involved the construction of a mid-block pedestrian refuge island. Figure 4.54 shows a layout plan of the facility.

The Tristram St project was confirmed as an improvement project through the HCC's Minor Traffic Improvement warrant system, and was programmed for construction during the 2006–07 financial year.

There was no promotion of the project to the public, apart from notification of the road works and consultation with those who were directly affected parties, such as nearby owners of business properties.

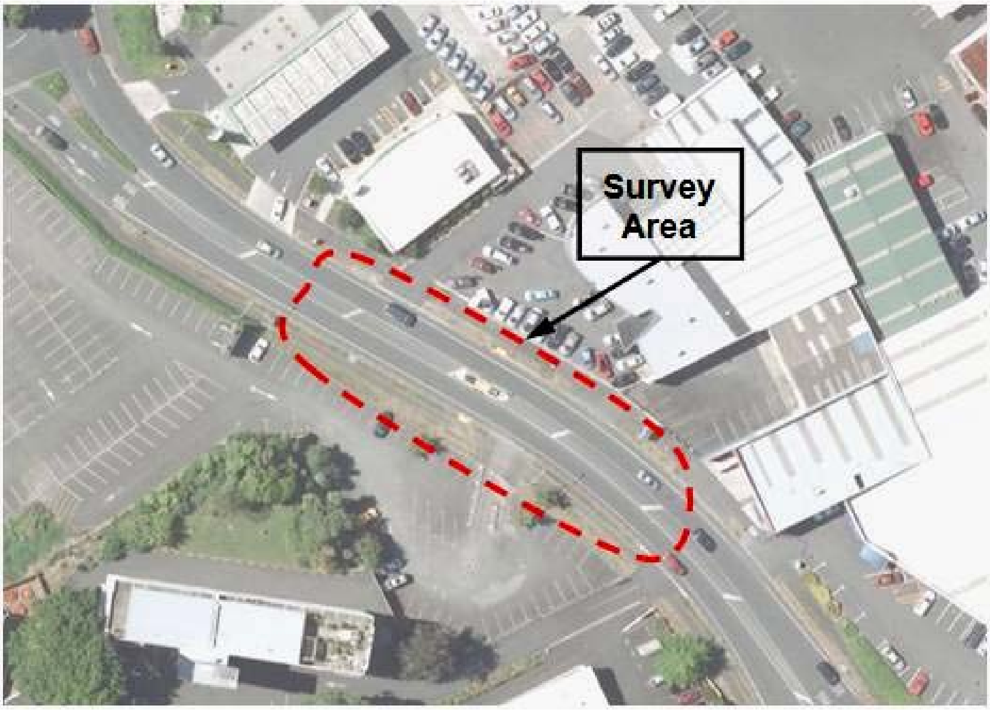
Figure 4.54 Tristram St pedestrian refuge island layout plan



4.8.6 Data collection and analysis

Pedestrian counts and a questionnaire survey were undertaken at the site in February and August/October 2007 for a 1.5 hour period (12–1:30pm). The survey area was a length of Tristram St where pedestrians crossed near the proposed pedestrian facility, covering an area of 30m to the north-west of the crossing facility towards the Tristram and Collingwood Sts roundabout, and 40m to the south-east along Collingwood St (see figure 4.55).

Figure 4.55 Survey area

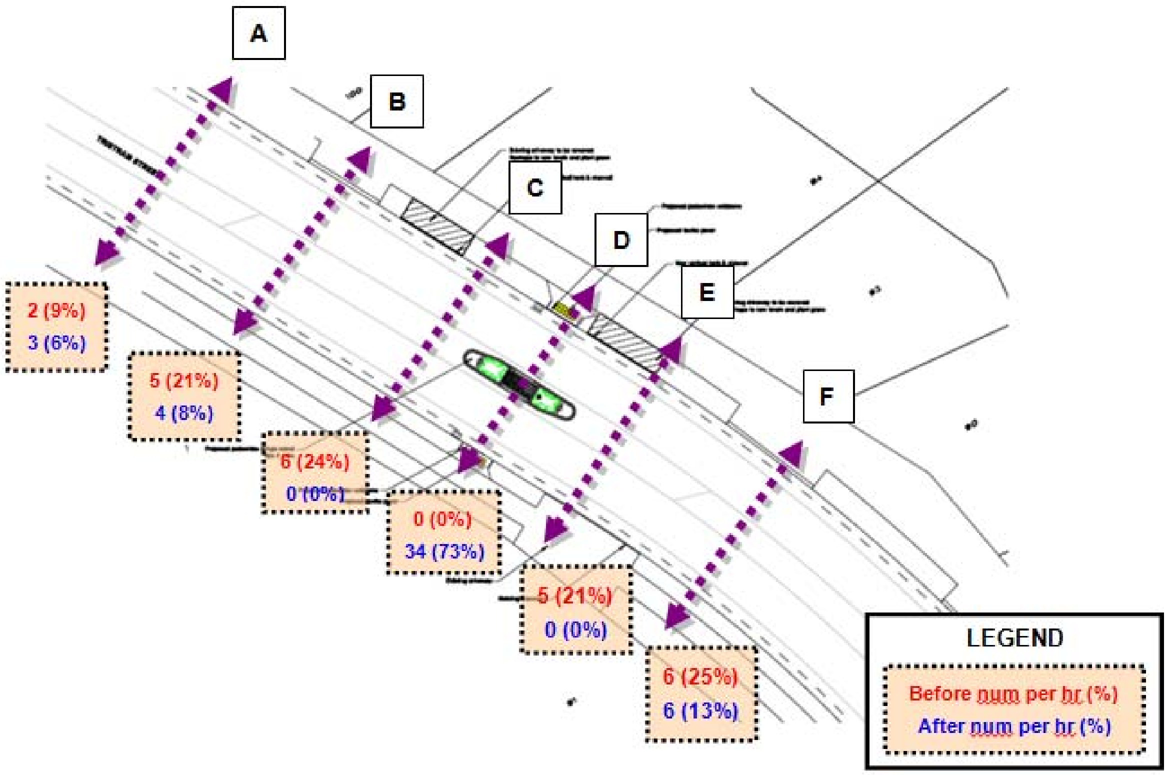


The results showed a significant increase in the number of pedestrians crossing within the observation area, from 25/hour (before the improvements) to 46 (after) – ie the rate almost doubled, confirming the facility's attractiveness to pedestrians.

4.8.7 Behaviour at the site

The count survey data showed five preferred crossing lines (see figure 4.56). Desire lines C and E made up 45% of the total crossings and were the crossing areas most favoured by pedestrians. The new facility was located on desire line D, in between C and E, as shown in figure 4.56. After the construction of the refuge island facility, there was a noticeable change in the proportion of users crossing at each desire line, with a clear trend for pedestrians to cross closer to the refuge island. Pedestrians who used to cross on desire lines C and E now crossed through the facility, and the number of pedestrians crossing on the other three desire lines declined. The new facility, capturing a total of 73% of crossing movements, was clearly an attractive crossing option.

Figure 4.56 Pedestrian desire lines at Tristram St (near Gary Keith Motors)



4.8.8 Pedestrian survey findings

As with the other cases studies, a questionnaire survey was undertaken (see appendix B for the questions).

A graph of the findings of the survey questionnaire is provided in figure 4.57. Each of the three questions and a rating on importance is presented along the horizontal axis. The rating for each survey question on the vertical axis is an average of the respondents' responses for each question, using the seven-point scale (-3 to +3).

Figure 4.57 Summary of before and after survey responses, by question type (average ratings)

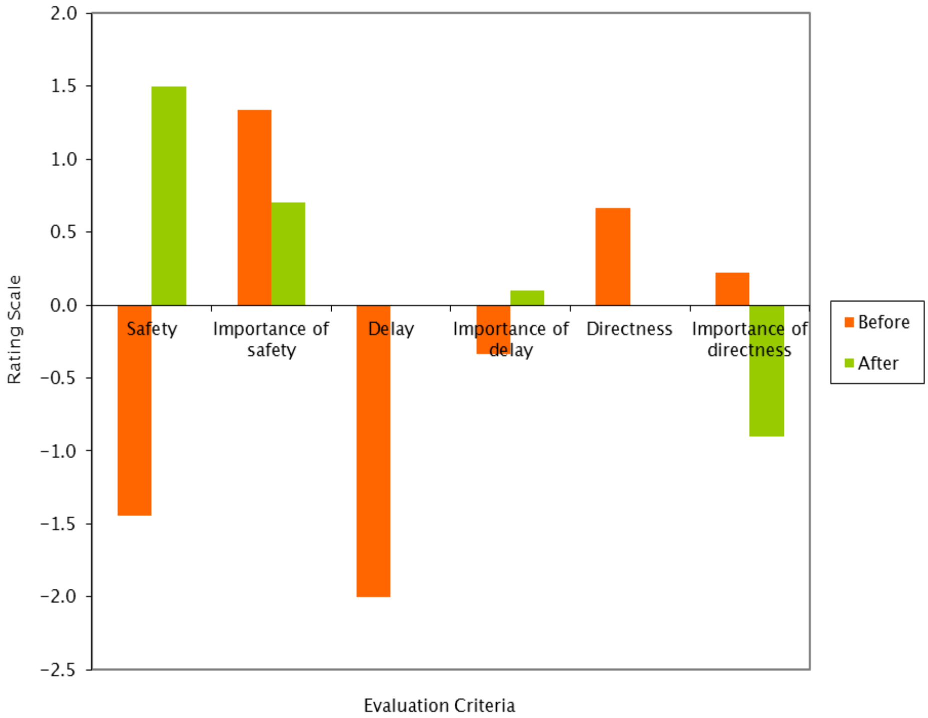


Table 4.9 Before and after perception surveys – average ratings

	Safety	Importance of safety	Delay	Importance of delay	Directness	Importance of directness
Before	-1.4	1.3	-2.0	-0.3	0.7	0.2
After	1.5	0.7	0	0.1	0	-0.9

The results indicated that the new facility had led to positive changes in pedestrians' perception of safety and delay. Before the improvement, crossing the street was rated as unsafe (-1.4), and involving significant delay (-2.0); after the improvement, safety was rated at 1.5 and delay had improved to 'medium', at 0. These findings were consistent with the increased use of the facility. As expected, respondents rated safety as important to them. They were neutral on the importance of delay.

The findings on directness were difficult to interpret, with only a minor change in the before and after ratings. This suggests that some pedestrians were adjusting their route and travelling further to use the facility.

4.9 Case study 8: Margot St, Grey Lynn, Auckland

4.9.1 Site summary

- Crossing type: Kea crossing with side islands
- Road: Local road, 2200 vehicles/day
- Project cost: Not available

4.9.2 Introduction

This site is located on Margot St in Auckland, near the entrance to the Diocesan School for Girls (see figure 4.58). This Auckland City Council (ACC) project was part of the council's plan to make the road environment safer for pedestrians and ease traffic on Auckland roads. It involved the construction of a kea crossing near the entrance to the Diocesan School for Girls, to make it easier for students to cross the road. Side islands were also installed on both sides of Margot St to reduce the crossing distance and check vehicle speeds. Some parking spaces on Margot St had to be removed to allow the construction of this facility.

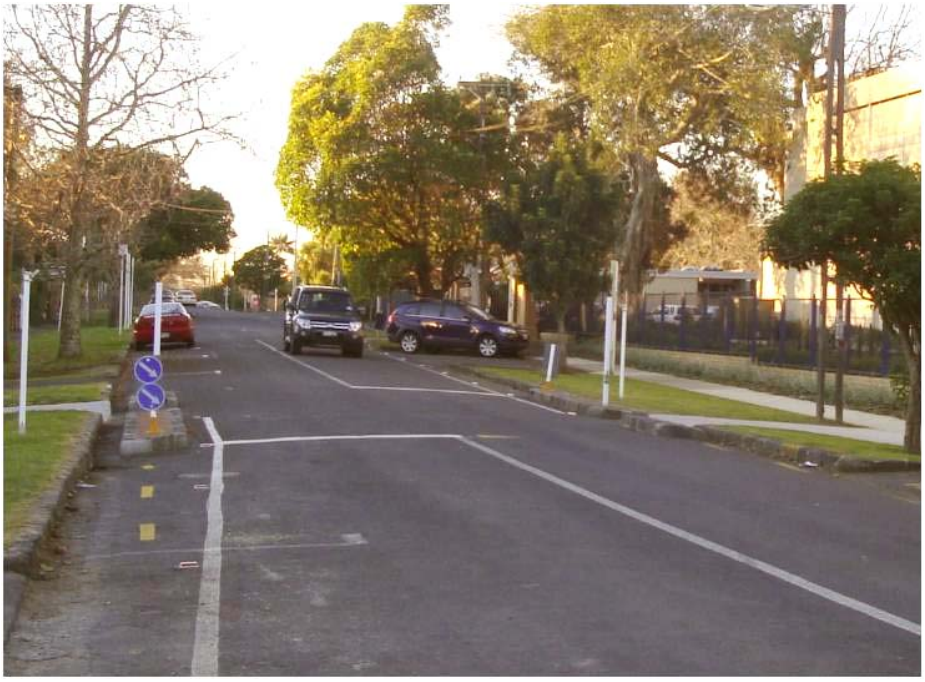
Figure 4.58 Aerial photo showing the location of the site

4.9.3 Site characteristics

Margot St is a local road located in the Auckland suburb of Epsom, which is a largely residential suburb. It carries an average of 2200 vehicles/day, with a high proportion of through traffic. Motor vehicles typically have low speeds while travelling through the area, probably because of drivers' awareness of the presence of the school and the level of roadside activity. Before the construction of the kea crossing, there were on-street parking spaces that were usually occupied during peak times. Double-parking was also common, meaning that traffic in one direction was often blocked. These on-street parking spaces were removed to allow the construction of the kea crossing (see figure 4.59).

The main entrance to the Diocesan School for Girls is located on Margot St. However, traffic leaving the school is also able to use another exit located on Clyde St to the north.

Figure 4.59 Margot St kea crossing



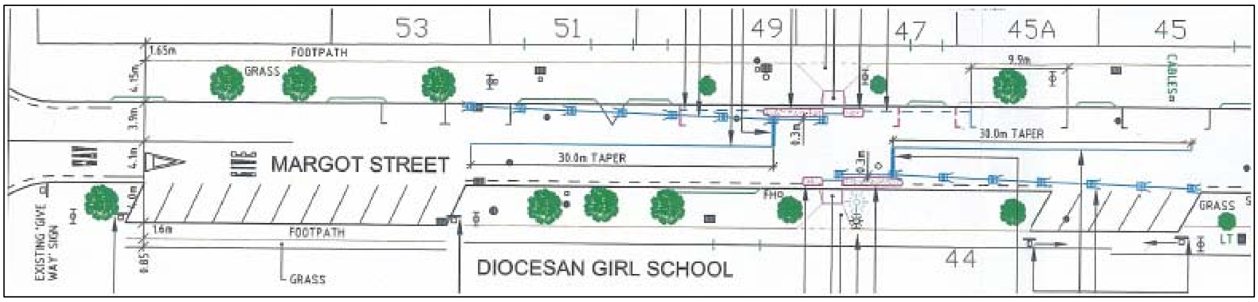
4.9.4 Crash history

No crashes were reported within 50m of the site during the five-year period between 2003 and 2007. This indicates that the length of Margot St within the study area has recently been a safe zone for pedestrians.

4.9.5 Facility design and consultation

The installation of a new kea crossing near the entrance to the Diocesan School for Girls aimed to improve safety and accessibility for pedestrians in the area. New side islands on both sides of Margot St were designed to reduce the crossing distance and encourage lower vehicle speeds, and on-street parking spaces outside property numbers 47 and 49 were removed (see figure 4.60).

Figure 4.60 Margot St kea crossing layout plan



Public consultation for this project, involving residents in the vicinity of the works (including absentee property owners), Stagecoach, the Diocesan School for Girls, the Community Board and the Ward Engineer, was carried out between 27 March 2008 and 11 April 2008. However, further queries were received after the consultation period ended.

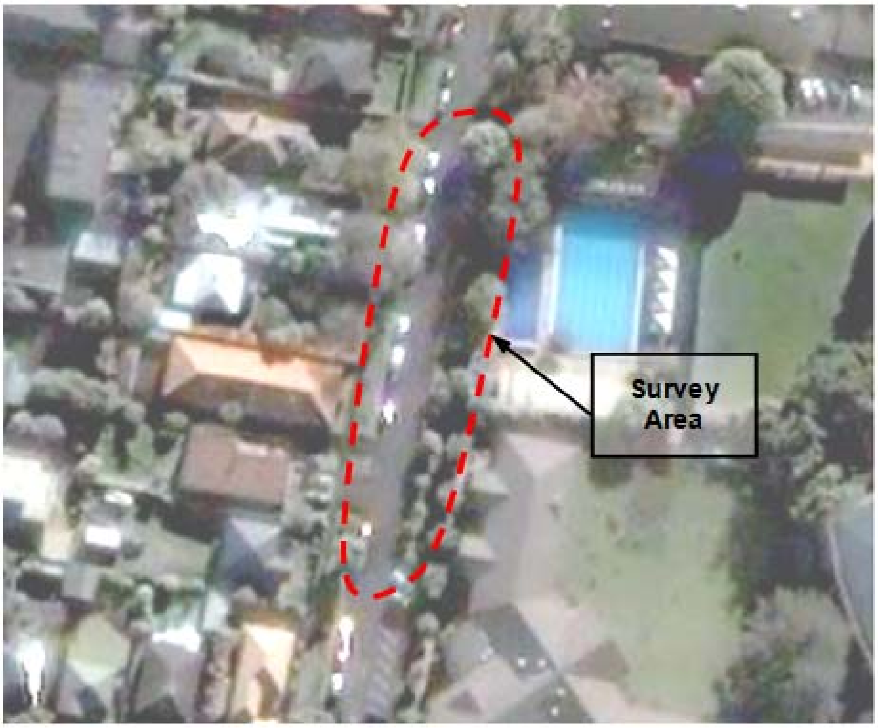
Five responses to the consultation letters were received, mostly expressing dissatisfaction with the proposed removal of the on-street parking spaces and the construction of the side islands. The responses said that Margot St was already a congested road, which would be worsened by the construction of the kea crossing and side islands, and the removal of parking spaces would leave residents with insufficient parking spaces.

However, the kea crossing was favoured by the Diocesan School for Girls, who did not believe the new crossing would create an impediment to the buses and vehicles using Margot St, but it would improve safety and accessibility for pedestrians in their area by reducing the severance created by the road.

4.9.6 Data collection and analysis

Before and after pedestrian count surveys were undertaken at the site during October 2008 and June 2009 respectively. Since the proposed kea crossing would attract significant usage at school opening and closing times, the surveys were conducted for one hour both in the morning (8–9am) and afternoon (2.30–3.30pm) to accurately record the number of crossing pedestrians during the period of maximum usage. The survey area covered a distance of 50m on both sides of the proposed kea crossing (see figure 4.61).

Figure 4.61 Survey area



The results showed a significant increase in the number of pedestrians crossing within the surveyed area after the improvements. The total number of pedestrians using the site per hour over the two periods (morning and afternoon) increased from 69 (before) to 98 (after). This represented an increase of approximately 42%, suggesting that the construction of the kea crossing and associated side islands and footpath accesses had made this facility more attractive to pedestrians (mostly students) at school opening and closing times.

4.9.7 Behaviour at the site

The count survey data showed there were three preferred crossing lines (desire lines), as shown in figures 4.62 and 4.63. The new facility was located on desire line B.

Construction of the kea crossing and side islands led to noticeable changes in where pedestrians chose to cross the road. In the mornings, 82% of pedestrians now crossed at the new kea crossing, and in the afternoons, 61% crossed there. There was a decrease in the proportion of pedestrians crossing at desire line A, which was further away from the school entrance, but an increase at desire line C at both the morning and afternoon times – possibly because of more people crossing to and from the angled car park to the north of the school entrance.

Figure 4.62 Pedestrian desire lines – morning peak

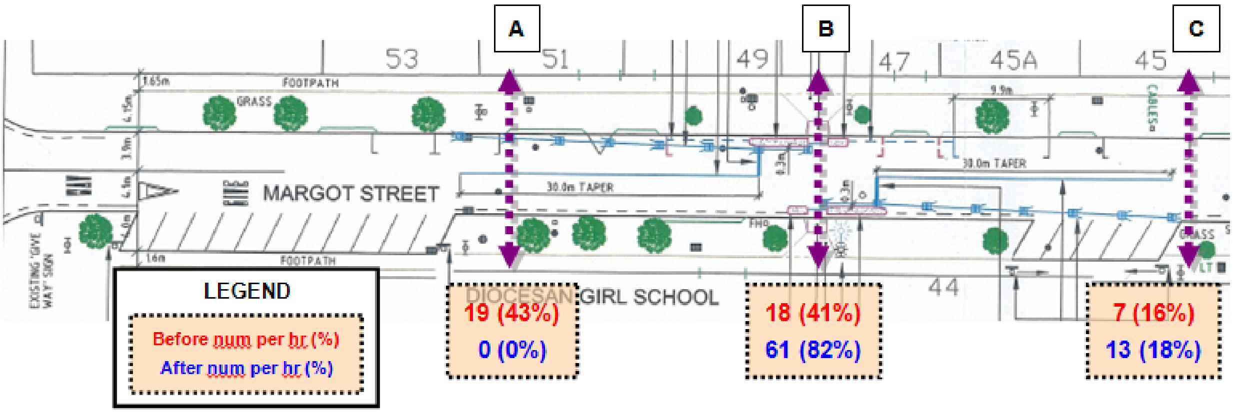
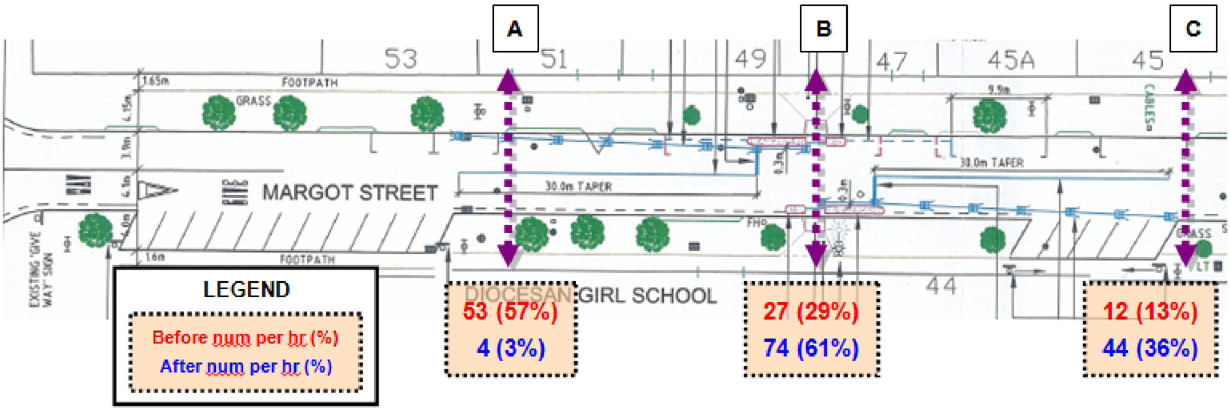


Figure 4.63 Pedestrian desire lines – afternoon peak



4.9.8 Pedestrian survey findings

As with the other cases studies, a questionnaire survey was undertaken (see the questions in appendix B).

A graph of the findings of the survey questionnaire is provided in figure 4.64. Each of the three questions and a rating on importance is presented along the horizontal axis. The rating for each survey question on the vertical axis is an average of the respondents' responses for each question, using the seven-point scale (-3 to +3).

Figure 4.64 Summary of before and after survey responses, by question type (average ratings)

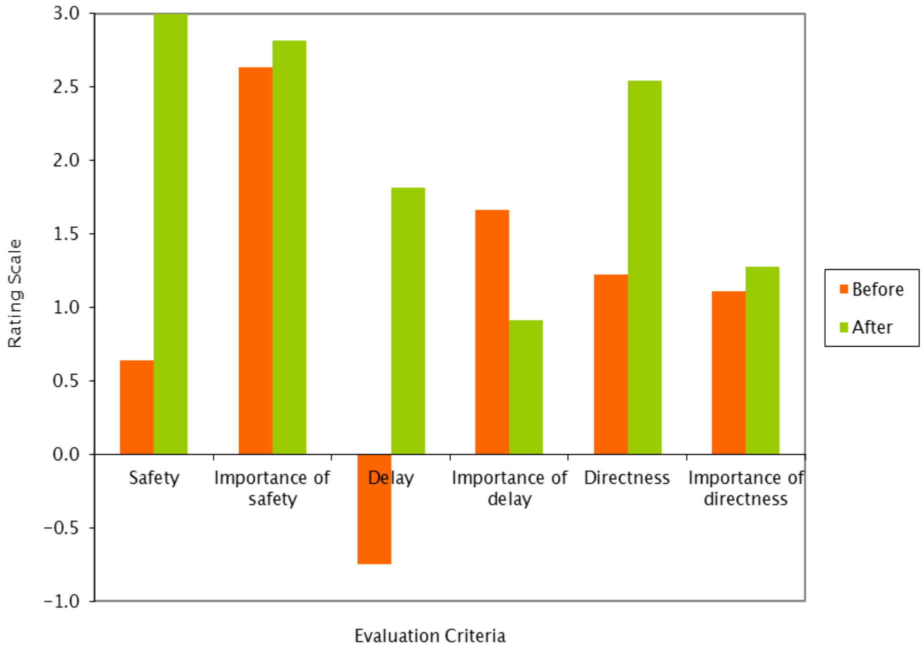


Table 4.10 Before and after perception surveys – average ratings

	Safety	Importance of safety	Delay	Importance of delay	Directness	Importance of directness
Before	0.6	2.6	-0.8	1.7	1.2	1.1
After	3.0	2.8	1.8	0.9	2.5	1.3

The results indicated that the new facility had led to positive changes in the pedestrian perception of safety, delay and directness. Before the improvement, the average rating for crossing the street here was 0.6 (mildly safe); after the improvement, all respondents rated it at 3, the maximum possible. This represented a significant increase of about 2.4, indicating that pedestrians felt extremely safe while using the new facility, which was consistent with the increased use of the facility. As expected, respondents rated safety as an important factor when choosing a crossing point – the average rating for this remained stable (2.6 before, 2.8 after).

There was also a significant reduction in the amount of delay experienced by pedestrians, with the average 'before' rating of -0.8 (a medium level of delay) improving to 1.8 in the after survey. The importance of delay was rated lower after the improvement (1.7 down to 0.9), which could mean that pedestrians did not have to wait long to cross the road, thus making delay less significant.

The average rating for directness doubled from 1.2 (before the improvement) to 2.5 (after), indicating that fewer pedestrians needed to adjust their route to use the facility. The rating for importance of directness did not change much (1.1 before the improvement and 1.3 after).

5 Data analysis

5.1 Introduction

This section analyses and identifies trends in the before and after count data and pedestrian perceptions of safety, delay and directness, and the importance of each of these when deciding on a location to cross the road. A description of the key results for each of the individual sites in this study is provided, as well as the trends across all the sites.

The hypothesis of this study is that pedestrian numbers will increase in a certain location or at a certain crossing facility when pedestrians have the perception that the levels of safety, delay, or other aspects that are important to them, have been improved.

In this section, an attempt is made to identify the factors responsible for an increase or decrease in the number of pedestrians crossing the road at the locations of the improved pedestrian facilities, and to evaluate the related changes in perception of safety, delay and directness that might have led to these changes.

Each of the eight sites for which data was collected was analysed individually and summarised (see section 5.2) according to a standard case study format consisting of the following comparison parameters:

- site summary, including the following characteristics:
  - type of pedestrian facility
  - road category and AADT
  - surrounding land use
  - crash history (2003–2007)
- pedestrian counts before and after the implementation of the pedestrian facility
- behaviour of pedestrians, described through changes in pedestrian desire lines
- pedestrian survey findings, summarising the results of the before and after perception surveys
- conclusions specific to that particular site, based on the above information.

In addition, a cross-analysis of sites was conducted, based on the type of crossing and perception factors of safety, delay and directness. Results from this analysis are presented in section 5.3, grouped under the following criteria:

- comparison of before and after counts across all sites
- comparison of changes in the perception of safety, delay and directness across all sites
- comparison of before and after perceptions of safety, delay and directness for individual crossing types

- comparative performance of different crossing facilities according to the criteria of safety, delay and directness.

5.2 Analysis for individual sites

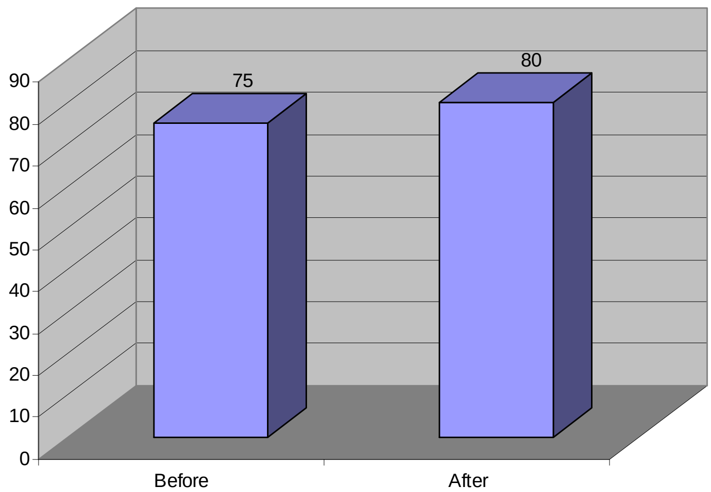
5.2.1 Case study 1: Moorhouse Ave at Hoyts 8/Science Alive!, Christchurch

5.2.1.1 Site summary

Crossing type	Signalised crossing
Road category	Six-lane median-divided arterial
AADT	40,000 vehicles/day
Land use	Commercial
Crash history	Four minor-injury crashes (2003–2007)

5.2.1.2 Pedestrian counts

Figure 5.1 Before and after counts



There was a marginal increase in total pedestrian numbers between the before (75 pedestrians/hour) and after (80 pedestrians/hour) surveys.

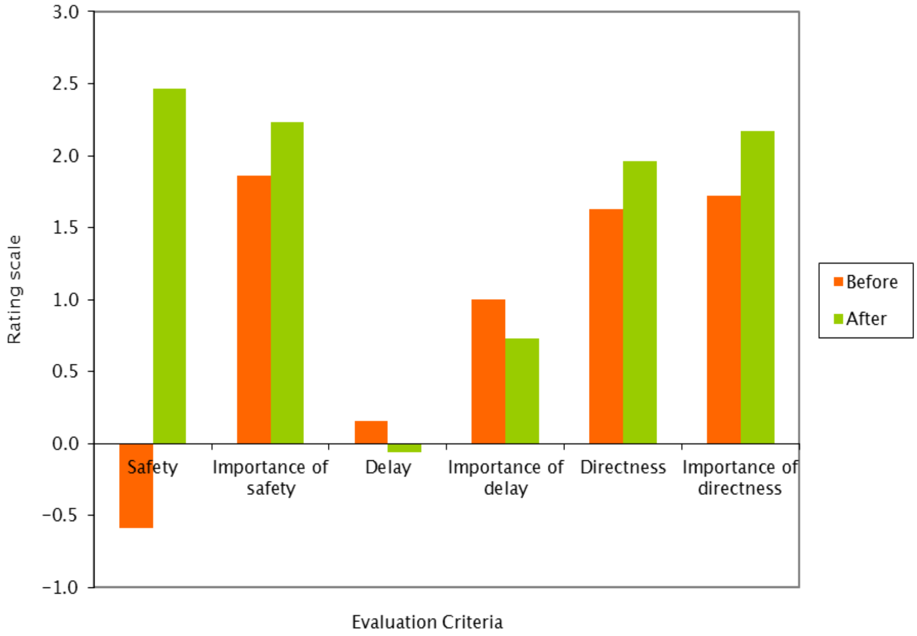
5.2.1.3 Pedestrian behaviour

However, the *proportion* of people crossing at the new facility approximately doubled from 40% (before the improvement) to 79% (after), indicating that pedestrians crossing the road in the general area were choosing to use the new facility. Although the increase in the proportion of pedestrians choosing to cross at the new facility resulted in an equivalent reduction in numbers crossing at other locations along Moorhouse Ave, a small number of pedestrians continued to cross without using the facility, mainly because the traffic signals at Manchester St and Madras St, on either side of the pedestrian crossing, created large gaps in through traffic.

This increase in the percentage of people using the crossing was not surprising, as the signalised pedestrian crossing provided a safer crossing environment. It seemed that the majority of pedestrians recognised its benefits, in spite of the extra travel time involved in walking to the crossing point and waiting for the signalled crossing.

5.2.1.4 Pedestrian survey findings

Figure 5.2 Perception survey results



Pedestrian perception surveys at this site indicated a significant improvement in the perception of safety, with respondents reporting that they felt ‘very safe’ in using the new crossing facility. This was further supported by the changes in pedestrian desire lines, as described above. Ratings of directness also improved. However, pedestrians reported having to wait slightly longer to cross the road.

5.2.1.5 Conclusions

The improved pedestrian facility at Moorhouse Ave did not lead to increased usage of the facility by pedestrians. However, the perception survey indicated that pedestrians felt much safer when crossing at the new facility, which is an important issue when crossing a busy multi-lane arterial road such as Moorhouse Ave. The high AADT and the presence of six lanes on Moorhouse Ave had effectively ruled out the construction of other types of facilities, such as a zebra crossing, and a signalised pedestrian crossing had been seen as the only viable alternative. The safety benefits of the new facility justified the implementation of a signalised crossing for pedestrians at the site, even though considerably higher pedestrian numbers had not been achieved.

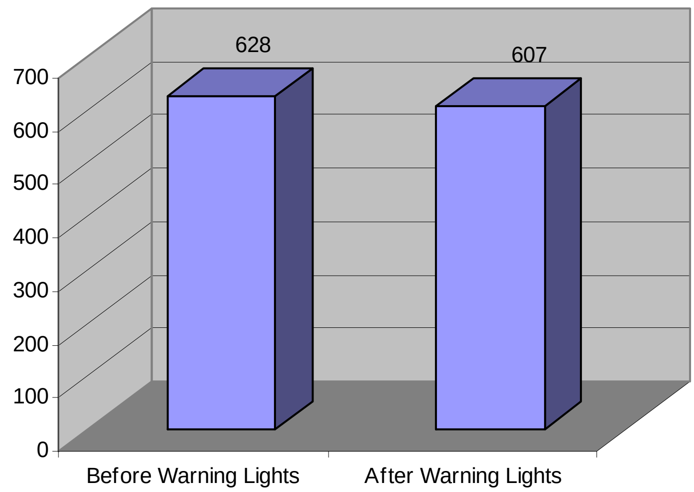
5.2.2 Case study 2: Hereford St at Westpac Lane/National Mutual Arcade, Christchurch

5.2.2.1 Site summary

Crossing type	Raised zebra crossing with warning light system
Road category	Collector road
AADT	9500 vehicles/day
Land use	Commercial
Crash history	Two non-injury crashes (2003–2007)

5.2.2.2 Pedestrian counts

Figure 5.3 Before and after counts



After the installation of the warning light system, there was a slight decrease in the total number of pedestrians crossing the road in the vicinity of this facility – from 628 pedestrians/hour (before) to 607 (after). However, this decrease was not considered to be statistically significant (see section 5.2).

Although the *overall* number of pedestrians crossing Hereford St within the study area decreased slightly, the number of pedestrians *using the facility* increased from 413 to 548/hour.

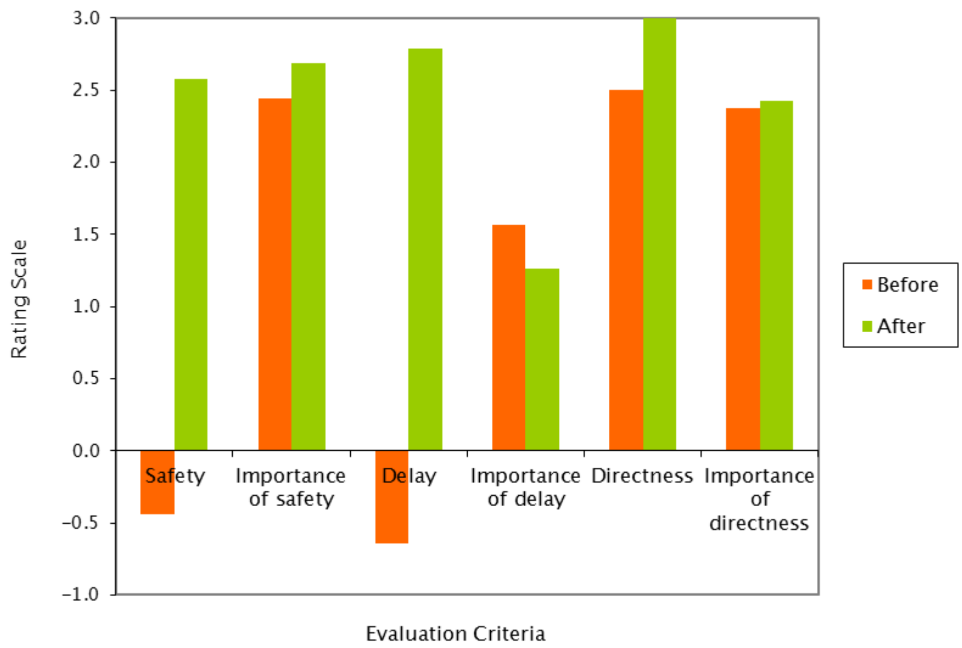
5.2.2.3 Pedestrian behaviour

The proportion of people crossing at the new facility increased from 66% (before the improvements) to 90% (after), suggesting that most of the people crossing within the study area did so at the improved zebra crossing.

It is possible that the surveys at this site were undertaken too close together, and therefore did not actually measure the effect of the crossing warning light upgrade (the after survey was undertaken only one month after that improvement). The increase in use of the facility might have been due to the earlier installation of the new zebra crossing facility, with pedestrians slowly changing their behaviour over a few months as they learnt about it. Therefore, it is difficult to draw wider conclusions about the change of behaviour observed at this site.

5.2.2.4 Pedestrian survey findings

Figure 5.4 Perception survey results



The results from the pedestrian perception surveys highlighted that the installation of the warning light system on the existing zebra crossing had led to a significant increase in the perceived safety of the facility, which was an important factor for pedestrians when deciding where to cross. There was a significant improvement in the average rating for delay, suggesting that pedestrians crossing at the site experienced lower waiting times. Both these factors were further supported by the changes in pedestrian desire line proportions and the increase in the proportion of pedestrians crossing Hereford St at the location of the zebra crossing.

The improvement in the rating for directness could not be accurately attributed to the installation of the warning lights – it is probably sufficient to conclude that the facility had been well located and was providing good access to pedestrians using the nearby pedestrian arcade and surrounding commercial businesses and shops.

5.2.2.5 Conclusions

The decrease in the total number of people crossing in the vicinity of the new facility was difficult to interpret (considering the consistently higher ratings of safety, delay and directness), and could have been because of changes in the land use in the surrounding area. However, the increase in pedestrian numbers crossing at the *actual* location of the facility support the findings from the perception surveys, and points to the attractiveness of the facility for pedestrians.

Pedestrians in busy commercial environments such as Hereford St were expected to place a greater emphasis on the value of delay. The pedestrian perception survey results confirmed this, and suggested that a reduction in the delay experienced by pedestrians could have been an important causal factor in the increased number of pedestrians using the facility.

The Hereford St pedestrian crossing had a higher rate of pedestrians crossing per hour than any other site considered in this study. The results described above highlighted the usefulness of providing a zebra crossing with kerb extensions and warning lights at this location, providing pedestrians with a safer and more convenient crossing point.

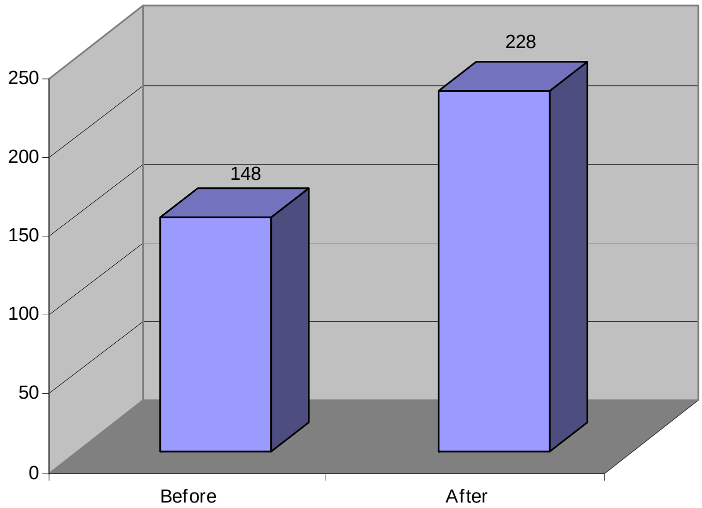
5.2.3 Case study 3: Sparks Rd, Christchurch

5.2.3.1 Site summary

Crossing type	School-patrolled zebra crossing
Road category	Minor arterial
AADT	10,700 vehicles/day
Land use	Residential, school
Crash history	No crashes reported (2003–2007)

5.2.3.2 Pedestrian counts

Figure 5.5 Before and after counts



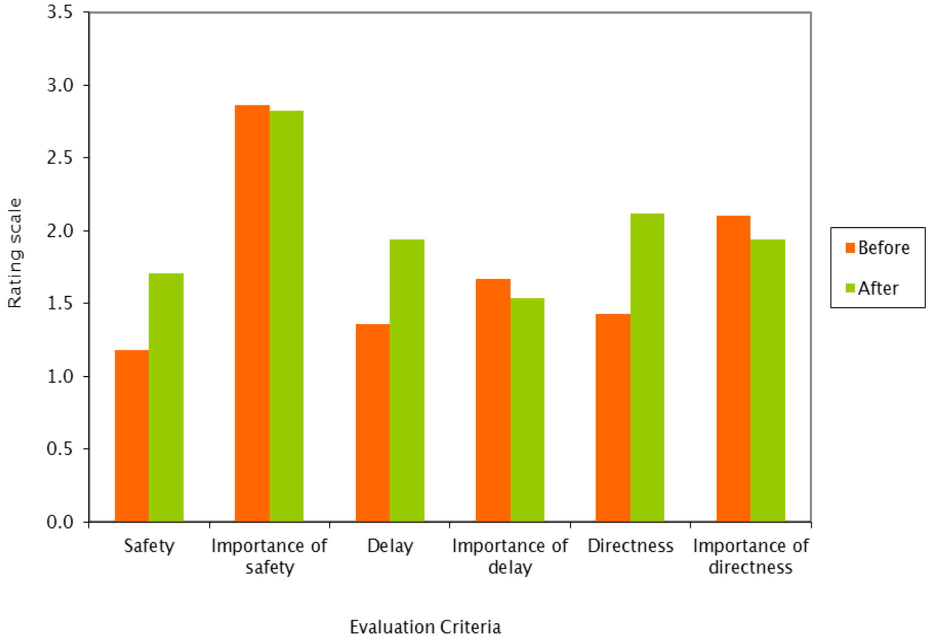
Pedestrian numbers were found to have increased by over 50%, from 148 (before the improvement) to 228 (after).

5.2.3.3 Pedestrian behaviour

Pedestrian desire lines indicated that 85% of the people crossing Sparks Rd within the study area used the new relocated zebra crossing. This represented a significant majority of all crossing pedestrians, and suggested that even though the new facility was not directly located near either of the two school entrances, it was still an attractive option for pedestrians crossing the road. This was further reinforced by the increase in the numbers of pedestrians crossing the road after completion of the facility, as described above.

5.2.3.4 Pedestrian survey findings

Figure 5.6 Perception survey results



Pedestrian perception surveys at this location suggested that although the existing zebra crossing (before the improvements) was reasonably favourable in terms of safety, delay and directness, implementation of the new facility had resulted in further improvements in the perceptions of pedestrians using the facility. This had also led to an increase in the number of people using the site per hour, as described above.

5.2.3.5 Conclusions

Implementation of the school-patrolled zebra crossing on Sparks Rd more than doubled the number of pedestrians crossing within the study area.

Because of its location on a minor arterial road, and the fact that this facility provided access to the two school entrances located nearby, it was expected that safety would be the most important factor considered by pedestrians when choosing a location to cross Sparks Rd.

Pedestrian desire lines before and after implementation of the new facility indicated that the majority of the pedestrians had shifted to crossing at the new school-patrolled zebra crossing, although a small number still favoured crossing the road away from the new crossing and closer to the schools’ entrances.

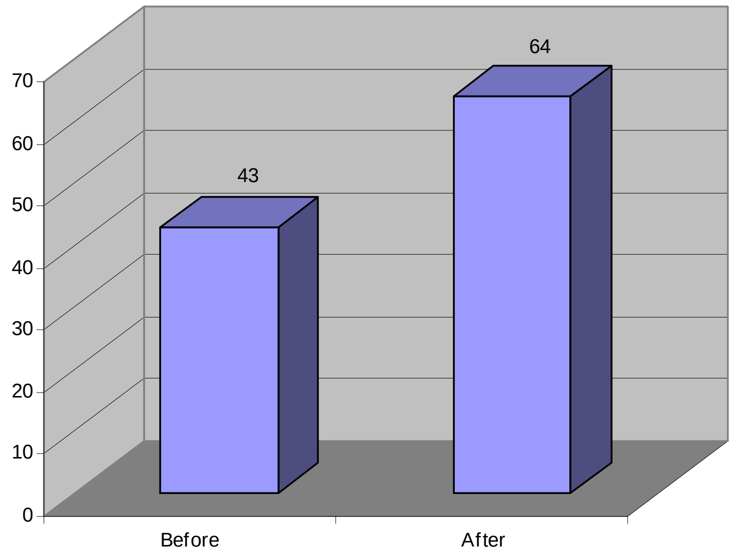
5.2.4 Case study 4: Hoon Hay Rd, Christchurch

5.2.4.1 Site summary

Crossing type	Kea crossing
Road category	Minor arterial
AADT	7000 vehicles/day
Land use	Residential, school
Crash history	One non-injury crash (2003–2007)

5.2.4.2 Pedestrian counts

Figure 5.7 Before and after counts



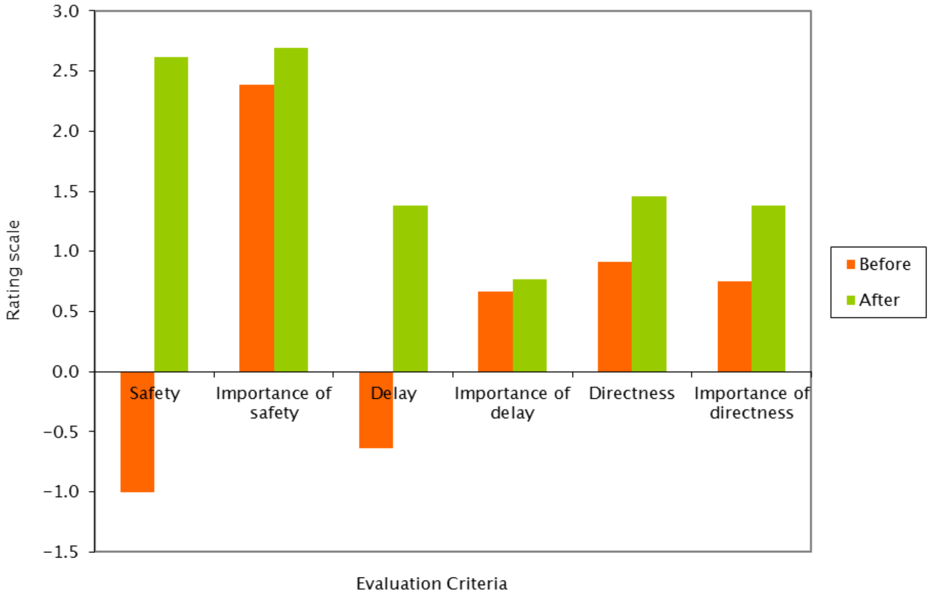
The total number of pedestrians crossing within the study area increased from 43 to 64, representing an increase of approximately 50%.

5.2.4.3 Pedestrian behaviour

Pedestrian desire lines indicated that after the improvements, approximately 85% of pedestrians used the new kea crossing facility to cross Hoon Hay Rd during the morning and afternoon survey periods. A consequent decrease in the number of pedestrians who crossed the road at other locations was also observed. This indicated that pedestrians greatly preferred the new crossing facility.

5.2.4.4 Pedestrian survey findings

Figure 5.8 Perception survey results



Findings from the questionnaire surveys indicated that construction of the new kea crossing had resulted in a significant improvement in pedestrians' perception of safety and delay, and a marginal improvement in directness. Pedestrians considered the new facility to be a safe and direct crossing point for access to OLA School. The increased average rating for delay also suggested that pedestrians were experiencing shorter waiting times while crossing Hoon Hay Rd.

5.2.4.5 Conclusions

It could be reasonably concluded that the increase in the number of pedestrians crossing at this site was directly attributable to the improvements in pedestrians' perceptions of safety, delay and directness.

Since the site was used primarily by students, parents and staff entering and leaving OLA School, safety was an especially important consideration. As with the installation of a kea crossing at Margot St, in case study 8, pedestrians clearly derived significant safety benefits from this kea crossing.

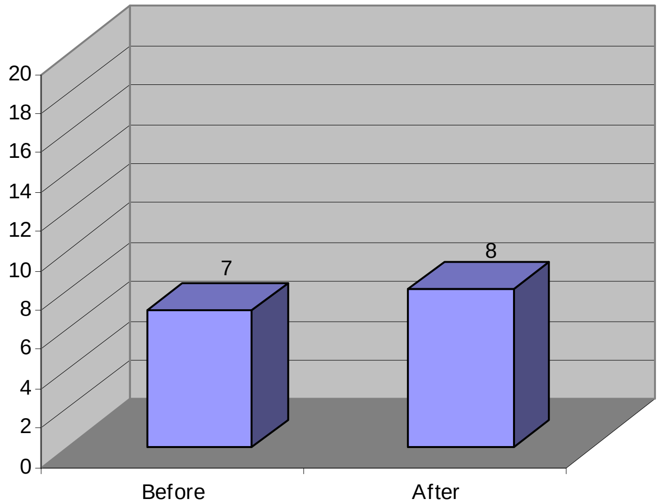
5.2.5 Case study 5: Ensors Rd, Christchurch

5.2.5.1 Site summary

Crossing type	Refuge island and kerb extension
Road category	Minor arterial
AADT	8200 vehicles/day
Land use	Residential
Crash history	One minor-injury crash, two non-injury crashes (2003–2007)

5.2.5.2 Pedestrian counts

Figure 5.9 Before and after counts



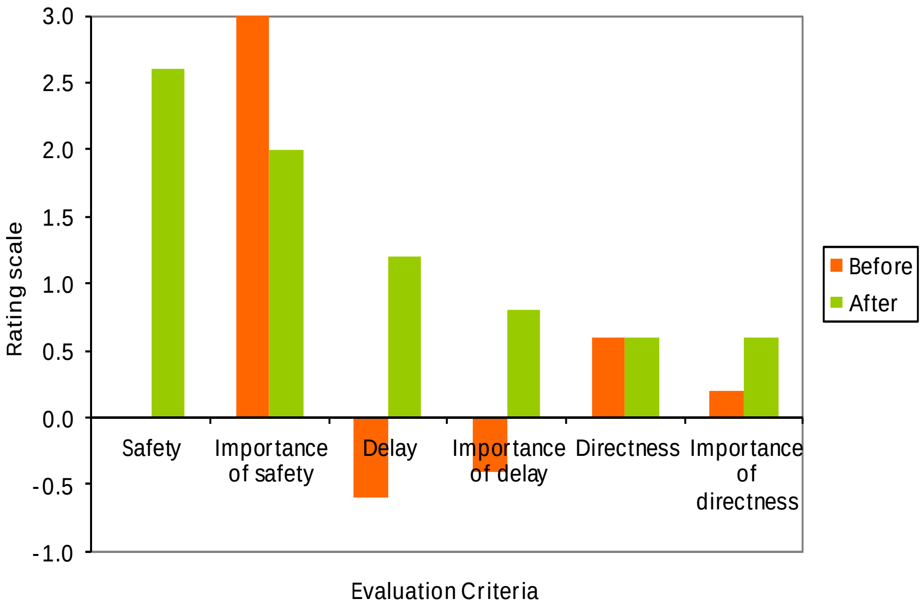
Pedestrian count surveys indicated that the number of pedestrians using the site was very low. The before and after rates remained almost the same, with seven pedestrians crossing during the before survey and eight pedestrians crossing during the after survey.

5.2.5.3 Pedestrian behaviour

Construction of the pedestrian facility led to an increased proportion of people utilising the facility for crossing the road. However, 73% of pedestrians crossing within the study area still did not utilise the new facility.

5.2.5.4 Pedestrian survey findings

Figure 5.10 Perception survey results



The results from the perception surveys showed significant increases in the perceptions of safety and delay, indicating that the pedestrians who utilised the crossing derived significant benefits from it. The perception of directness was low, and remained the same both before and after the improvements. However, it must be noted that the low usage of the site meant only a small sample size was available for analysis.

5.2.5.5 Conclusions

Implementation of the pedestrian facility at Ensors Rd did not lead to a noticeable increase in the number of pedestrians crossing in the area, even though the perception surveys indicated that pedestrians perceived the site to be safer and having less delay. Also, the facility had not been able to capture a significant proportion of the pedestrians who were crossing the road.

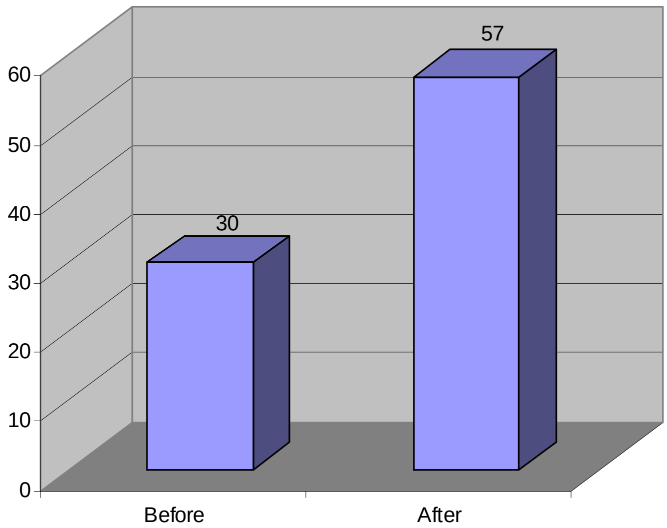
5.2.6 Case study 6: Collingwood St, Hamilton

5.2.6.1 Site summary

Crossing typ	Kerb extensions
Road category	Collector
AADT	6500 vehicles/day
Land use	Educational, commercial
Crash history	One minor-injury crash, two non-injury crashes (2003–2007)

5.2.6.2 Pedestrian counts

Figure 5.11 Before and after counts



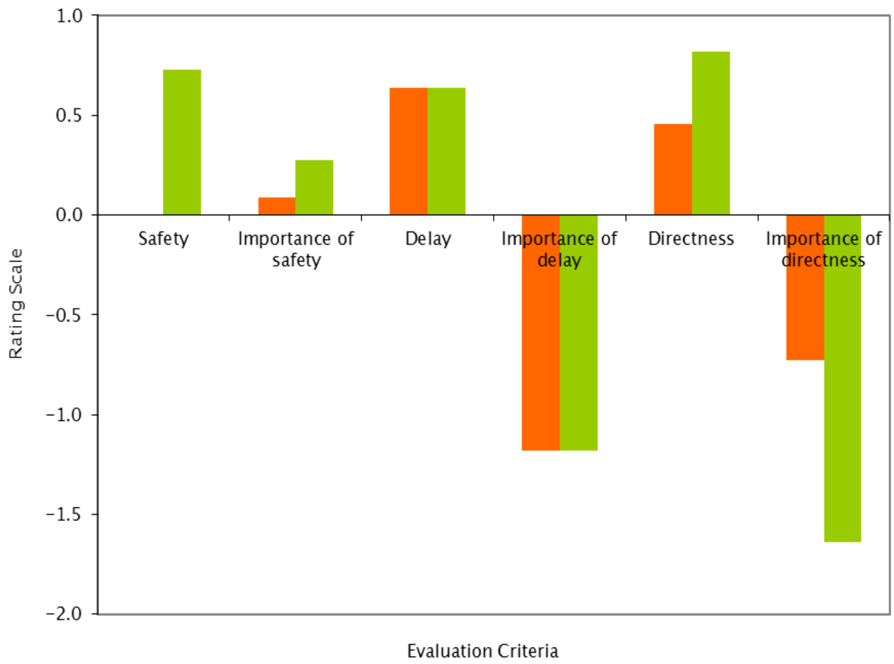
Construction of the new pedestrian crossing facility resulted in almost doubling the number of pedestrians crossing Collingwood St within the study area, from 30 pedestrians/hour (before the improvements) to 57 (after).

5.2.6.3 Pedestrian behaviour

After the improvements, 28% of the pedestrians crossing within the study area utilised the new pedestrian facility for crossing Collingwood St. However, the facility appeared to have had little impact on pedestrians who were choosing to cross near the roundabout, with 58% of pedestrians still crossing in that area. This suggested that if the facility had been constructed at the location of the desire line of the majority of pedestrians (desire line B in figure 9.7) it might have been used more – however, there may have been safety reasons that prevented the use of this location.

5.2.6.4 Pedestrian survey findings

Figure 5.12 Perception survey results



Findings from the questionnaire survey indicated that the facility had perceived safety benefits that were reflected in its increased usage by pedestrians. However, the new facility had had little impact on users' perceived waiting time when crossing Collingwood St, or on the importance that they attached to it. The low importance given to safety may have been a function of the relatively young age profile of survey respondents/users, and other factors such as the speed and volume of traffic at this location.

5.2.6.5 Conclusions

Pedestrians seemed to use this facility when it was closely aligned with their planned walking route, finding it safer and more attractive than crossing at other locations along Collingwood St. However, where it was outside their route, they did not walk the extra distance to use the facility. The low traffic volumes on Collingwood St meant that pedestrians were less likely to deviate from their most direct and desired crossing path – this was reflected in the low ratings for directness and importance of directness.

One of the main reasons for implementing a pedestrian facility at this location was the issue of the speed of traffic at the roundabout – the aim was to move the preferred crossing location further away from the roundabout. However, the proportions shown in the crossing desire lines for this site suggest that this objective was not achieved.

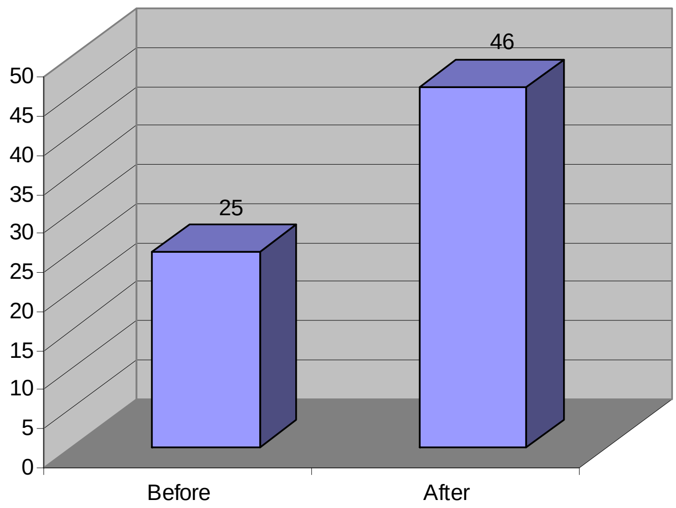
5.2.7 Case study 7: Tristram St (near Gary Keith Motors), Hamilton

5.2.7.1 Site summary

Crossing type	Refuge island
Road category	Minor arterial
AADT	21,000 vehicles/day
Land use	Educational, commercial
Crash history	One non-injury crash (2003–2007)

5.2.7.2 Pedestrian counts

Figure 5.13 Before and after counts



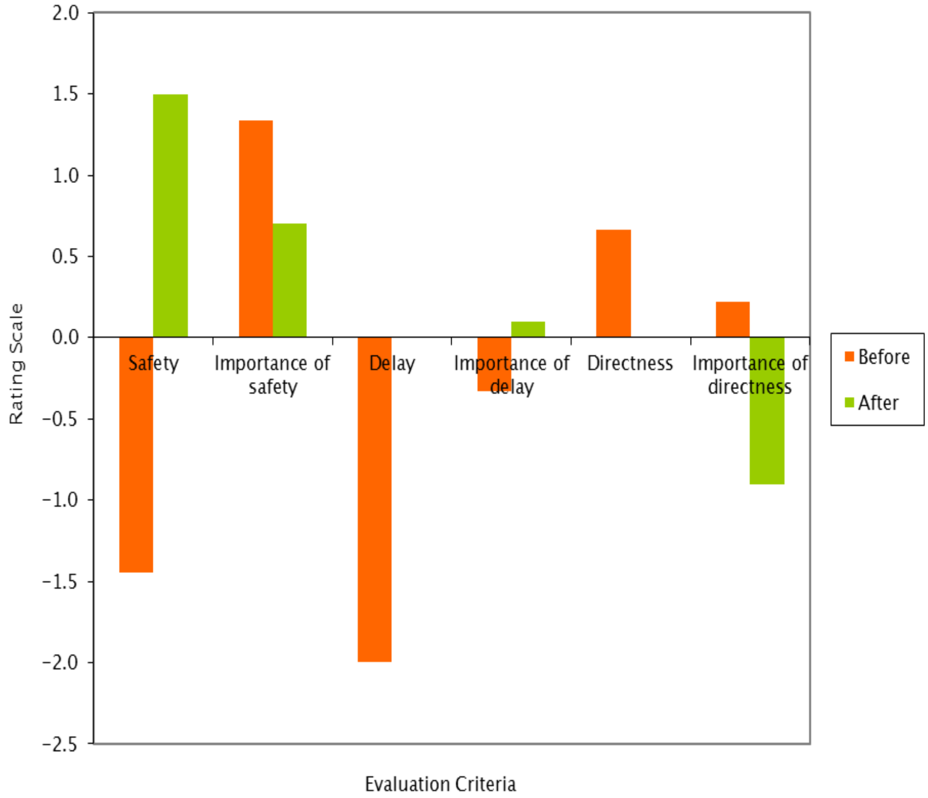
After the improvements, the number of pedestrians crossing within the observation area almost doubled, from 25 pedestrians/hour (before) to 46 (after).

5.2.7.3 Pedestrian behaviour

Analysis of the pedestrian desire lines indicated that the facility had been successful in attracting pedestrians, with 73% of pedestrians crossing within the study area now using the new facility.

5.2.7.4 Pedestrian survey findings

Figure 5.14 Perception survey results



After the improvement, the perception survey indicated significant increases in the ratings for safety and delay. However, pedestrians still rated delay as neutral, which was a sign of less-than-favourable waiting times. The rating for directness was lower during the after survey, which suggested that some pedestrians were choosing to use a less direct route so they could use the new facility.

5.2.7.5 Conclusions

It is likely that significant improvements in perceived safety and delay had led to the significant increase in usage at this site. This was supported by the pedestrian desire line results, which suggested that people preferred to use the new facility to cross the road, even though they might have had to divert from their most direct route to do this.

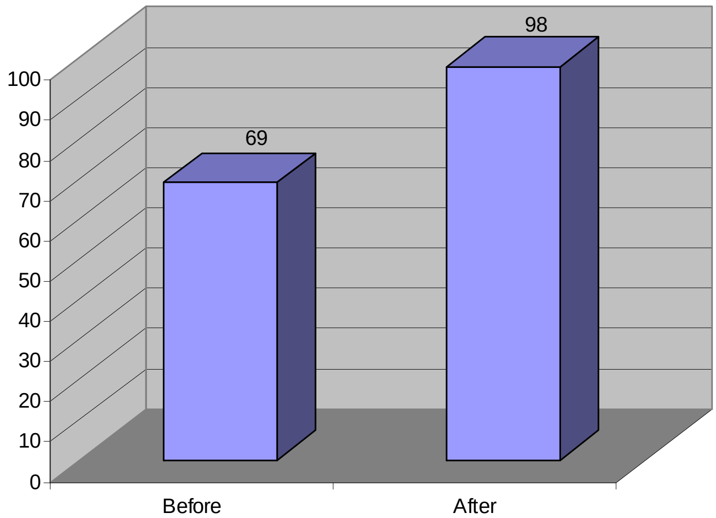
5.2.8 Case study 8: Margot St, Grey Lynn, Auckland

5.2.8.1 Site summary

Crossing type	Kea crossing
Road category	Local road
AADT	2200 vehicles/day
Land use	Residential, school
Crash history	No reported crashes (2003–2007)

5.2.8.2 Pedestrian counts

Figure 5.15 Before and after counts



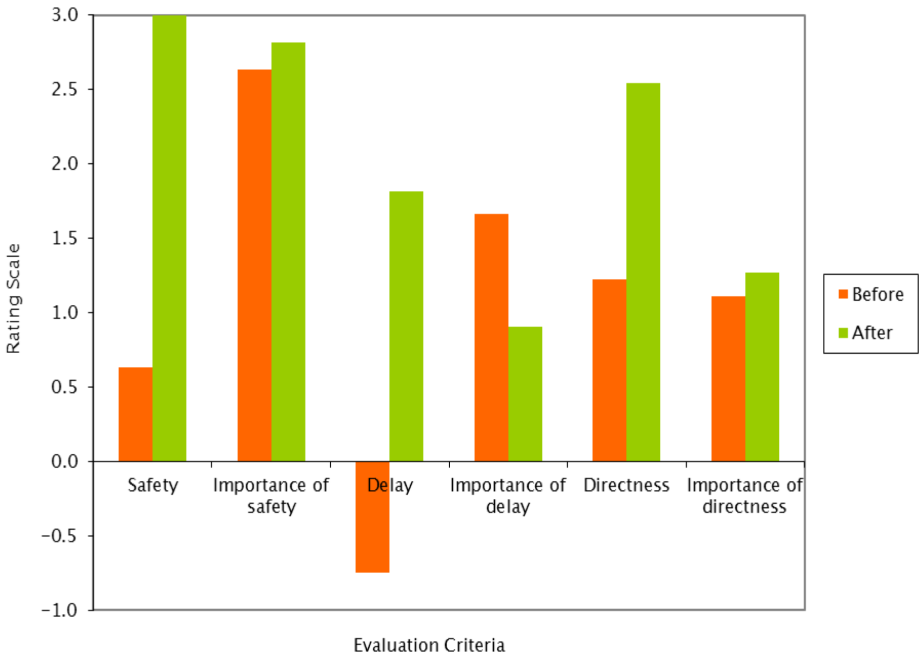
After the improvements, the number of pedestrians using the site per hour over the two periods (morning and afternoon) increased from 69 (before) to 98 (after), representing an increase of approximately 42%.

5.2.8.3 Pedestrian behaviour

Pedestrian desire lines indicated a trend for people to cross closer to the new kea crossing – 82% during the morning period, and 61% during the afternoon period. This, when taken together with the increase in total pedestrian numbers in the study area, showed that pedestrians found the new facility to be a favourable crossing point.

5.2.8.4 Pedestrian survey findings

Figure 5.16 Perception survey results



The perception surveys indicated considerable improvements in all three parameters of safety, delay and directness. This implied that the new facility was able to provide a safe crossing location that was directly on the crossing route of pedestrians, while also reducing waiting times.

Respondents rated safety as the most important factor for consideration. The importance of delay was lower in the after survey, probably because of reduced waiting times at the crossing.

5.2.8.5 Conclusions

The construction of the kea crossing had led to significant improvements in the safety environment and waiting times, and a 42% increase in the number of people crossing within the study area.

The pedestrian desire lines showed a general preference for pedestrians to cross at the location of the new kea crossing, rather than at other locations along Margot St within the study area.

5.3 Cross analysis

This section compares the various sites analysed in this report across the different criteria under consideration: before and after counts, safety, delay and directness.

5.3.1 Changes in pedestrian counts on new/improved facilities

Table 5.1 below compares the pedestrian counts before and after the implementation of a new or improved pedestrian facility for the eight sites analysed in this study.

Table 5.1 Pedestrian numbers before and after the improvements

Location	Type of improvement	'Before' survey (ped/hr)	'After' survey (ped/hr)	% change	Significant change?
Moorhouse Ave at Hoyts 8/ Science Alive!, Christchurch	Signalised crossing	75	80	7%	No
Hereford St, Christchurch	Raised zebra crossing with warning light system	628	607	-3%	No
Sparks Rd, Christchurch	School-patrolled zebra crossing	148	228	54%	Yes
Hoon Hay Rd, Christchurch	Kea crossing	43	64	49%	Yes
Ensors Rd, Christchurch	Refuge island and kerb extension	7	8	14%	No
Collingwood St, Hamilton	Kerb extensions	30	57	90%	Yes
Tristram St, Hamilton	Refuge island	25	46	84%	Yes
Margot St, Auckland	Kea crossing	69	98	42%	Yes

Overall, all of the sites except for the zebra crossing at Hereford St in Christchurch experienced an increase in pedestrian flows after implementation of the new facility. The magnitude of these increases varied – up to 90% at Collingwood St, Hamilton, and 7% at Moorhouse Ave, Christchurch. The change at some sites, such as Moorhouse Ave, Hereford St and Ensors Rd, was well below the figure for the percentage increase that is deemed to be statistically significant (see the discussion in section 3.3.2). Therefore, it could reasonably be concluded that the construction of new facilities at these locations had not had a significant impact on pedestrian numbers.

The specific factors pertaining to each of these individual sites, and likely causes of the change in pedestrian numbers, have been discussed in the individual case studies in section 4.

5.3.2 Pedestrian desire lines

Analysis of the before and after counts and pedestrian desire lines indicated that the desire lines remained more or less the same before and after implementation of the improved facility. However, there were significant changes in the proportions of pedestrians crossing at each of the desire lines, with the magnitude of these changes varying from site to site. It was broadly observed that the construction of an improved pedestrian facility resulted in an increased proportion of pedestrians using the desire line at the location of the improvement.

A key outcome of this analysis is the importance of pedestrian desire lines to the location of new or improved pedestrian facilities. The utility of a facility is maximised when it is placed on pedestrians' most desirable crossing path – ie a facility that does not lie on the path that is most preferred by pedestrians may not be utilised by a large proportion of pedestrians in the area, as was the case with the Collingwood St kerb extensions.

5.3.3 Pedestrians' perceptions of safety, delay and directness

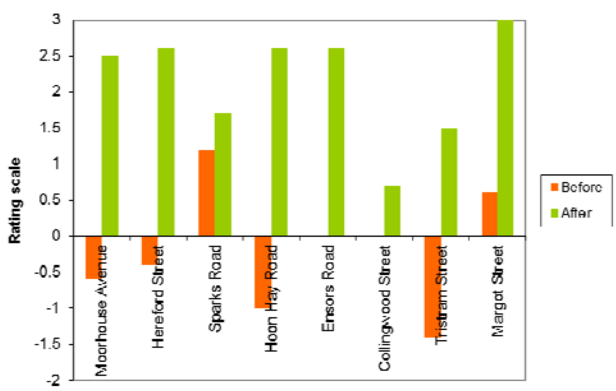
This section compares the changes in the perceived levels of safety, delay and directness at the eight study sites. Survey respondents at each site allocated a different degree of importance to each parameter. However, pedestrians across all of the sites were unanimous in rating safety as the most important factor when considering where to cross a road.

5.3.3.1 Safety

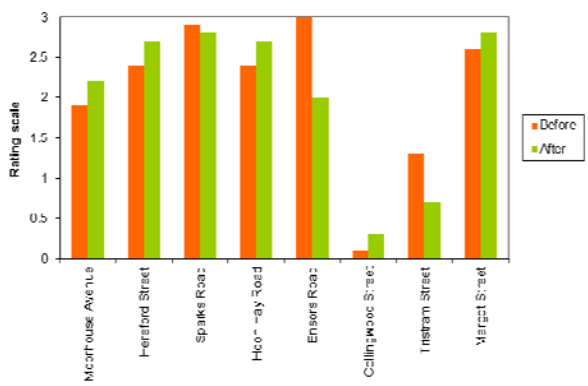
Figure 5.17 compares the effects of implementation of new pedestrian facilities on the perceived level of safety, and the importance of safety, at each of the eight sites analysed in this study.

Figure 5.17 Changes in perceived level of safety, and the importance of safety

Safety



Importance of safety



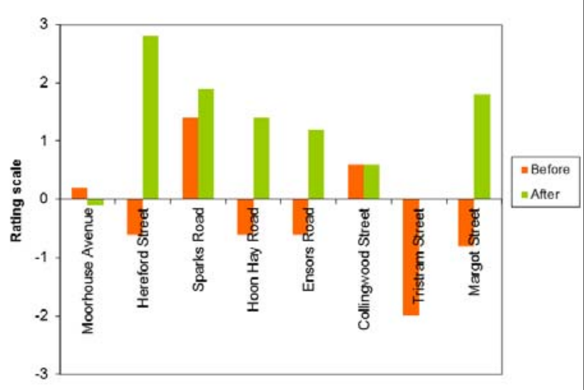
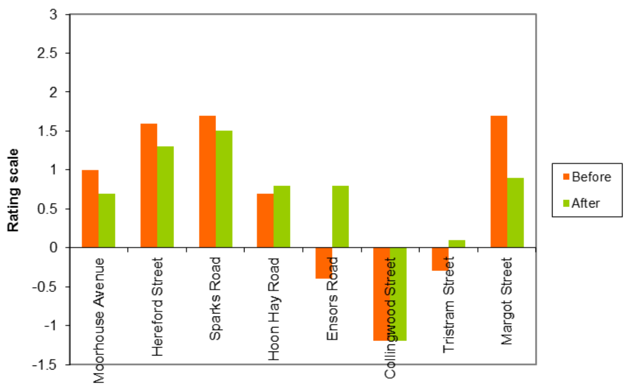
It is obvious from the above figure that pedestrians were unanimous in their perception that the improved facilities at the above locations provided a safer crossing environment. It can also be seen that at five of the sites (Moorhouse Ave, Hereford St, Hoon Hay Rd and Sparks Rd in Christchurch, and Margot St in Auckland), the rating for perceived level of safety rose to (or above) 2.5 out of a maximum of 3. Each of these locations had had a 'before' safety perception rating that was mildly negative, neutral or slightly positive. This suggested that pedestrians had derived great safety benefits from the improvements.

The other three locations (Collingwood St and Tristram St in Hamilton, and Sparks Rd in Christchurch) also had significant improvements in perceived levels of safety, although not of a magnitude comparable to the five sites described above. The facility at Sparks Rd, in particular, had a high 'before' rating for safety, probably because there was already a pedestrian facility in place at the site, which was relocated. However, even this slightly smaller improvement in perceived safety was probably a major contributing factor in the large increases in pedestrian numbers observed at these sites. This can also be seen in table 5.17 above, which shows that flows at Collingwood St, Tristram St and Sparks Rd increased by 90%, 84% and 54% respectively.

5.3.3.2 Delay

Figure 5.18 compares the effects of new pedestrian facilities on the perceived level of delay, and the importance of delay, at each of the eight sites analysed in this study. It should be noted that a higher rating for delay in the first graph indicates reduced waiting times when crossing.

Figure 5.18 Changes in perceived level of delay, and the importance of delay

Delay	Importance of delay
	

It is clear from the above figure that the implementation of new pedestrian facilities resulted in shorter waiting times for crossing pedestrians at all but two of the locations analysed – Moorhouse Ave (Christchurch) and Collingwood St (Hamilton).

Pedestrians at Moorhouse Ave reported a slight increase in waiting time. However, this was an expected outcome for the implementation of a signalised pedestrian crossing, and the slight increase in flows (7%) at this site suggested that pedestrians were willing to accept a slight increase in waiting time if they perceived other conditions, such as safety and directness, to be favourable.

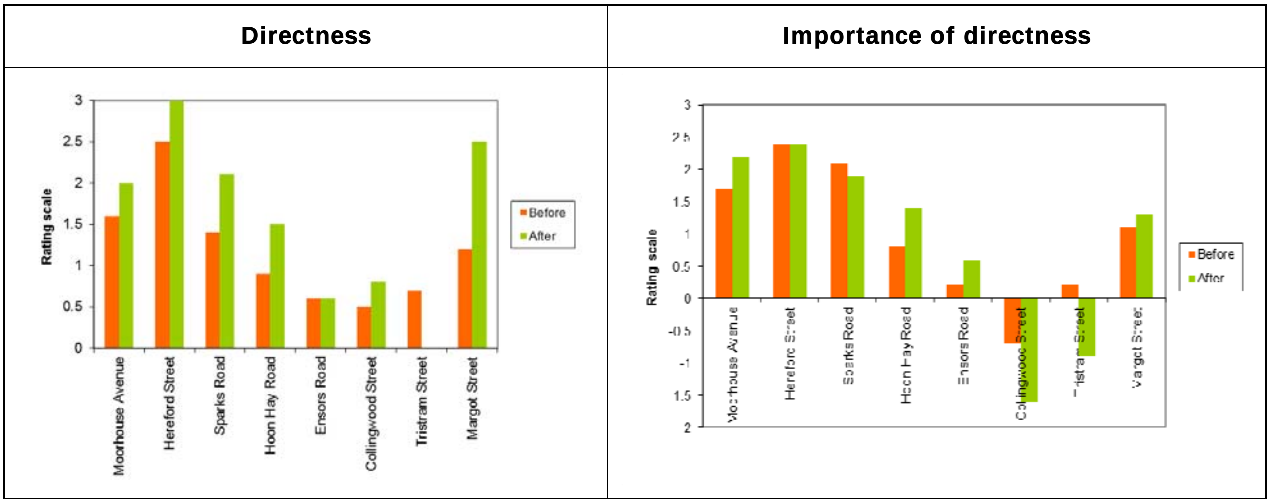
Pedestrians at Collingwood St did not report any change in their waiting time after construction of the kerb extensions. The large increase in pedestrian numbers at this site implied that delay was not a significant factor here, a conclusion that was supported by the fact that pedestrians at Collingwood St gave a negative rating to the importance of delay.

Another interesting observation was that for five of the eight sites, the importance of delay during the after survey was found to be lower than, or equal to, the importance of delay during the before survey. This was the case at Moorhouse Ave, which was the only site where pedestrians' perceived waiting times had increased after construction of the new facility. This trend indicates that pedestrians are generally likely to be satisfied with changes in waiting times experienced as a result of new facilities, and are thus more likely to give more importance to factors other than delay.

5.3.3.3 Directness

Figure 5.19 compares the effects of implementation of new or improved pedestrian facilities on the perceived level of directness, and the importance of directness, at each of the eight sites analysed in this study.

Figure 5.19 Changes in perceived level of directness, and the importance of directness



The above figure for directness shows that the improvements at six out of the eight sites provided a more direct crossing path for pedestrians. The exceptions were the refuge islands and kerb extension at Ensors Rd, where pedestrians did not report a change in directness, and the refuge island at Tristram St, where pedestrians reported that the new facility did not lie on the most direct path that they would otherwise have chosen.

5.3.4 Results by type of facility

This section compares the changes in the ratings of safety, delay and directness, and their respective importance, for each of the four individual pedestrian facility types examined during this study, namely:

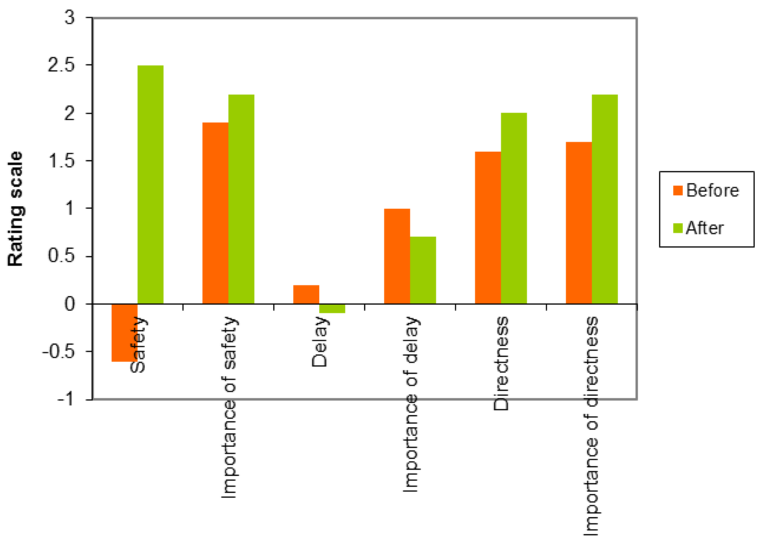
- signalised crossings
- zebra crossings
- kea crossings
- kerb extensions/pedestrian refuge islands.

While the comparisons below are based on the eight sites analysed within this study, the monitoring of new sites and their subsequent entry into the monitoring database will enable a better and more robust analysis of the benefits of each type of facility.

5.3.4.1 Pedestrian signals

Only one of the sites in this case study, namely Moorhouse Ave in Christchurch, involved the implementation of a signalised pedestrian crossing. Results from the before and after analysis are depicted in figure 5.20.

Figure 5.20 Changes in perceived level of safety, delay and directness, for signalised pedestrian crossings



The implementation of traffic signals resulted in a significant improvement in the perceived safety at the site. Directness was also found to have increased slightly. However, the signalised crossing also caused a slight increase in pedestrian waiting times and delay, as is expected from the implementation of signals. The perceived importance of delay and directness increased, while that of delay showed a slight reduction after construction of the facility.

Pedestrian numbers increased by 7%, from 75 to 80 pedestrians/hour. However, this marginal increase in pedestrian usage was well within the natural level of variation and was not considered statistically significant.

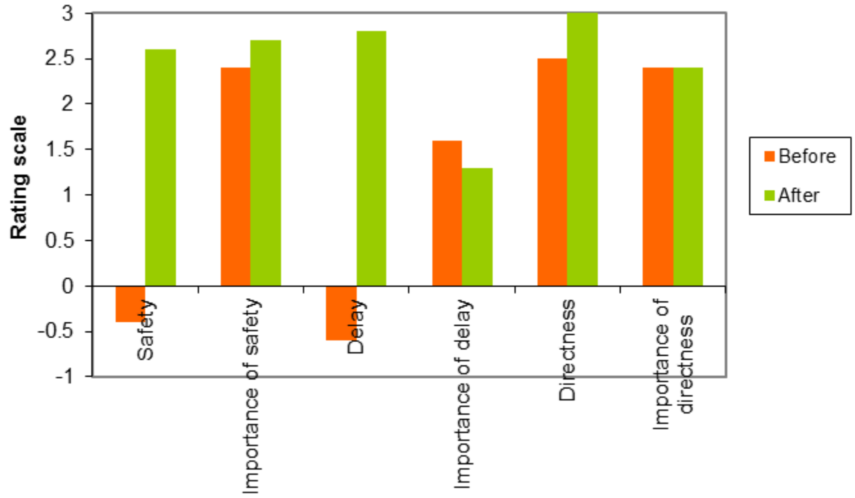
The above observations suggested that the improvements in perceived safety and directness at this site had resulted in significant benefits for pedestrians.

5.3.4.2 Zebra crossings

Two of the sites in this case study involved the implementation of a zebra crossing – Hereford St (zebra crossing with a warning light system) and Sparks Rd (school-patrolled zebra crossing). However, the facility at Sparks Rd has been excluded from this analysis, since it was not a new facility but only the relocation of an existing facility on Sparks Rd.

Results from the before and after analysis of the implementation of a zebra crossing at Hereford St are illustrated in figure 5.21.

Figure 5.21 Changes in perceived level of safety, delay and directness for zebra crossings



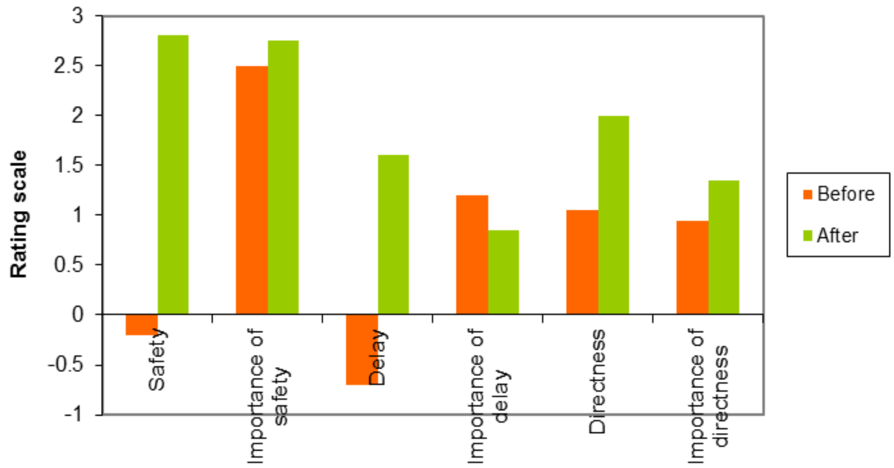
As was the case with traffic signals, the implementation of a zebra crossing resulted in significant improvements in the perceived safety of the crossing environment. Construction of the zebra crossing also resulted in a significant decrease in the waiting times experienced by pedestrians, which was an expected outcome of motor vehicles giving way to pedestrians at these crossings. The perception survey results also indicated that the zebra crossing at Hereford St provided a more direct route for pedestrians, as compared with the 'before' scenario.

Although the implementation of the Hereford St zebra crossings resulted in significant gains in perceived levels of safety and delay, it did not result in a statistically significant change in the volume of pedestrians (3% fewer pedestrians crossed here after the construction of the new facility). It must be noted, however, that construction of the zebra crossing at the new location on Sparks Rd resulted in a 54% increase in the total number of pedestrians crossing at that location.

5.3.4.3 Kea crossings

Two of the sites, at Hoon Hay Rd and Margot St, involved the implementation of a kea crossing. Figure 5.22 shows the effects of the implementation of kea crossings at these locations.

Figure 5.22 Changes in perceived level of safety, delay and directness for kea crossings

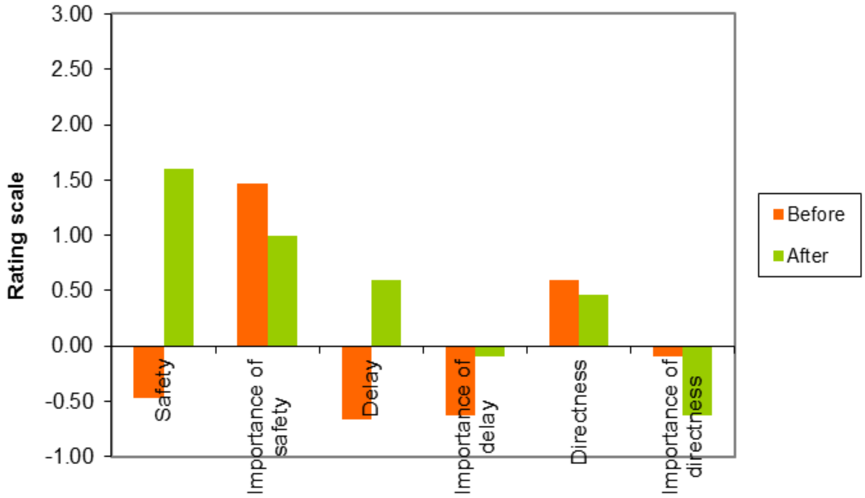


Both of the locations where kea crossings were implemented experienced a substantial increase in usage – 49% at Hoon Hay Rd, and 42% at Margot St. Figure 5.22 shows that the perceived ratings for all three criteria of safety, delay and directness improved after construction of the kea crossing. However, the large improvement in the perceived level of safety was probably the major contributing factor for the increase in flows at these locations. Both of the kea crossings were constructed near the entrances to schools, in order to provide easier and safer access to people entering and leaving the schools' premises – before the improvements, respondents reported feeling slightly unsafe about crossing the roads, especially parents accompanying young children.

5.3.4.4 Kerb extensions and refuge islands

Three of the sites – Collingwood St and Tristram St in Hamilton, and Ensors Rd in Christchurch – involved the construction of kerb extensions and refuge islands for pedestrians. Figure 5.23 shows the effect of the implementation of kerb extensions and refuge islands at these locations.

Figure 5.23 Changes in perceived level of safety, delay and directness for kerb extensions and refuge islands



The implementation of facility improvements at these locations also resulted in an improvement in pedestrians' perceived values of safety and delay. However, the magnitude of the improvement for safety was noticeably smaller than the improvement at signalised crossings, zebra crossings and kea crossings.

Improvements in the perceived level of delay and directness were also smaller than at the other kinds of facilities. While the implementation of these facilities resulted in reduced waiting times for pedestrians at these sites, it also resulted in worse ratings for directness, probably because the crossings did not lie directly on the path adopted by most crossing pedestrians. This may also have been because some pedestrians chose not to use the crossing and adopted an alternate path instead, as was the case with the facility at Collingwood St. The ratings for delay also indicate that although pedestrian waiting times had improved substantially after the improvements, the 'after' value for delay was still not as good as that at zebra and kea crossings.

The above figure also indicates that respondents at these sites did not consider delay and directness to be important criteria for deciding where to cross the road, and safety was the most important criteria.

Even though the construction of kerb extensions and refuge islands did not result in as much improvement in the ratings for safety, delay and directness as the other facility types, these locations still had large increases in usage – 90% at Collingwood St, 84% at Tristram St, and 14% at Ensors Rd.

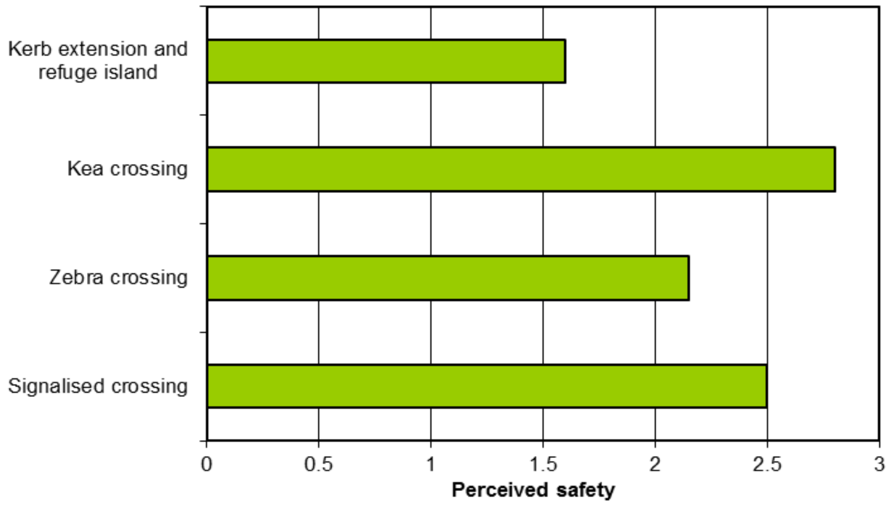
5.3.5 Comparison of different pedestrian facilities

This section compares how each of the four crossing types examined during this study performed based on the criteria for safety, delay, and closeness to key pedestrian desire lines. The results of the after survey for each of these criteria are illustrated in the relevant sections below to show the benefits that each of these crossing types provided.

5.3.5.1 Safety

Figure 5.24 compares the different kinds of facilities according to the perceived safety reported by respondents during the after survey.

Figure 5.24 Perception of safety after completion of the facility

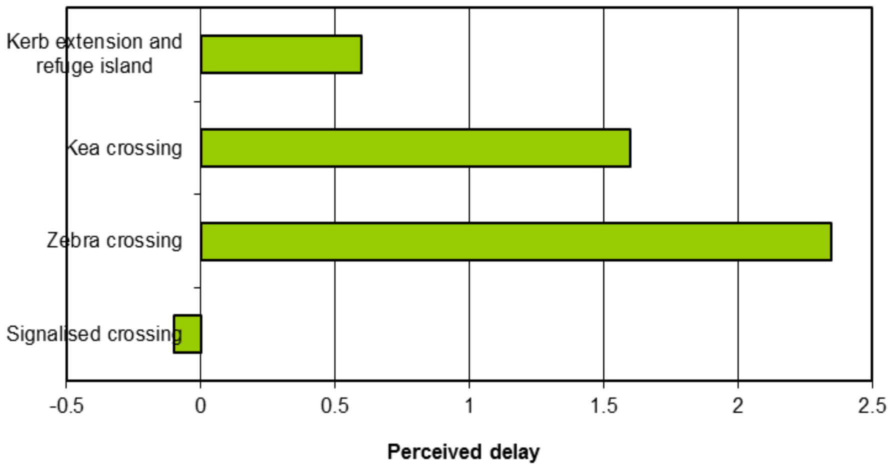


Kea crossings had the highest average rating for perceived safety during the after survey, followed by signalised crossing and zebra crossings. Kerb extensions/refuge islands rated the lowest out of these crossing types in perceived safety.

5.3.5.2 Delay

Figure 5.25 compares the different kinds of facilities according to the perceived delay reported by respondents during the after survey.

Figure 5.25 Perception of delay after completion of facility

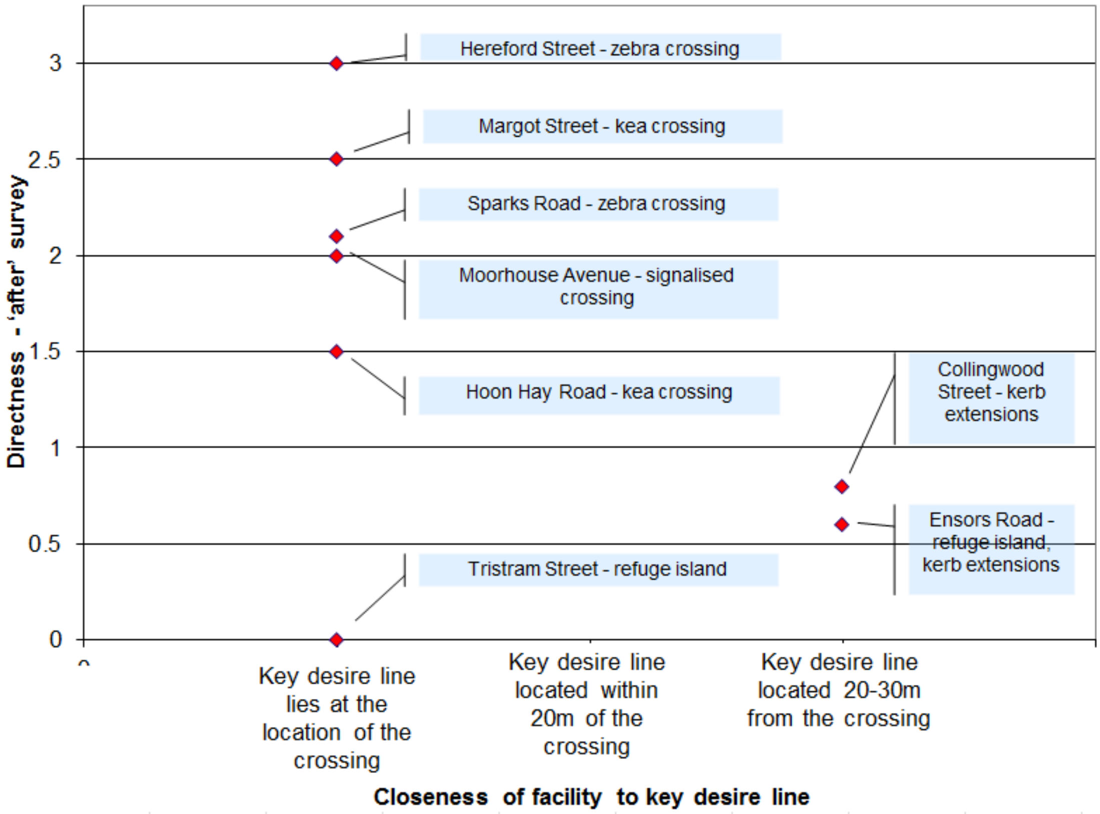


Zebra crossings provided the greatest reduction in perceived waiting times for pedestrians, followed by kea crossings and kerb extensions/refuge islands. Implementation of the signalised crossing resulted in worse perceived pedestrian waiting times.

5.3.5.3 Closeness to key crossing desire lines

In figure 5.26, the perception of the directness of each of the crossings that was reported by survey respondents during the after surveys is compared with the closeness of the location of these facilities to the key pedestrian desire line.

Figure 5.26 Directness vs closeness of crossing to preferred desire line



The above figure indicates that six of the eight pedestrian facilities were either located on the pedestrians' most preferred crossing path, or created a change in pedestrians' most desired paths to align with the location of the new facility. Pedestrians rated directness as medium or high during the after survey, except at the Tristram St refuge islands. At this location, much of the pedestrian activity in the area involved access to and from the car park on the west side of Tristram St near the roundabout, and pedestrians using the new facility needed to take a slightly longer route to avoid the less safe option of crossing near the roundabout.

The pedestrian desire lines at the crossing facilities on Collingwood St and Ensors Rd were located more than 20m away from the new pedestrian facility, which resulted in lower ratings for directness there.

6 Conclusions

6.1 Before and after pedestrian counts

The implementation of improved pedestrian facilities resulted in increased usage in seven out of the eight study areas analysed during this study. While the increase in pedestrian numbers at the Moorhouse Ave, Hereford St and Ensors Rd crossing facilities was considered to be within the range of natural variability, the increase in flows at the remaining five sites was significant. Table 6.1 details the changes in pedestrian numbers before and after the construction of a new facility at each of the eight sites.

Table 6.1 Changes in numbers of pedestrians crossing at the surveyed areas

Location	Type of improvement	'Before' survey (ped/hr)	'After' survey (ped/hr)	% change	Significant change?
Moorhouse Ave at Hoyts 8/ Science Alive!, Christchurch	Signalised crossing	75	80	7%	No
Hereford St, Christchurch	Raised zebra crossing with warning light system	628	607	-3%	No
Sparks Rd, Christchurch	School-patrolled zebra crossing	148	228	54%	Yes
Hoon Hay Rd, Christchurch	Kea crossing	43	64	49%	Yes
Ensors Rd, Christchurch	Refuge island and kerb extension	7	8	14%	No
Collingwood St, Hamilton	Kerb extensions	30	57	90%	Yes
Tristram St, Hamilton	Refuge island	25	46	84%	Yes
Margot St, Auckland	Kea crossing	69	98	42%	Yes

From the above table it can be seen that among the various types of facilities analysed, the construction of kerb extensions/refuge islands resulted in the largest increases in pedestrian usage (90% at Collingwood St, Hamilton, 84% at Tristram St, Hamilton). The implementation of kea crossings also resulted in large increases in usage (49% at Hoon Hay Rd, Christchurch, 42% at Margot St, Auckland).

The implementation of new or improved facilities also resulted in many pedestrians changing their preferred crossing location to utilise the benefits of the new facility, even though the general desire lines of all pedestrians in the vicinity of the facility were the same before and after construction.

6.2 Effects of the improvements on pedestrians' perception of safety, delay and directness

6.2.1 Safety

- Safety was rated as the most important factor considered by pedestrians when choosing a location to cross the road.
- Pedestrians at all of the study sites reported feeling safer while crossing the street after the implementation of the new pedestrian facility.
- At five of the eight study sites, the average 'after' safety rating was 2.5 or more (out of a maximum of 3), indicating that these facilities had been successful in providing the perception of an extremely safe crossing environment.
- An increase in perceived levels of safety did not guarantee an increase in pedestrian numbers, as was the case at Ensors Rd, where even though the rating for safety increased significantly, a corresponding increase in pedestrian numbers was not observed. Other factors such as reduced waiting times and location on a route directly used by pedestrians were also important.

6.2.2 Delay

- At six out of the eight study sites, the implementation of new or improved pedestrian facilities resulted in reducing pedestrians' perceived waiting time.
- For five out of the eight analysis sites, the importance of delay during the after survey was found to be lower than, or equal to, the importance of delay during the before survey. This suggested that the importance of delay frequently became secondary once other criteria, such as levels of safety, were improved.

6.2.3 Directness

- Six out of the eight facilities were either situated directly on the most common path used by pedestrians, or resulted in providing a more direct crossing path that was subsequently adopted by pedestrians.
- For a new facility to have maximum utility for pedestrians, it must be located on, or close to, the most-preferred paths used by pedestrians when crossing the road.

6.3 Comparison of different pedestrian facilities

Table 6.2 shows how the different facilities fared in the various criteria asked for in the 'after' perception surveys.

Table 6.2 Performance of the various facilities with respect to safety, delay and directness

	Safety	Delay	Directness
Highest perceived rating	Kea crossing	Zebra crossing	Zebra crossing
	Signalised crossing	Kea crossing	Kea crossing, signalised crossing
	Zebra crossing	Kerb extension/ refuge island	
Lowest perceived rating	Kerb extension/ refuge island	Signalised crossing	Kerb extension/ refuge island

Zebra crossings scored the highest average ratings for levels of delay and directness. In terms of safety, kea crossings performed the best. Pedestrians perceived the construction of kerb extensions/refuge islands to make the least contribution to improvement of safety and directness at the respective locations.

Another critical element when designing pedestrian facilities is the 'perception of safety'. Often, the *actual* safety and *perceived* safety of various types of facilities can differ significantly, and improving perceived safety can often outweigh actual safety. Ekman (1996) studied the actual safety of pedestrians using zebra and signalised crossings, and compared them with pedestrians crossing the road with no facilities. The crash rate at zebra crossings was found to be higher than at locations with no crossing facility, and at signalised crossings, it was slightly below that for locations with no facility. Ekman concluded that zebra and signalised crossings gave pedestrians a false sense of protection.

6.4 Database

One of the objectives of this research was to develop a database where the benefits of a proposed new/improved facility could be evaluated, and the expected increase in pedestrian volume could be estimated. The database would also provide a standardised format that could be used in transport planning and project funding.

A template for the database was set up by the study team and populated with information from the case studies analysed during this study. At the time of writing, the database had a provision for entering site-specific data on the following:

- Location
- Road classification
- Daily traffic volume
- Presence of a school in the vicinity
- Surrounding land use
- Crash history
- Type of pedestrian facility improvement
- Before and after survey dates
- Before and after pedestrian counts
- Project cost
- Details of promotion undertaken
- Additional comments

The database can be easily modified to include any additional data fields that may be required at a future date.

7 Recommendations

7.1 The need for further research

The extent of the conclusions developed in this study was constrained by the limited number of suitable sites available to the study team – a total of eight. This was not considered to be a large enough sample set to draw generalised conclusions. Future case study analysis of other locations where pedestrian facilities are implemented would help in increasing the sample set of available data, and could aid in identifying the trends in usage, safety, delay and directness for the various kinds of pedestrian crossing facilities that could not be included in this study.

The study team also noted a shortage of research, both within New Zealand and internationally, that studied the before and after effects of improving pedestrian facilities, and the induced pedestrian demands generated by them. This points to a need for future research in this area. Research examining the effects of wider-area treatments for pedestrians also needs to be undertaken, to give further insight into the network-wide effects of the implementation of pedestrian facilities and the resultant benefits.

7.2 Use of crash prediction models

Considerable benefits could also be derived from the use of the crash prediction models created by Turner et al (2006) for identifying sites that are likely to have a high rate of crashes involving pedestrians. These models could provide a first step in identifying locations that are unsafe for pedestrians, and suitable pedestrian facilities to mitigate the safety hazards could then be identified – the models could predict the existing crash risk and calculate the reduction in crash risk following the implementation of various kinds of pedestrian amenities. Future research in this area could include the use of, and results from, such crash predictions in relevant methodologies and conclusions.

7.3 Improved monitoring of walking

Local authorities may derive considerable benefit from monitoring pedestrian usage at various locations – both those where new facilities have been implemented, as well as those where no facilities for pedestrians currently exist. Monitoring at locations that have existing pedestrian facilities is also likely to aid the respective local authorities and future researchers in understanding the effects that these facilities have had on pedestrian usage and behaviour. It could also give an indication of the performance of these facilities in terms of safety, delay and directness, and highlight the need for any further improvements, if required.

7.4 Pedestrian facility monitoring database

One of the objectives of this study was the creation of a database for monitoring changes brought about by the implementation of new or improved pedestrian facilities. Although only limited data is currently input into the database, it could be populated over time with the various details and parameters of new and upcoming pedestrian facility improvement projects. This would provide a comprehensive record of past implementations, and a usable record of the kinds of facilities implemented in various cases based on traffic volumes, pedestrian numbers, land use, etc.

The customisable design of the database allows easy addition of any fields considered relevant, and thus various local authorities can add more data that applies to specific sites being monitored.

8 Bibliography

Akin, D and VP Sisiopiku (2000) Study of pedestrians' crossing preferences and perceptions. *Proceedings of the 2000 ITE International Conference*, Irvine, CA.

Borgers N, J Hox and D Sikkel (2003) Response quality in survey research with children and adolescents: the effect of labelled response options and vague quantifiers – Research note. *International Journal of Public Opinion Research 15*, no.1: 83–94.

Buchanan P and D Heuman (2004) Measuring the benefits of pedestrian improvements. Paper presented to *Walk21-V Cities for People, The Fifth International Conference on Walking in the 21st Century*, June 9–11, Copenhagen, Denmark.

Christchurch City Council (2007) *Agenda paper – Moorhouse Ave/Barbadoes St traffic management and safety improvements*. 9pp.

Christchurch City Council (2008) *Sparks Rd – Hoon Hay Rd traffic safety improvements.*

Chu, X, M Guttenplan and M Baltes (2004) *Why people cross where they do – the role of the street environment.* University of South Florida: Centre for Urban Transportation Research. 12pp.

City of Camas and Washington State Department of Transportation (1999) *Pedestrian crossing improvements: before and after study, Everett Street (SR 500) at 19th Avenue*. Washington. 8pp.

Cottam, P (2001) *Christchurch's 40km/h part-time school speed zone trial: community perceptions and attitudes*. Christchurch: Christchurch City Council. 5pp.

Creative Research Systems (2006) The survey system. Accessed June 2008. *www.surveysystem.com/sdesign.htm*

Department for Transport (2005) Puffin pedestrian crossings – before and after behavioural study. UK: Transportation Research Group. 109pp.

Ekman, L (1996) On the treatment of flow in traffic safety analysis: a non-parametric approach applied on vulnerable road users. *Tekniska Hogskolan I Lund Institutionen For Trafikteknik, Bulletin 136*. 22pp.

Federal Highway Administration (1999) *Guidebook on methods to estimate non-motorized travel*. Washington: US Department of Transportation. 180pp.

Flyvbjerg, B (2006) Five misunderstandings about case study research. *Qualitative Inquiry 12*, no.2. 15pp.

Hagley/Ferrymead Community Board (2006) *Hagley/Ferrymead Community Board Meeting Agenda*, 12 April 2006.

Hill, MR (1984) Walking, crossing streets, and choosing pedestrian routes: a survey of recent insights from the social/behavioural sciences. *University of Nebraska Studies New Series 66*. 70pp.

Israel, GD (1992) Determining sample size: program evaluation and organizational development. University of Florida Institute of Food and Agricultural Sciences (IFAS) PEOD-6. Accessed 10 March 2011. *http://edis.ifas.ufl.edu/pd006*

Knoblauch, RL, M Nitzburg and RF Seifert (2001) Pedestrian crosswalk case studies: Richmond, Virginia; Buffalo, New York; Stillwater, Minnesota. *US Department of Transportation FHWA-RD-00-103*. 52pp.

Land Transport NZ (2006) *Non-motorised user review procedure – guidelines*. Wellington: Land Transport NZ. 83pp.

Land Transport NZ (2007) *Pedestrian planning and design guide*. Wellington: Land Transport NZ. 188pp.

Landis, B (2001) Modelling the roadside walking environment: a pedestrian level of service. *Transportation Research Record1773, Part 2*: 82–88.

McCann B, and B DeLille (2000) *Mean streets 2000: pedestrian safety, health and federal transportation spending*. Washington: Surface Transportation Policy Project.

MacLean, AS and DJ Howie (1980) Survey of the performance of pedestrian crossing facilities. Au*stralian Road Research 10,* no.3: 38–45.

McMillan, TE (2005) Urban form and a child's trip to school: the current literature and a framework for future research. *Journal of Planning Literature 19,* no.4: 440–456.

Maricopa Association of Governments (2005) Identify pedestrian facility need. Pp39–46 in *Pedestrian policies and design guidelines*. Phoenix, USA.

Matlick, JM (1996) *If we build it, will they come?* Washington: Washington State DOT. 8pp.

Ministry of Transport (2002) *New Zealand transport strategy*. Wellington: Ministry of Transport.

Ministry of Transport (2007) *New Zealand household travel survey*. Wellington: Ministry of Transport.

Ministry of Transport (2008) *Transport monitoring indicator framework*. Accessed 24 February 2006. *www.transport.govt.nz/ourwork/TMIF*

Ministry of Transport (2009) Transport monitoring indicator framework – Version 2. Accessed 6 April 2011. *www.transport.govt.nz/ourwork/TMIF/Documents/TMIFV2%20FINAL.pdf*

Ministry of Transport (2009) *Government Policy Statement on Land Transport*.

Ministry of Transport (2010) *Pedestrians crash fact sheet 2010*. Accessed 6 April 2010. www.transport.govt.nz/research/Documents/Pedestrian-crash-fact-sheet-2010.pdf

NZ Transport Agency (2010) *Economic evaluation manual* (EEM). Wellington: NZ Transport Agency.

Partnership for a Walkable America, US Department of Transportation and Pedestrian and Bicycle Information Centre (2009) Walkability checklist: how walkable is your community? Accessed 22 February 2006. *www.walkableamerica.org/checklist-walkability.pdf*

Porter, C, J Suhrbier and WL Schwartz (1999) Forecasting bicycle and pedestrian travel: state of practice and research needs. *Transportation Research Record 1674, paper no.99-0750*: 94–101.

Questionnaire design (2006) Accessed 20 February 2006. *www.cc.gatech.edu/classes/cs6751_97_winter/Topics/quest-design/*

Robertson, SA, R Thorreau and RE Allsop (2005) *Development of a framework to assess the usability of pedestrian crossings*. University College London, Centre for Transportation Studies. 10pp.

Ryan, B (2003) *Let's talk business – economic benefits of a walkable community*. University of Wisconsin: Centre for Community Economic Development. 2pp.

Sharples, JM and JP Fletcher (2001) *Pedestrian perceptions of road crossing facilities*. Scotland: Scottish Executive Central Research Unit. 57pp.

Sisiopiku, VP and D Akin (2003) Pedestrian behaviours at and perceptions towards various pedestrian facilities: an examination based on observation and survey data. *Transportation Research Part F*: 250–274.

Smith, TW (2006) Little things matter: a sampler of how differences in questionnaire format can affect survey response. National Opinion Research Center. Accessed 22 February 2006. *www.amstat.org/sections/srms/proceedings/papers/1995_182.pdf*

Smith, M (2008) When flashing is good: pedestrian crossing warning light trial. IPENZ Transportation Conference 2008. 9pp.

StatPac Inc (2006) *Survey & questionnaire design*. Accessed 21 February 2006. *www.statpac.com/surveys*

Taylor-Powell, E (2006) Questionnaire design: asking questions with a purpose. Accessed 24 February 2006. *www.learningstore.uwex.edu/pdf/G3658-2.pdf*

TDM Encyclopedia (2005) Nonmotorized transportation planning – identifying ways to improve pedestrian and bicycle transport. Canada: Victoria Transport Policy Institute. 16pp.

TDM Encyclopedia (2005) *Walking improvements – strategies to make walking convenient, safe and pleasant*. Canada: Victoria Transport Policy Institute. 13pp.

Turner, SA, AP Roozenburg and T Francis (2006) Predicting accident rates for cyclists and pedestrians. *Land Transport NZ research report 289*. 180pp.

Walton, D and S Sunseri (2007) Impediments to walking as a mode choice. *Land Transport NZ research report 329*. 46pp.

WebSurveyor for Marketing (2006) Survey design considerations: recommendations for writing effective questionnaires. Accessed 22 February 2006. *www.websurveyor.com/pdf/designtips.pdf*

Zacharias, J (2001) Pedestrian behavior and perception in urban walking environments. *Journal of Planning Literature 16*, no.1: 3–18.

Appendix A: Memorandum

To:	**Shane Turner**	Date:	**3 February 2006**
From:	**Susanne Eckes /Zoe Collins**	Our Ref:	**3380580/TTR**
Copy:			
Subject:	**Pedestrian Facilities Research Project - Draft Survey Methodology**		

The following survey methodology / ideas have been developed for the LTNZ "Before and After Studies, Implementation of New and Improved Pedestrian Facilities", in relation to how the before and after surveys will be conducted.

1 Selection of Facilities

With the budget available for the surveys themselves it was agreed through the steering group that in order to collect a large enough sample of data for meaningful analysis it would be beneficial to narrow down the original study brief to consider only 3 types of pedestrian facility in two areas. The facilities most commonly due for implementation over the next 2 years were chosen based on results of the questionnaires completed by the local authorities and discussion at the first steering group meeting (19 September 2005). Those are:

- Pedestrian refuges (with or without kerb extensions);
- Zebra crossings; and
- Signalised crossings (mid-block and at intersections)

The two study areas selected are:

- Auckland Region; and
- Christchurch.

These locations were chosen due to the commitment of respective councils to this project and the likely range of facilities being implemented in these areas.

2 Site Characteristics / Influences

The following section describes the types of information that will be collected and the method of measurement.

2.1 Walkability of Location

The walkability rating of the area will be determined using information from LTNZ. If the data is not available, the following information will be collected while undertaking a site visit:

The walkability rating of the area will be determined using information from LTNZ. If the data is not available, the following information will be collected while undertaking a site visit:

- Quality of foot paths including lighting, condition of surface/level of maintenance etc
- Characteristics of surrounding area including cleanliness, conditions of buildings etc.
- Level of signage
- Availability of resting places
- Other crossing facilities in vicinity of the subject facility
- Types of pedestrians in the area

Additionally, any particularities of the area which might influence the walkability or pedestrian behaviour in this area will be recorded. A rough assessment of the area in relation to walkability and pedestrian movements (good, average, bad) will be undertaken based on this information.

2.2 Land-uses in the vicinity of the proposed facility

The overall land use of the study areas will be roughly determined using the District Plan. Sites will be selected in commercial areas and residential areas close to schools only.

2.3 Land-uses fronting the proposed facility

As part of background information to be used or not, as deemed appropriate, a rough description of the land-uses within 50 to 100m to either side of the proposed pedestrian facility will be recorded. This will be determined from observations made on site and may also include any exceptional locations which could attract significantly higher pedestrian numbers such as shops, institutions etc. From this information we will determine likely desire lines in the vicinity of the proposed facilities.

2.4 Traffic Flows

Traffic flow information will be collected from AADT and peak hour flow data provided by the local authorities, where this data exists. If this information is not available it is not planned to conduct traffic counts due to limitations of the budget that is available.

2.5 Road Classification

The road classification will also provide some indication of the traffic volumes on it. Roads will be classified in accordance with Auckland's District Plan, Part 9 i.e. Strategic Roads, Regional Arterial Roads, Collector Roads, Local Roads and Service Lanes.

2.6 Speed data

A speed gun will be used at the initial site visit to take five samples of actual vehicle speed at each location. Due to budget constraints a limited number of samples can be collected only and therefore the data will be used to give an indication of the actual vehicle speed only.

2.7 Road Cross-Sections

A description of the road cross-section at the location of the proposed pedestrian facility will be recorded e.g. Parking lane + 1 lane + flush median + 1 lane + bus lane. The actual seal width of the road as well as the actual crossing width for pedestrians, taking refuges and parking lanes into account will also be noted down.

2.8 Demographics

Factors which may influence people's walking behaviour can relate to many (demographic) factors. The deprivation index/decile rating will be used to give a rough indication of the local situation. It should be noted that pedestrians in the area might not necessarily live there.

At school locations, the number of pupils attending the school will be recorded for background information purposes.

2.9 Weather

The type of weather on the day of the surveys will affect the number of people out walking e.g. less people are likely to be out walking on a rainy day. It is therefore proposed that where possible surveys are conducted on fine days. The actual weather will be recorded on the survey day by the surveyors.

2.10 Accident Statistics

Accident statistics covering the 100m distances to either side of the proposed pedestrian facility may provide an indication of the perceived danger of this location for pedestrians. A summary of accidents at the site over the previous 5 years will be produced. Additionally, the interviews with pedestrians which will be conducted as part of the after-survey will be used to gain an understanding of pedestrians' perception of safety at the respective location before and after installation of the facility.

2.11 Promotion of Facility

The Local Authority responsible for the proposed pedestrian facility will be asked to provide data on establishing any means of promotion that has been undertaken for it. It may be that the facility has been implemented as part of a school travel plan, in which case school children and their parents and teachers may have been actively involved in the design process. There may also have been a local campaign or similar marketing strategy. However, this data is considered as background data which might not be put into the final database. It would be difficult to judge the effectiveness of the marketing and this could therefore be an unhelpful factor to add to the final analysis. Also the collection of the data can be relatively complicated and therefore it will be decided during the data collection process whether to continue with the collection of such data or not.

Information on the existence of walking maps for the area, which include (or not) the respective facility, will also be collected from councils.

2.12 Drivers for construction of new facility or improvement

Local authorities will also be asked for the information on drivers for the construction of a new facility or the upgrade of an existing facility. They will be categorised into the following groups:

- Problem site – delay or safety issues;
- Road construction;
- Part of area-wide strategy; and
- Other (specified).

3 Method for Conducting Before and After Surveys

3.1 Pedestrian Counts

Data collection protocols will be kept consistent so that reliable comparisons can be made. The following procedures were identified in the literature review and will be followed in this study:

- The data collection form will consist of a plan of the site with marked survey zones.
- The proposed location of the pedestrian facility will also be marked on the plan.
- Data will be recorded using coloured pencils.
- Observers place tick marks where pedestrians step off the kerb and enter the carriageway.
- If a group crosses the road together a number of ticks will be placed and then circled to indicate the group.
- Babies being carried by their mothers will be excluded from the counts.
- All pedestrians entering the carriageway will be counted even if they abort their crossing.
- New data sheets will be started every 10 minutes.
- At the end of the count period all tick marks will be counted for each zone and recorded in a summary table.

Surveyors will count the number of people using the facility in the before and after scenarios. In the before scenario numbers of pedestrians crossing at the proposed facility location as well as to either side of the proposed facility location will be recorded according to the identified zones. In the after survey the same information will be collected. i.e. for installation of a pedestrian crossing, the before study will cover the 10m section where the proposed facility is to be implemented as well as separately, 45 to 95m to either side of this. For the after survey the number of people using the crossing itself will be recorded as well as separately, those that continue to cross to either side of it within 50 to 100m in each direction. The exact distance will be decided on a site-by-site basis depending on existing desire lines.

For each site, there will be one surveyor counting pedestrians. This surveyor will be provided with maps which he or she will use to mark crossing points of pedestrians. This will enable us to comment on whether the facility was suitably located. At busy sites, two surveyors may be employed to do the counts.

The counter will count all pedestrians using the crossing except children being carried by another person. Cyclists using the crossing will not be counted.

An additional surveyor will conduct the interviews during the after surveys. The proposed interview methodology is outlined in section 3.3 below, however, this will be reviewed and defined in more detail after the first before surveys have been undertaken.

3.2 Survey Hours

Two surveys will be conducted in two consecutive weeks on the same day of the week and at the same time of day. Generally, there will be no surveys conducted on a Saturday, Sunday, and public holiday and also not during school or university holidays. The survey time period will be selected based on the most likely pedestrian peak hours for each site based on an estimate. A 1.5-hour period is suggested for most sites, however, the determination of the survey time period will be site specific.

3.2.1 Commercial Site

A site located in a predominantly commercial area is most likely to be busy during lunch times and weekends. Surveys will therefore potentially be conducted between 12:00 and 13:30 on a weekday. However, this will be decided on a site-by-site basis.

3.2.2 School Site

A site located in the vicinity of a school is likely to be busiest during the AM and interpeak period and likely to be a more intense peak than in a commercial area since children leave the school at the same time. In this instance surveys will be conducted in the AM peak over a time period of approximately 1.5 hours depending on school opening hours and other local circumstances.

3.3 Pedestrian Interviews (after survey only)

Brief pedestrian interviews will be conducted to gain support information to the counts. Questions will enquire about whether people crossed here before, whether they felt safe doing so, and what problems they perceived with the previous crossing facility and the new facility etc. A draft of the questionnaire is attached to this document.

It is proposed that surveyors will interview as many people as possible during the 1.5 hour period, which will be conducted at the same time as the pedestrian counts are undertaken. All people from the age of 5 will be surveyed. However, if school children are accompanied by a guardian, the guardian only will be surveyed and it will be noted that they were accompanying a child.

Zoe Collins/Susanne Eckes
Transportation Planner
Direct Dial: +64-9-308 0862
Email: susanne.eckes@beca.com

Appendix B: Survey questionnaire

NZ TRANSPORT AGENCY
WAKA KOTAHI

A

Pedestrian survey at improved pedestrian facilities

AFTER

1. **How often have you used this particular crossing facility to cross here since the improvements have been made?**
   ❑ More than ten times ❑ Four to ten times ❑ Two or three times ❑ First time
   Reason:

1. **What are your views of this crossing facility?**

a) Safety - *Please rate how safe you feel now this crossing has been improved and circle the appropriate number.*

I feel very safe +3 +2 +1 0 -1 -2 -3 I do not feel safe at all

Are safety aspects important to you when deciding on a location to crossing the street?

Please rate how important these aspects are for you and circle the appropriate number.

Yes they are very important +3 +2 +1 0 -1 -2 -3 No they are not important at all

Comment:

b) Delay - *Please rate how much delay you experience at this crossing and circle the appropriate number.*

There is no delay +3 +2 +1 0 -1 -2 -3 There is a large delay

Are delay aspects important to you when deciding on a location to cross the street?

Please rate how important those aspects are for you and circle the appropriate number.

Yes they are very important +3 +2 +1 0 -1 -2 -3 No they are not important at all

Comment:

c) Directness - *Please rate how directly this crossing is on your route and circle the appropriate number.*

It is directly on my route +3 +2 +1 0 -1 -2 -3 It is not on my route at all

Is the directness of crossing facilities important to you when deciding on a location to cross the street?

Please rate how important this aspect is to you and circle the appropriate number.

Yes directness is very important +3 +2 +1 0 -1 -2 -3 No directness is not important at all

Comment:

BEFORE

2. **Did you cross at this particular crossing before the improvements were made?**
   ❑ More than twice per day ❑ Once or twice per day ❑ Several times per week ❑ Less frequently ❑ Never
   Reason:

3. **Did you cross at another location close to this crossing facility before the improvements were made?**
   Location (*please specify in distance from this crossing or landmark*): ____________________
   ❑ More than twice per day ❑ Once or twice per day ❑ Several times per week ❑ Less frequently ❑ Never
   Reason:

4. **What were your views of the crossing situation before the improvements were made?**

a) Safety - *Please rate how safe you felt before the improvements were made and circle the appropriate number.*

I felt very safe +3 +2 +1 0 -1 -2 -3 I did not feel safe at all

Were safety aspects important to you when deciding on a location to cross the street?

Please rate how important these aspects were to you and circle the appropriate number.

Yes they were very important +3 +2 +1 0 -1 -2 -3 No they were not important at all

Comment:

BEFORE

b) Delay - *Please rate how much delay you experienced before the improvements were made and circle the appropriate number.*

There was no delay +3 +2 +1 0 -1 -2 -3 There was a large delay

Were these delay aspects important to you when deciding on a location to cross the street?

Please rate how important these aspects were to you and circle the appropriate number.

Yes they were very important +3 +2 +1 0 -1 -2 -3 No they were not important at all

Comment:

c) Directness - *Please rate how directly this crossing was on your route before the improvements were made and circle the appropriate number.*

It was directly on my route +3 +2 +1 0 -1 -2 -3 It was not on my route at all

Was the directness of crossing facilities important to you when deciding on a location to cross the street?

Please rate how important this aspect was to you and circle the appropriate number.

Yes directness was very important +3 +2 +1 0 -1 -2 -3 No, directness was not important at all

Comment:

GENERAL

General *Please provide us with some information about yourself – this information will be treated as absolutely confidential.*

1. Age
   ❑ <18 ❑ 18 to 29 ❑ 30 to 39 ❑ 40 to 49 ❑ 50 to 59
   ❑ 60 to 69 ❑ 70 to 79 ❑ 80+
2. Gender ❑ Male ❑ Female
3. Physical Ability
   a) Eyesight
   ❑ No usable vision ❑ Partially sighted ❑ Normal vision or fully corrected by lenses
   b) Mobility level
   ❑ I use a wheelchair or mobility scooter ❑ I walk unaided but step carefully
   ❑ I use a walking aid – walking with frame or stick ❑ I walk confidently ❑ I run easily
4. Purpose of walk/trip
   ❑ Work/School ❑ Shopping ❑ Leisure ❑ Other (please specify)________________
5. Familiarity to area
   ❑ Live in the area ❑ Work in the area ❑ Other (please specify) ________________

COMMENTS

Comment

Please state any comment you would like to make on this survey and/or the issues addressed.

____

____

____

Thank you very much for your time!!!

To be completed by surveyor:

Site:________________________________

Date: ____/____/20___ Time: ____:____

Day of week: ❑ Monday ❑ Tuesday ❑ Wednesday ❑ Thursday ❑ Friday

Weather condition: ❑ blue sky ❑ mostly sunny ❑ cloudy/no sun
❑ about to rain ❑ raining

Is this person accompanying a child younger than 8 years old? ❑ Yes ❑ No

Appendix C: Crash records

NZ TRANSPORT AGENCY

Plain English report, split by injury/non-injury, run on 04-May-2009 Page 1

First Street	D/I/R Distance	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day DDD	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot Inj F S M A E I T R N
Injury crashes														
MOORHOUSE AVENUE	100W	MADRAS ST	2321546	17/04/2003	Thu	1345	CAR1 WBD on MOORHOUSE AVENUE hit PEDESTRIAN2 (Age 13) crossing road from left side	PEDESTRIAN2 crossing road confused by traffic or stepped back	Wet	Overcast	Light Rain	Unknown	N/A	1
MOORHOUSE AVENUE	100W	MADRAS ST	2421669	30/04/2004	Fri	2000	VAN1 EBD on MOORHOUSE AVENUE hit PEDESTRIAN2 (Age 15) crossing road from right side	PEDESTRIAN2 crossing road, running heedless of traffic	Dry	Dark	Fine	Unknown	N/A	1
MOORHOUSE AVENUE	100E	MANCHESTER ST	2622355	29/06/2006	Thu	1428	CAR1 WBD on MOORHOUSE AVENUE hit PEDESTRIAN2 (Age 17) crossing road from left side	PEDESTRIAN2 crossing heedless of traffic	Dry	Overcast	Light Rain	Unknown	N/A	1
MOORHOUSE AVENUE	150E	MANCHESTER ST	2522078	20/06/2005	Mon	1324	TRUCK1 EBD on MOORHOUSE AVENUE hit rear end of CAR2 stop/slow for queue	TRUCK1 following too closely, failed to notice car slowing CAR2 following too closely CAR3 following too closely	Dry	Overcast	Fine	Unknown	N/A	1

NZ TRANSPORT AGENCY

Plain English report, split by injury/non-injury, run on 04-May-2009 Page 1

First Street	D/I/R Distance	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day DDD	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot Inj F S M A E I T R N
Non-Injury crashes														
HEREFORD ST	120E	COLOMBO ST	2771228	24/04/2007	Tue	1500	MOTOR CYCLE1 WBD on HEREFORD ST hit rear end of CAR2 stopped/moving slowly	MOTOR CYCLE1 too fast on straight, following too closely	Dry	Overcast	Fine	Unknown	N/A	
HEREFORD ST	100W	MANCHESTER ST	2372675	29/08/2003	Fri	1210	CAR2 EBD on HEREFORD ST opened door into path of another party, CYCLIST1 hit Parked Vehicle	CAR2 didnt see/look behind when opening door or leaving vehicle	Dry	Bright	Fine	Unknown	N/A	

NZ TRANSPORT AGENCY
WAKA KOTAHI

Plain English report, split by injury/non-injury, run on 04-May-2009 Page 1

First Street	Distance | D/I/R	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day DDD	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot Inj F S M / A E I / T R N
Non-Injury crashes														
HOON HAY ROAD	30N	SPARKS ROAD	2373185	03/10/2003	Fri	1840	VAN1 SBD on HOON HAY ROAD hit CAR2 reversing along road	CAR2 didnt see/look behind when reversing/manoeuvering	Dry	Dark	Fine	Unknown	N/A	

NZ TRANSPORT AGENCY
WAKA KOTAHI

Plain English report, split by injury/non-injury, run on 25-May-2009 Page 1

First Street	Distance | D/I/R	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day DDD	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot Inj F S M / A E I / T R N
Injury crashes														
ENSORS ROAD	I	FIFIELD TERRACE	2521217	21/01/2005	Fri	1048	CAR1 SBD on ENSORS ROAD hit rear end of VAN2 stop/slow for cross traffic	CAR1 failed to notice car slowing, attention diverted by other traffic	Dry	Bright	Fine	T Type Junction	Stop Sign	1
Non-Injury crashes														
ENSORS ROAD	I	FIFIELD TERRACE	2571755	22/06/2005	Wed	0940	CAR1 SBD on ENSORS ROAD hit CAR2 turning right onto ENSORS ROAD from the left	CAR2 failed to give way at stop sign, didnt see/look when required to give way to traffic from another direction	Dry	Overcast	Fine	T Type Junction	Stop Sign	
ST MARTINS ROAD	I	RIVERLAW TERRACE	2373326	03/04/2003	Thu	1945	VAN1 NBD on ST MARTINS ROAD lost control turning left, VAN1 hit Parked Vehicle, CAR2 hit Parked Vehicle	VAN1 too far left/right, cell phone, communication or navigation device	Dry	Dark	Fine	T Type Junction	Nil	

NZ TRANSPORT AGENCY
WAKA KOTAHI

Plain English report, split by injury/non-injury, run on 04-May-2009 Page 1

First Street	Distance (D/I/R)	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day DDD	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot Inj F A T / S E R / M I N
Injury crashes														
COLLINGWOOD ST	40E	TRISTRAM ST	2301475	13/02/2003	Thu	1414	CAR1 EBD on COLLINGWOOD ST turning right hit PEDESTRIAN2 (Age 18) crossing TRISTRAM ST from left	CAR1 did not see or look for other party until too late PEDESTRIAN2 stepped out from behind vehicle ENV: entering or leaving private house / farm	Dry	Bright	Fine	Driveway	Nil	1
Non-Injury crashes														
COLLINGWOOD ST	50E	TRISTRAM ST	2746001	06/12/2007	Thu	1700	CAR1 WBD on COLLINGWOOD ST hit parked veh, CAR1 hit Parked Vehicle	CAR1 misjudged speed of own vehicle, overseas driver failed to adjust to local conditions	Dry	Bright	Fine	Unknown	Nil	
COLLINGWOOD ST	100E	TRISTRAM ST	2639629	18/08/2006	Fri	1400	CAR1 WBD on COLLINGWOOD ST hit rear end of CAR2 stop/slow for queue		Dry	Bright	Fine	Unknown	Nil	

NZ TRANSPORT AGENCY
WAKA KOTAHI

Plain English report, split by injury/non-injury, run on 25-May-2009 Page 1

First Street	Distance (D/I/R)	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day DDD	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot Inj F A T / S E R / M I N
Non-Injury crashes														
TRISTRAM ST	50N	THACKERAY ST	2337640	15/07/2003	Tue	0945	CAR1 SBD on TRISTRAM ST lost control turning right, CAR1 hit Traffic Sign on right hand bend	ENV: entering or leaving private house / farm	Dry	Overcast	Light Rain	Driveway	Nil	