Trialling pedestrian countdown timers at traffic signals

December 2010

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NZ Transport Agency research report 428

ISBN 978-0-478-37136-9 (print)
ISBN 978-0-478-37135-2 (electronic)
ISSN 1173-3756 (print)
ISSN 1173-3764 (electronic)

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Wanty, DK[1] and SM Wilkie[2] (2010) Trialling pedestrian countdown timers at traffic signals. *NZ Transport Agency research report no.428*. 38pp.

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Keywords: countdown timer, New Zealand, proportion, signalised pedestrian crossing, statistical analysis.

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Acknowledgements

The authors of this report would like to thank the following people for their input and assistance:

Hutt City Council and Wellington City Council for assistance in selecting an appropriate site

Hutt City Council employees for participating in an attitudinal survey

DCO Finance for making their Lower Hutt office available for video surveys

The following peer reviewers are thanked for their input:

Steve Spence (Wellington City Council)

Wayne King (Hutt City Council)

Glossary

CBD	central business district
Clearance time	The allowed time for pedestrians to clear an intersection before the next traffic signal phase, which is generally calculated as the crossing distance divided by the pedestrian design speed, where the latter is typically about the 15th percentile walk speed.
Conflict	The interaction between vehicles and pedestrians when both are competing for the same space at the same time, eg a pedestrian–vehicle conflict is when the paths of a vehicle and a pedestrian are certain to cross and evasive action is required to prevent collision.
Countdown timer	A traffic control device which displays the remaining time available for pedestrians to complete their crossing at a traffic signal controlled intersection; the displayed time counts down to zero.
Cycle	A complete sequence of traffic signal phases, the length of which typically ranges from 40 to 120 seconds.
Phase	The part of a traffic signal cycle during which one or more movements receive right of way subject to resolution of any vehicle or pedestrian conflicts by priority rules. A phase is identified by at least one movement gaining right of way at the start of the phase and at least one movement losing right of way when the phase ends.

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Executive summary

Countdown timers are used at signalised pedestrian crossings to advise pedestrians how much remaining time they have to cross the road safely. The purpose of the timers is to reduce the number of crossings made outside the pedestrian phase, thus increasing pedestrian safety and driver efficiency. The overall research objective was to evaluate changes in safety and efficiency from installing countdown timers at signalised pedestrian crossings in New Zealand.

The trial was initially proposed at two sites in the Wellington region:

1 Vivian/Taranaki St intersection in Wellington

2 Queens Drive, Bunny Street and Margaret Street intersection in Lower Hutt.

As a fundamental change occurred at the first site after the project was initiated, this trial was aborted as no before and after comparison could be made. Therefore, the trial of the countdown timers only took place at the Lower Hutt site where two 300mm three-aspect signals were installed in addition to the existing signals. The top aspect displayed the red man, the middle aspect the countdown timer, and the lower aspect the animated green man. The equipment was installed on 16 July 2007 and was easily integrated with the existing traffic control system.

Video and questionnaire surveys were carried out. The video survey methodology described in the project brief was a before and after survey of pedestrian behaviour. An elevated video survey of pedestrian movements was selected as the method for analysing the effect of the countdown timers. One weekend and one midweek survey were repeated for three evaluation periods: once before and twice after installation – one after the initial settling-down period and one six months after installation. The timing of the surveys was selected in collaboration with the Hutt City Council which provided information regarding current use and operating hours of the surrounding businesses. The council had previously surveyed pedestrian movements on a Tuesday and Saturday in February 2005.

The following characteristics were recorded:

- total number of pedestrians per phase
- number of elderly/sensitive users (including any children in pushchairs)
- number of pedestrians starting to cross when the signal was flashing red
- number of pedestrians on the road when the solid red man was displayed
- number of pedestrians running to complete the crossing
- number of aborted crossings
- number of violators – pedestrians crossing on a vehicle phase
- number of pedestrian/vehicle conflicts.

Standard statistical testing was conducted involving an analysis of variance that first determined whether the data could be compared by determining differences in the means, then if this was successful, comparing the variances in the data sets.

The data analysis consisted of the percentage of late finishers, later starters, runners/aborters, violators and pedestrian–vehicle conflicts. The percentage basis was the total number of pedestrians starting to cross on the green or flashing red man for the three evaluation periods.

Off-site and on-site questionnaire surveys were conducted between the first and second video surveys after installation. The questionnaire surveys were completed to gauge public reaction to the countdown timers and to determine if the timers influenced pedestrian crossing behaviour.

The trial countdown timer installation showed that pedestrian safety actually decreased as there was an increase in the percentage of pedestrians remaining in the roadway when the solid red man was displayed and an increase in the percentage of pedestrians starting to cross at the display of the flashing red man. The on-site questionnaire showed that pedestrians underestimated the crossing time which may have explained the increase in the percentage of pedestrians crossing late and the decrease in the percentage of pedestrians running to finish crossing.

The theoretical analysis showed that with the current clearance time of 18.7s, the minimum pedestrian speeds required to cross the longest parallel and diagonal crossings were 0.9m/s and 1.6m/s respectively.

The key findings from the study were:

1. A statistically significant increase (all data: 11% to 17%) in the number of pedestrians remaining in the roadway at the end of the pedestrian phase (late finishers)
2. A statistically significant increase (all data: 20% to 23%) in the number of pedestrians commencing crossing at the display of the flashing red man (late starters)
3. A statistically significant decrease (all data: 7% to 5%) in the number of pedestrians running to complete crossing (late starters)
4. A statistically significant decrease (all data: 4% to 3%) in the number of pedestrians crossing on vehicle phases (violators)
5. Almost all pedestrians interviewed thought the countdown timers added to pedestrian safety and almost all pedestrians (95%) understood their function
6. Most pedestrians (over 80%) underestimated the time to cross the intersection diagonally
7. The current phase time for pedestrians was too short for slower pedestrians to cross diagonally.

The study showed a different result from the September 2006 to April 2007 trial at the Queen Street/Victoria Street intersection in the CBD of Auckland. The study in Auckland showed that pedestrian safety was improved by the installation of the countdown timers. It is believed, however, that pedestrian characteristics of the two sites are significantly different.

It is recommended that Hutt City Council investigate a longer pedestrian phase time to reduce the risk for pedestrians making the diagonal crossing. A further study of pedestrian behaviour should be carried out if the pedestrian timings are adjusted.

Abstract

The overall research objective was to evaluate changes in pedestrian safety and traffic efficiency from installing pedestrian countdown timers. The study analysed pedestrian behaviour and safety before and after the installation of a trial countdown timer at the intersection of Queens Street, Bunny Street and Margaret Street in Lower Hutt in July 2007. The results were compared with the 2006/07 trial at the Queen Street/Victoria Street intersection in Auckland CBD and showed very different results. The Auckland city trial indicated that, if placed in suitable locations, pedestrian countdown signals were associated with pedestrian behaviour change that enhanced safety. This study in Lower Hutt demonstrated that the observed pedestrian safety decreased as the percentage of both late starters and late finishers increased, although this was likely to be due to the nature of the intersection with one particularly long diagonal crossing coupled with the allocated phase times. In contrast, perceived pedestrian safety increased with the installation of the countdown timers.

1 Introduction

1.1 Background

Countdown timers are used at signalised pedestrian crossings to advise pedestrians how much remaining time they have to cross the road safely. The purpose of the timers is to reduce the number of crossings made outside the pedestrian phase, thus increasing pedestrian safety and driver efficiency. This project was undertaken to determine whether these devices could improve the safety and efficiency at signalised pedestrian crossings within New Zealand.

Current knowledge on the use of countdown timers is based upon a recent New Zealand trial in Auckland and extensive application in other countries such as the United States of America, Singapore and Ireland. Several types of countdown timer are available.

This project was accepted for funding in the 2006/07 research round. However, it did not commence until April 2007 due to road changes at one of the proposed trial sites and was carried out within the 2007/08 and 2008/09 research years.

1.2 Countdown timers within the New Zealand transport system

Land Transport Rule: Traffic Control Devices 2004 specifies the types of devices to be used at signalised pedestrian crossings:

> *6.6(3) Pedestrian traffic signals must comprise the following:*
>
> *(a) a green walking human figure signal; and*
>
> *(b) a red standing human figure signal placed immediately above the green human figure signal.*
>
> *6.6(4) Pedestrian signals must operate in the following sequence:*
>
> *(a) a steady green walking human figure symbol to indicate the period during which a pedestrian is allowed to enter a roadway followed by a flashing red standing human figure symbol to indicate the period during which a pedestrian is expected to finish crossing a roadway;*
>
> *(b) either the display at (a) or a steady red standing human figure, displayed for at least two seconds, to indicate when a pedestrian must not enter a roadway followed by;*
>
> *(i) the display at (a); or*
>
> *(ii) a blank display followed by:*
>
> *(A) the display at (a); or*
>
> *(B) a steady red standing human symbol followed by the display at (a).*

The Rule does not specify the use of countdown timers. However, trials of other devices are permitted within the Rule with appropriate warrants.

Implied in the Rule is that pedestrians are not allowed to enter a roadway when the flashing red man is activated.

1.3 Objective

The overall research objective was to evaluate changes in safety and efficiency as a result of installing countdown timers. In support of this the research team undertook:

- a literature review of recently completed studies of countdown timers
- a before and after study of pedestrian behaviour at a trial countdown timer installation at the intersection of Queens Street, Bunny Street and Margaret Street in Lower Hutt
- an attitudinal questionnaire survey of pedestrians using the trial site.

The changes in safety are indirect. It is believed that a countdown timer will clear more pedestrians from the crossing before the end of the pedestrian phase on the basis that pedestrians will make more informed decisions about when to cross and will increase their speed if necessary.

Note that most pedestrian crossings at signalised intersection are 'parallel' crossings whereby pedestrians cross parallel to the through traffic and motorists turning left (or right) have to give way to pedestrians crossing at the same time. However, where there are many pedestrians, an exclusive pedestrian phase (often called a 'Barnes Dance' or pedestrian scramble phase) may be programmed at an intersection during which all motorists will have a red light. Isolated signalised pedestrian crossings have also been installed at mid-block situations which are invariably simple two-phase (pedestrian: vehicles) traditional arrangements – some 'puffin' variants are currently under trial in Lower Hutt. This research focused on the Barnes Dance as being more appropriate to test in the first instance due to the relatively high number of pedestrians.

During the five years 2000 to 2004 inclusive, 146 injury crashes (seven fatal and 37 serious injury) involved a motorist failing to give way to a pedestrian when turning at signals. The social cost of these crashes was more than $40 million. In the same period, a total of 572 injury crashes (including 17 fatal and 143 serious injury) involved pedestrians at signalised intersections. The social cost of these crashes was more than $140 million. A number of these crashes consisted of pedestrians stepping onto the roadway during the flashing man phase and still crossing when the lights changed. Even if the countdown pedestrian devices resulted in only a small reduction in crash risk or severity they would be worthwhile.

At intersections with both heavy traffic and pedestrian flows, there could be some efficiency gain from fewer instances of motorists having to delay their departure due to pedestrians still crossing. The traffic signals engineer might be able to set a shorter inter-green (amber plus red) period. The engineer might also have more flexibility to modify the phasing, not needing to double cycle the pedestrian phase and skipping a cycle if need be, thereby enhancing overall intersection and network performance.

1.4 Timeline of project events

The initial timeframe for the research project with respect to the 'before and after' surveys is shown in table 1.1.

Table 1-1 Timeline of events

Time reference	Event	Dates
-1 month	Video before surveys	Saturday 23 June 2007, 1.10pm–3.10pm Wednesday 27 June 2007, 12.:30pm–1.30pm
0	Equipment installation	Monday 16 July 2007; cowls removed 20 July
+2 months	Video after surveys	Wednesday 19 September 2007, 12.50pm–1.50pm Saturday 22 September 2007, 1.00pm–3.00pm
+3.5 months	Off-site questionnaire surveys	Friday 2 November 2007 – Tuesday 6 November 2007
+4 months	On-site questionnaire surveys	Thursday 22 November 2007, 12.00pm–12.50pm Friday 23 November 2007, 12.00pm–2.15pm
+6 months	Video 6 months after surveys	Saturday 26 January 2008, 12.30pm–2.30pm Thursday 7 February 2008, 12.30pm–1.30pm

2 Literature review

An internet-based literature review of the use of countdown timers at pedestrian crossings was carried out as part of this study. Additionally, documents of other recent studies, specifically the 2007 trial in Auckland city, were sourced and reviewed.

The aim of the review was to provide a background to the types of timers in use and establish a sound methodology for this study.

The review considered the following aspects:

- equipment and setup
- effectiveness of countdown timers
- attitudes towards countdown timers.

It also compared the results of the studies.

2.1 Equipment and setup

The pedestrian phase for a signalised intersection has the following displays: a short interval solid green man, followed by a flashing red man, and then a short interval solid red man. The longest interval duration is the flashing red man. There are variants to the display with the USA using a hand symbol. Also there are variants in the legend used for the man, eg profile, front on, running.

Countdown timer units have been used to display either the amount of time remaining until the green man is displayed, or the amount of time remaining until the solid red man is displayed. The former setup seems to be preferred in Europe with trials in Dublin (Keegan and O'Mahony 2003) and France (Druilhe 1987). In other parts of Europe a light surrounding the pedestrian activator button darkens as the amount of time remaining before the crossing phase decreases. Keegan and O'Mahony (2003) support using the countdown timer as they see it being safer for pedestrians. However, this type of display may lead to increased non-compliance when the indicated waiting times are long (Baass 1989).

Most of the research on countdown timer installations has been conducted in the USA where the timers display the amount of time remaining until the solid red man is displayed. The timers are used in place of the traditional signals.

Only one US study commented on the type and reliability of the timer. The equipment used in San Francisco and studied by Markowitz (2006) was manufactured by GELcore and Dialight (see figure 2.1). The city operations manager reported that the countdown timers were as reliable as conventional signals.

Figure 2-1 Countdown timers used in San Francisco

Opus International Consultants conducted a trial of countdown timers at two intersections in Auckland CBD (Hooper et al 2007). Two-aspect 300mm diameter signals were selected and purchased from Traffic Systems, with the countdown display in the green man aspect. These new countdown timers replaced the conventional pedestrian signals. In discussion with the supplier and researcher, no reliability issues were encountered throughout the trial. The equipment installed in Auckland is shown in figure 2.2.

Figure 2-2 Countdown timers used in Auckland city

Countdown timers of the type installed in Auckland have been installed in Singapore and other countries. However, no published research studies could be sourced documenting the quality of the equipment, although Singaporeans supposedly expressed strong endorsement of them and they have now been introduced everywhere in Singapore.

2.2 Effectiveness – crashes

The ultimate measure of the effectiveness of a pedestrian countdown signal is the number of pedestrian crashes it prevents. However, crashes involving pedestrians on signalised crossings are relatively rare, and so most studies supplement an analysis of pedestrian crashes with evaluations of pedestrian behaviour and attitudes.

Two studies reported a reduction in crashes as a result of introducing countdown timers. Markowitz (2006) reported a 53% reduction in injury crashes from the introduction of countdown timers at 14 intersections. However, when considering the change in the number of crashes at control intersections this was not a significant reduction. Botha et al (2002) completed a before and after study reporting zero crashes in the after period. However, there was little confidence in this result as the after period was only three months. From these results, analysis of pedestrian crashes appeared to be too coarse to measure effectiveness.

Common pedestrian behaviours studied included: pedestrians starting or finishing their crossing at different stages of the pedestrian phase, pedestrians running or aborting crossing, and near misses (or pedestrian–vehicle conflicts). Collecting data on all these behaviours was straightforward apart from the near misses where definitions varied between studies.

2.3 Effectiveness – behaviours

The principal behaviour studied was compliance with the ‘Walk’ signal. Non-compliance was measured as an increase in the number of pedestrians crossing on ‘Flashing don’t walk’.

Huang and Zegeer (2000) conducted a treatment and control study of two intersections with countdown timers and three similar intersections without countdown timers in Lake Buena Vista, Florida. Common to other research in this review, the study results showed a reduction (59% to 47%) in pedestrian compliance with the ‘Walk’ signal. It was often hypothesised that the additional information about the amount of time remaining in the phase gave pedestrians the impression they had enough time to cross safely. The number of pedestrians still crossing when the steady ‘Don’t walk’ displayed increased (8% to 11%). Also fewer pedestrians ran to complete their crossing when the flashing ‘Don’t walk’ signal appeared (10% to 3%). The chi-square statistic was used in the analysis. The authors concluded that although compliance appeared to decrease at the countdown signal locations, the countdown signals also seemed to cause pedestrians who had started crossing during the flashing ‘Don’t walk’ to walk quickly to complete their crossing before the steady ‘Don’t walk’ was displayed, resulting in no significant change in the number of pedestrians who ran out of time. The study concluded that countdown signals were not recommended for standard use and that further on-site testing be carried out.

Eccles et al (2004) observed pedestrian behaviour before and after countdown timers were installed at five intersections in Montgomery County, Maryland. Three intersections showed a significant decrease in the number of phases where pedestrians were still crossing when the traffic began moving again. The other two intersections showed no difference. The study reported statistically different proportions of pedestrians starting to cross when the ‘Walk’ sign was displayed. Each approach was analysed, 20 in total. Six of the approaches experienced significant increases while two experienced significant decreases.

PHA Transportation Consultants (2005) also found that the number of pedestrians remaining in the intersection when the steady ‘Don’t walk’ displayed decreased (23% to 15%), while compliance improved with a decrease of 5% pedestrians crossing during the display of the flashing ‘Don’t walk’. However no statistical testing was completed on these results.

Countdown signals have been shown to result in fewer pedestrians still in the crosswalk when the steady ‘Don’t walk’ signal appears (compared with sites without countdown signals). However, countdown signals have also had the undesired effect of reducing pedestrian compliance and increasing the number of late finishers (Huang and Zegeer 2000).

Eccles et al (2004) observed conflicts as a surrogate measure for pedestrian crashes as part of the previously mentioned study in Montgomery County, Maryland. This study of pedestrian–vehicle conflicts found a significant decrease in the proportion of pedestrians involved in conflicts with motor vehicles after the installation of pedestrian countdown timers at four of the intersections where conflicts had been observed.

Note that at the majority of US sites, countdown timers were installed at intersections with pedestrian phases concurrent with vehicle phases.

2.4 Impact on vehicle speeds

A serious concern about the countdown timers was that they might increase the number and severity of crashes if motorists increased speeds in response to the countdown display. This was proved ill founded by Eccles (2004) who recorded vehicle speeds on seven intersection approaches. Only one approach experienced a significant change and this was a decrease in speed.

2.5 Attitudes

Pedestrian attitudes are measured using questionnaire surveys. Usually these are carried out on site next to the traffic signals and immediately after a person has crossed. This ensures the most accurate perception of the equipment.

Eccles et al (2004) conducted a survey of pedestrians at five intersections equipped with countdown timers in Montgomery County, Maryland in 2003. In total, 107 pedestrians who had just crossed these intersections were surveyed about their awareness and understanding of the countdown timers.

Pedestrians were asked if they noticed whether or not the pedestrian signal at the intersection was different from pedestrian signals in the surrounding area. If a pedestrian responded 'yes', he or she was asked to explain how the signal was different. Pedestrians whose response mentioned the countdown or 'numbers' were considered aware of the countdown timers. Significant findings from this study included the following:

- The majority (68%) were aware of the countdown timers. Pedestrians were asked to explain the meaning of the numbers on the countdown timers. The majority (63%) of the people interviewed correctly responded that the countdown indicated the seconds remaining to complete the crossing or to reach the median (if one existed).
- An additional 32% responded that the countdown indicated the seconds remaining until the light turned red. Although this was not correct, it was a more conservative interpretation of time remaining to cross. Accepting this type of misunderstanding as a 'safe answer', overall 95% of the pedestrians understood the meaning of the countdown.

Botha et al (2002) found that pedestrians underestimated the crossing time by 3–10 seconds below the design clearance time. Of the total number of pedestrians surveyed, 80% thought they could enter the intersection if they believed they could reach the other side before the timer counted down to zero. The surveys also asked whether pedestrians were permitted to cross on the flashing hand symbol. The percentage reduced from 76% on an intersection without countdown timers to 59% when shown the symbol adjacent to a countdown timer.

2.6 Conclusion

Countdown timers appear to be suited to crossings with all pedestrian phases and high numbers of pedestrians. Thus the number of suitable crossings in New Zealand is limited.

In general, the limited evaluation studies available suggest the countermeasure may cause more pedestrians to complete their crossings before the onset of the steady 'Don't walk' phase, although there is also evidence of some adverse behavioural response.

3 Site selection

The research team is based in Wellington so sites were chosen in the Wellington region. Criteria for the trial sites included high pedestrian use, intersections with a pedestrian phase for all pedestrian movements (scramble or Barnes Dance), and sites endorsed by local councils.

Initially two sites were selected in the Wellington region:

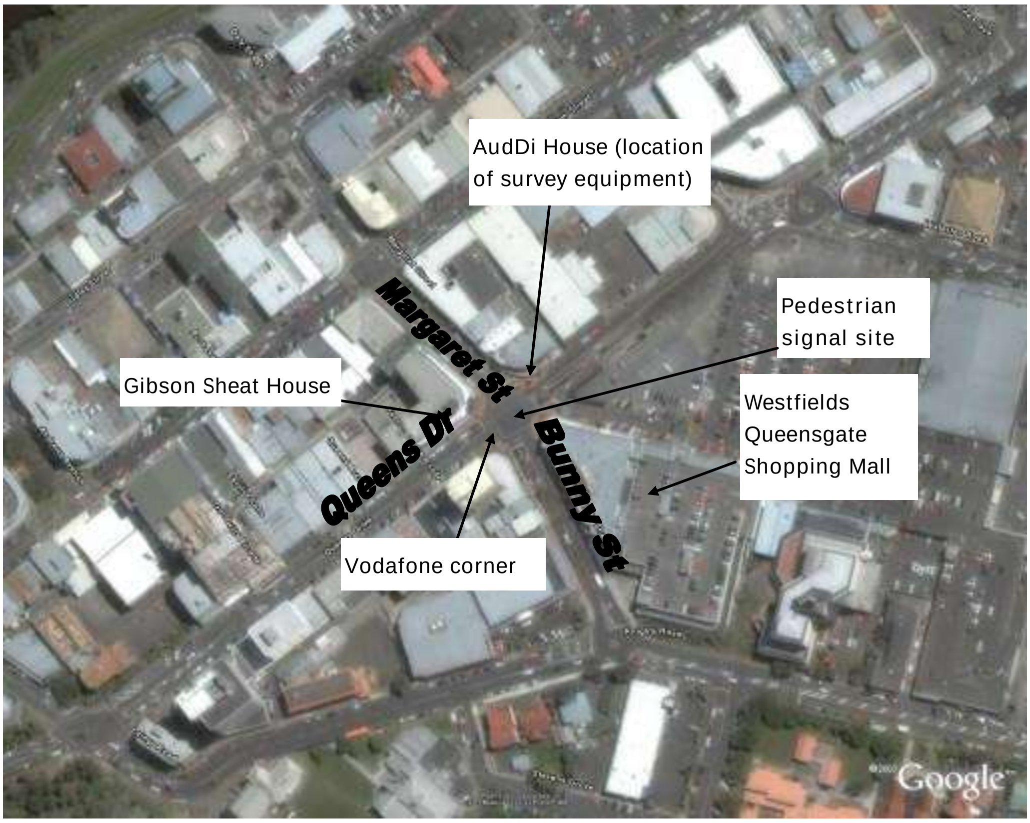
1 Vivian/Taranaki St intersection in Wellington

2 Queens Drive, Bunny Street, and Margaret Street intersection in Lower Hutt.

Road works were being prepared for site 1 at the initial selection stage which did not alter the pedestrian phasing. However, when the countdown timer equipment was about to be purchased, the research team discovered that the scramble phasing was to change to parallel phasing. This information voided the site, and the research team discussed with local councils and Land Transport NZ (now NZTA) about potential replacement sites. No suitable ones were found and the project continued with one site in Lower Hutt.

The Lower Hutt intersection is shown in the aerial photo below.

Figure 3-1 Aerial photo of site (source: Google



4 Equipment selection and installation

The equipment selected for the trial was based on the Auckland city trial equipment. Traffic Systems built a two-aspect signal in Auckland city with the red man in the top aspect and the green animated man and the countdown timer in the lower aspect. This replaced the traditional pedestrian signals and meant that at the four-leg intersection a total of eight signals were installed.

In some jurisdictions, countdown timers comprise two aspects whereas in others they consist of the traditional red and green man plus the timer (which can be located in a variety of positions). For example in Singapore, the bulk of countdown timers were retrofitted to existing signals and comprised a large timer added to the side of the red and green man aspects. Subsequently Singapore has introduced integrated countdown timers for new installations of traffic signals. The type of countdown timers selected for the trial and the location of the timer aspect were discussed with Land Transport NZ (now NZTA) prior to the formal commencement of the research project.

For this trial, a three-aspect signal, using European standards for the walking man and numbers on the countdown, was installed supplementary to the existing signals. The top aspect displayed the red man, the middle aspect the countdown timer, and the lower aspect the animated green man. The existing signals were retained as only two signals were installed at the intersection, compared with eight installed per intersection in Auckland city.

HTS Group, the contractor, received the equipment on 6 July 2007 and installed it on 16 July. The equipment, which took only about 2½ hours to install, was simple to integrate with the existing traffic control system. Hutt City Council noted that the signals were not clearly visible from all four corners of the intersection, primarily because of the protrusion of the cowls on the signals. The cowls on the signals were removed on 20 July 2007.

A Hutt City Council representative preferred the Auckland city equipment noting a more attractive form of the signal. This was most likely because the existing pedestrian signals were removed and replaced with the new integrated pedestrian signals. Figures 4.1 and 4.2 show the equipment installed at Lower Hutt.

Figure 4-1 Countdown timer on southern side of Queens/Margaret outside Gibson Sheat Building with the side of the existing pedestrian signal in view

Figure 4-2 Countdown timer on northern side of Bunny/Queens in front of the Westfield Queensgate Mall entrance with the side of the existing pedestrian signal in view

5 Video surveys

5.1 Survey methodology

The methodology described in the project brief was a before and after survey of pedestrian behaviour. This was supported by the literature review. The main alternative discussed in the studies reviewed was the control type study. A control type study is generally used where data from before a change is not available, and so two initially similar sites are compared. The disadvantage in these studies is that the control site can never be exactly the same as the study site and there may be other external factors influencing behaviour.

An elevated video survey of pedestrian movements was selected as the method for analysing any effect of the countdown timers. This was preferred to surveyors at the corners of the intersection as it:

- provided a permanent recording of pedestrian movement
- prevented any observer influence on pedestrian behaviour.

The surveys were completed using two camcorders each viewing a part of the intersection. The camcorders were mounted on tripods on the first floor of AudDi House at the corner of Queens Drive and Margaret Street. The pedestrian crossings and the pedestrian signal aspects were captured on each of the camcorders (different from the Auckland trial where CCTV captured the signals, and a camera on the Sky Tower captured the pedestrians). The digital video files were transferred to a computer and viewed simultaneously, with the following characteristics recorded:

- total number of pedestrians per phase
- number of elderly/sensitive users (including any children in pushchairs)
- number of pedestrians starting to cross when the signal was flashing red
- number of pedestrians on the road when the solid red man displayed
- number of pedestrians running to complete the crossing
- number of aborted crossings
- number of violators – pedestrians crossing during a vehicle phase
- number of pedestrian–vehicle conflicts.

The key characteristics were the number of pedestrians starting to cross when the signal was flashing red, and the number of pedestrians on the road when the solid red man was displayed. These characteristics were linked to the safety risk of the intersection and were determined in this study by the existing pedestrian signals. These remained in place for the duration of the study and were supplemented by the two countdown timers.

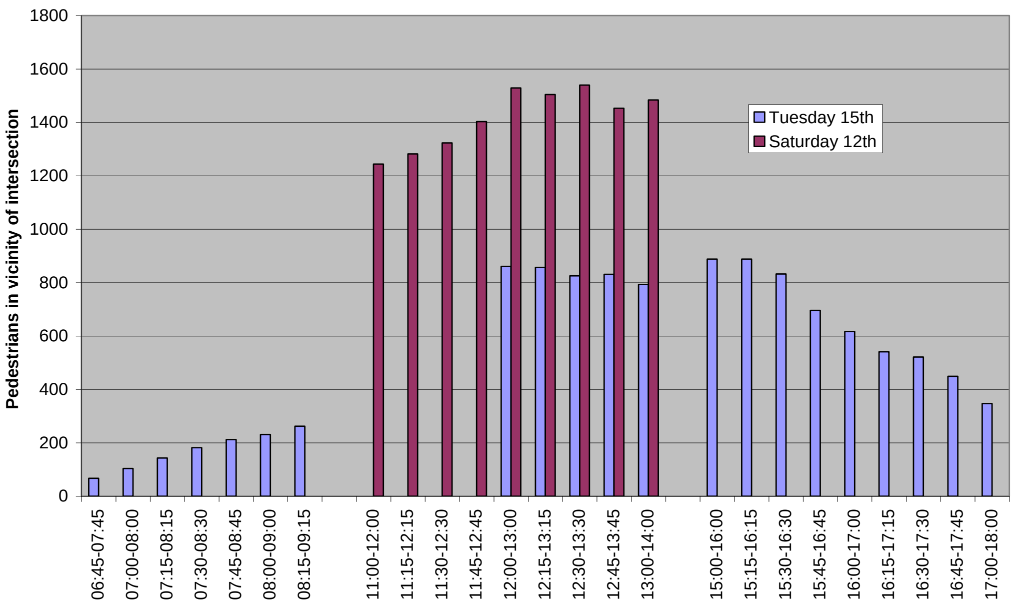
A pedestrian–vehicle conflict was when the paths of a vehicle and a pedestrian were certain to cross and evasive action was required to prevent collision.

The vehicle detector flows were also recorded to provide an indication of the potential for these conflicts.

One weekend and one midweek survey were chosen to be repeated for three evaluation periods: one before and two after installation. For the latter, one survey took place soon after the initial settling down period, and the other six months after installation.

The timing of the surveys was selected in collaboration with the Hutt City Council which provided information regarding current use and operating hours of the surrounding businesses. The council had previously surveyed pedestrian movements on a Tuesday and a Saturday in February 2005. The distribution of pedestrians surveyed over time is shown in figure 5.1.

Figure 5.1 Pedestrian temporal distribution at the trial site



The distribution in figure 5.1 shows the number of pedestrians was higher on a Saturday and that it peaked between 12pm and 2pm. For the midweek survey, few pedestrians used the intersection in the early morning and the number of pedestrians peaked between 12pm and 2pm, and 3pm and 4.30pm.

The midweek survey showed that during a peak hour over 3200 pedestrians might use the intersection, and for the weekend the peak was 6200 per hour.

As most pedestrian activity occurs on the weekend, the survey design allowed for a two-hour survey on a Saturday and a one-hour survey on a weekday. Saturday afternoon was chosen as it is the busiest time of the week for pedestrian movement.

The dates of the three stages of the video surveys are shown in table 1.1.

5.2 Analysis methodology

In the proposal, possible analyses included the number of pedestrians still crossing after the red man had stopped flashing, the number of pedestrians crossing illegally during the solid red man display, and at what time pedestrians started to cross.

As noted in the proposal, determining the time at which pedestrians started to cross would be complicated. This meant that individual pedestrians would have to be tracked. After considering the additional effort required, the resulting information, and the analyses undertaken in similar studies, this aspect was excluded.

Analysis methods used in previous studies were reviewed as described in the literature review section. The common behaviours studied were included in the research making sure that those studied in the Auckland city trial were also included.

Standard statistical testing involved an analysis of variance that first determined whether the data could be compared by determining differences in the means, and if so, then comparing the variances of the data sets.

The data was analysed for the percentage of:

- late finishers
- late starters
- runners/aborters
- violators
- pedestrian–vehicle conflicts.

The percentage basis was the total number of pedestrians starting to cross on the green or flashing red man for the three evaluation periods.

5.3 Results

This section presents summaries of the Lower Hutt video data.

5.3.1 Data summary

The number of pedestrians and pedestrian phases is shown in table 5.1.

Table 5.1 Total number of pedestrians and phases by evaluation period

Day of week	Data	Evaluation period			Total
		Before	2 months after	6 months after	
All	Total number crossing	2786	3628	3594	10 008
	Number of pedestrian phases	112	171	181	464
	Average number of pedestrians per phase	24	19	20	
Saturday (2-hour survey)	Total number crossing	1865	2425	1825	6115
	Number of pedestrian phases	76	114	118	308
	Average number of pedestrians per phase	24	15	21	
Midweek (1-hour survey)	Total number crossing	921	1203	1769	3893
	Number of pedestrian phases	36	57	63	156
	Average number of pedestrians per phase	24	28	20	

The total number of pedestrians surveyed in each of the two after-installation evaluation periods was similar, while there were fewer in the before-installation period. This was also the case for the number of pedestrian phases activated in the before period. This was probably due to the different seasons in which the evaluations took place.

For the three evaluation periods, the number of pedestrians using the crossing per hour was similar, independent of the day of the week, ie there was no pronounced peak during the weekend. The average number of pedestrians per hour was 3336. The average number of pedestrians per phase decreased between the before and six-month-after periods across the days of the week.

The number of pedestrian phases was reported rather than the number of cycles because the signal phasing at the site could be activated to give two pedestrian phases per cycle.

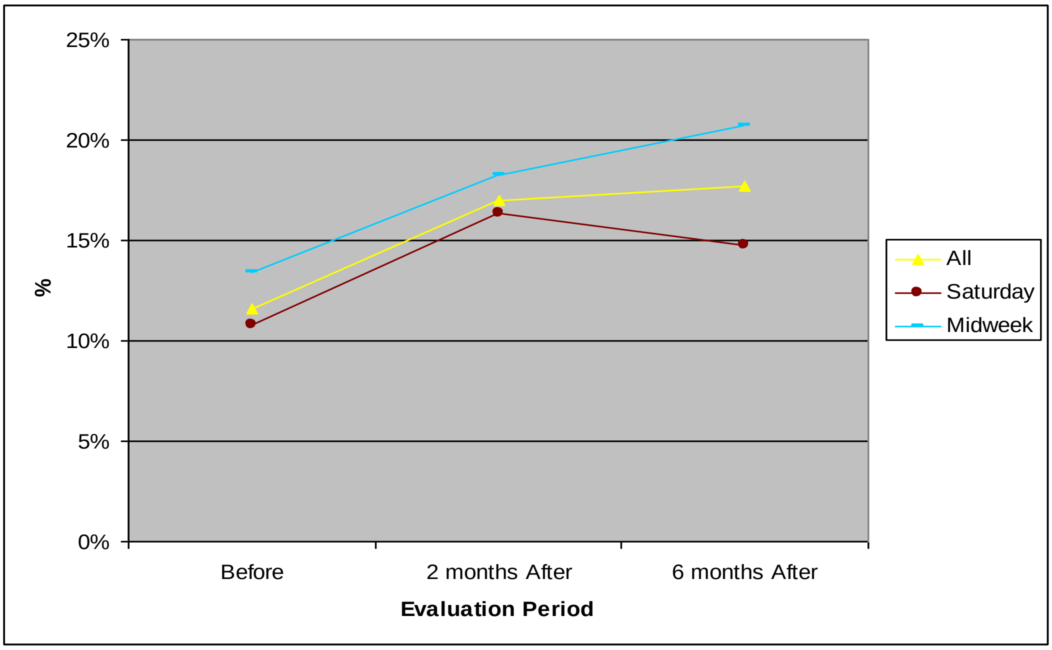
The following sections present the results of comparing certain pedestrian behaviours during the three different evaluation periods.

5.3.2 Late finishers

Late finishers are pedestrians who do not exit the intersection (step onto the footpath) before the solid red man is displayed.

The total number of late finishers was compared with the total number of pedestrians, excluding pedestrians crossing on any vehicle phase (violators), in each evaluation period. This was the proportion of late finishers. Figure 5.2 shows the change in this proportion for the evaluation periods.

Figure 5.2 Percentage of late finishers by evaluation period



For all data, the proportion increased from 11.6% in the before period to 17% two months after installation. Applying the normal distribution, this was statistically significant at the 5% level (Z=6.05, Z_{crit}=1.96). The increase from 17% to 17.7% for two months to six months after was not significant at the 5% level (Z=0.79, Z_{crit}=1.96).

For Saturday data only, the proportion increased from 10.8% in the before period to 16.4% two months after installation. This was statistically significant at the 5% level (Z=5.31, Z_{cri_t}=1.96). The decrease from 16.4% two months after to 14.7% six months after installation was not significant at the 5% level (Z=1.43, Z_{crit}=1.96).

For midweek data only, the proportion increased from 13.4% for the before period to 18.2% two months after. This was statistically significant at the 5% level ($Z=2.98$, $Z_{crit}=1.96$). The increase from 18.2% two months after to 20.7% six months after installation was not significant at the 5% level ($Z=1.64$, $Z_{crit}=1.96$).

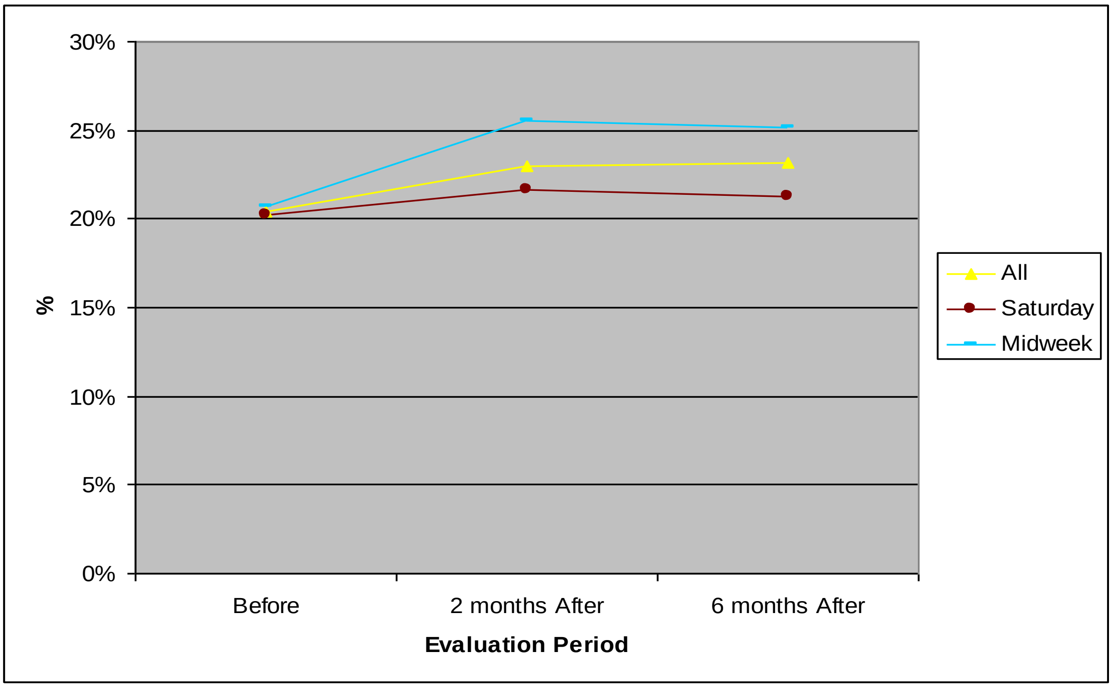
The change in proportion between the before and six month after period was statistically significant at the 5% level for all data (11.6% to 17.7%, $Z=6.80$, $Z_{crit}=1.96$), for midweek data (13.4% to 20.7%, $Z=4.83$, $Z_{crit}=1.96$), and for Saturday data (10.8% to 14.7%, $Z=3.55$, $Z_{crit}=1.96$).

5.3.3 Late starters

Late starters are pedestrians who begin crossing after the flashing red man has started.

The total number of late starters was compared with the total number of pedestrians, excluding pedestrians crossing on any vehicle phase (violators), in each evaluation period. This was the proportion of late starters. Figure 5.3 shows the change in this proportion for the evaluation periods.

Figure 5.3 Percentage of late starters by evaluation period



For all data, the proportion of late starters increased from 20.4% for the before period to 22.9% two months after installation. This was statistically significant at the 5% level ($Z=2.43$, $Z_{crit}=1.96$). The increase from 22.9% two months after to 23.2% six months after was not significant at the 5% level ($Z=0.24$, $Z_{crit}=1.96$).

For Saturday data only, the proportion increased from 20.2% for the before period to 21.6% two months after. This was not statistically significant at the 5% level ($Z=1.12$, $Z_{crit}=1.96$). The decrease from 21.6% two months after to 21.3% six months after was not significant at the 5% level ($Z=0.30$, $Z_{crit}=1.96$).

For midweek data only, the proportion increased from 20.7% for the before period to 25.6% two months after. This was statistically significant at the 5% level ($Z=2.60$, $Z_{crit}=1.96$). The decrease from 25.6% two months after to 25.1% six months after was not significant at the 5% level ($Z=0.27$, $Z_{crit}=1.96$).

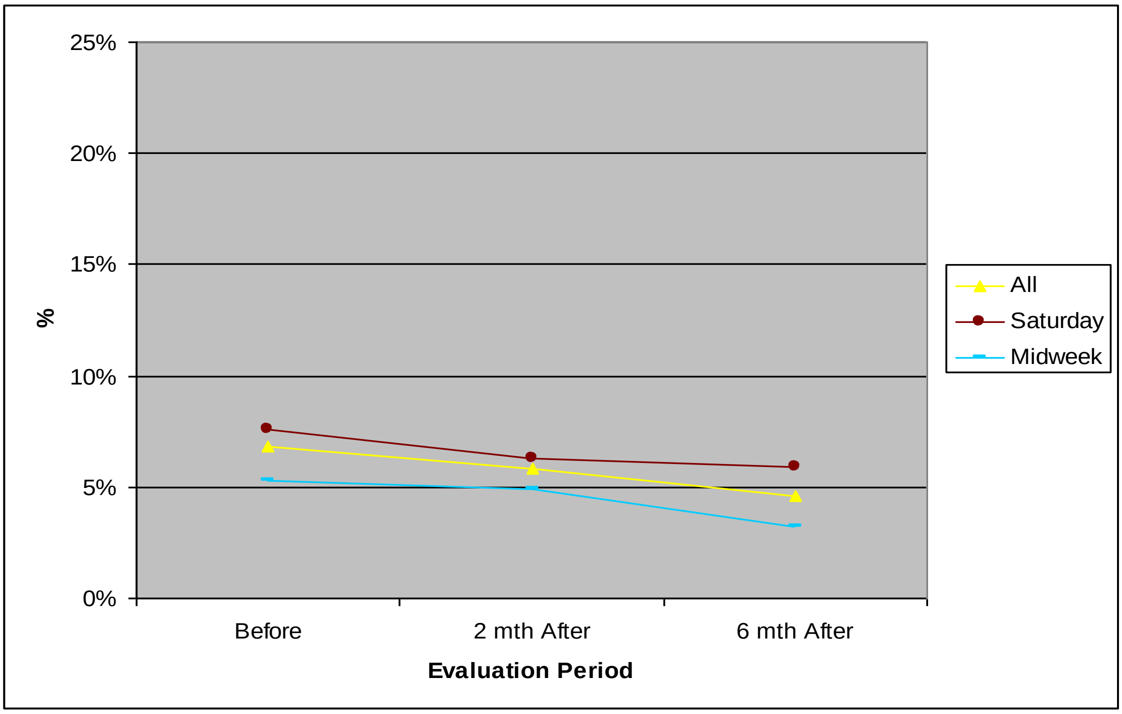
The change in proportion between the before and six month-after period was statistically significant at the 5% level for all data (20.4% to 23.2%, Z=2.66, Z_{crit}=1.96), for midweek data (20.7% to 25.1%, Z=2.58, Z_{crit}=1.96), and not significant for Saturday data (20.2% to 21.3%, Z=0.76, Z_{crit}=1.96).

5.3.4 Runners and aborters

Runners are pedestrians who run to complete their crossing. They might finish or start late but are not guaranteed to be in either or both groups. Aborters are pedestrians who start to cross and return to the footpath they set out from.

The total number of runners or aborters was compared with the total number of pedestrians, excluding pedestrians crossing on any vehicle phase (violators), in each evaluation period. This was the proportion of runners or aborters. Figure 5-4 shows the change in this proportion for the evaluation periods.

Figure 5.4 Percentage of runners or aborters by evaluation period



For all data, the proportion decreased from 6.8% for the before period to 5.8% two months after. This was not statistically significant at the 5% level (Z=1.61, Z_{crit}=1.96). The decrease from 5.8% two months after to 4.6% six months after was significant at the 5% level (Z=2.34, Z_{crit}=1.96), so too was the decrease from the before period to six months after (6.8% to 4.6%, Z=3.74, Z_{crit}=1.96).

For Saturday data only, the proportion decreased from 7.6% for the before period to 6.3% two months after, and to 5.9% at six months after. None of these decreases were statistically significant at the 5% level (Z=1.60, Z=0.46, Z_{crit}=1.96), and neither was the decrease from the before period to six months after (7.6% to 5.9%, Z=1.94, Z_{crit}=1.96).

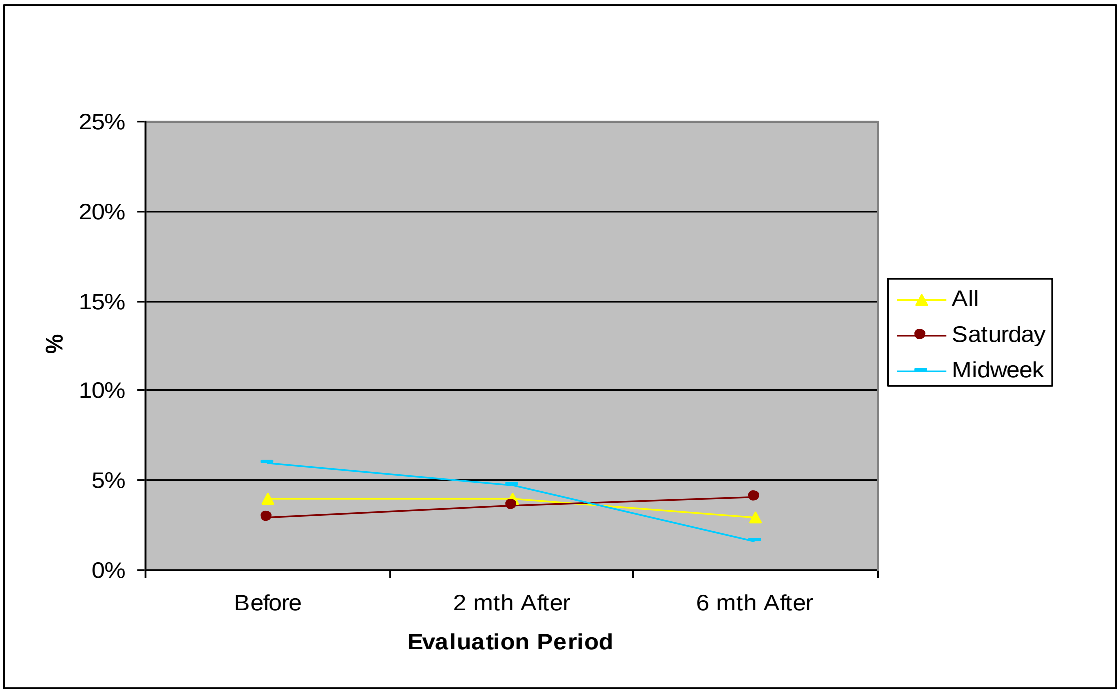
For midweek data only, the proportion decreased from 5.3% for the before period to 4.9% two months after. This was not statistically significant at the 5% level (Z=0.43, Z_{crit}=1.96). The decrease from 4.9% two months after to 3.2% six months after was statistically significant at the 5% level (Z=2.18, Z_{crit}=1.96), as was the decrease from the before period to six months after (5.3% to 3.2%, Z=2.40, Z_{crit}=1.96).

5.3.5 Violators

Violators are pedestrians who crossd during a vehicle phase.

The total number of violators was compared with the total number of pedestrians, including the pedestrians crossing on any vehicle phase, in each evaluation period. This was the proportion of violators. Figure 5-5 shows the change in this proportion for the evaluation periods.

Figure 5.5 Percentage of violators by evaluation period



For all data, the proportion increased from 3.9% for the before period to 4.0% two months after. This was not statistically significant at the 5% level ($Z=0.04$, $Z_{crit}=1.96$). The decrease from 4.0% two months after to 2.9% six months after was significant at the 5% level ($Z=2.51$, $Z_{cri_t}=1.96$), as was the decrease from the before period to six months after (3.9% to 2.9%, $Z=2.28$, $Z_{crit}=1.96$).

For Saturday data only, the proportion increased from 2.9% for the before period to 3.6% two months after, and to 4.1% at six months after. None of these increases were statistically significant at the 5% level ($Z=1.17$, $Z=0.87$, $Z_{cri_t}=1.96$), and neither was the increase from the before period to six months after (2.9% to 4.1%, $Z=1.91$, $Z_{crit}=1.96$).

For midweek data only, the proportion decreased from 6.0% for the before period to 4.7% two months after. This was not statistically significant at the 5% level ($Z=1.24$, $Z_{crit}=1.96$). The decrease from 4.7% two months after to 1.6% six months after was statistically significant at the 5% level ($Z=4.54$, $Z_{crit}=1.96$), as was the decrease from the before period to six months after (6.0% to 1.6%, $Z=5.18$, $Z_{crit}=1.96$).

5.3.6 Pedestrian-vehicle conflicts

A pedestrian-vehicle conflict occurs when a pedestrian or a vehicle must take evasive action to avoid collision. Only one event meeting this definition was recorded in the three evaluation periods.

6 Questionnaire surveys

Off-site and on-site questionnaire surveys were conducted between the first and second video surveys after installation. The questionnaire surveys were completed to gauge public reaction to the countdown timers and to determine if the timers influenced pedestrian crossing behaviour.

6.1 Off-site attitudinal questionnaire surveys

6.1.1 Introduction

Hutt City Council is the local government body that administers the area where the countdown timers were installed. The council building is within a short walking distance (approximately 400m) of the intersection.

An email survey was sent by Mr King (a peer reviewer for this project and a Hutt City Council employee) to Hutt City Council staff. The purpose of the survey was to test the questions for use on the general public and to seek preliminary reactions to the new equipment.

The survey data sheet is attached as appendix A. The three questions in the survey were:

1. During the last three months, have you noticed anything different about the pedestrian signals outside Queensgate?
2. In your opinion as a pedestrian, does it add or detract from pedestrian safety?
3. Do you think the new devices are a good idea? Rate on a scale of 1 – 5 (Bad – Good)

The questions were based on the survey used in the Auckland city trial.

6.1.2 Results

Of approximately 200 Hutt City Council staff, 70 replied to the email survey. The table below summarises the responses.

Table 6.1 Summary of Hutt City Council questionnaire responses

Question	Total responses to question	Favourable	Unfavourable
1 During the last 3 months, have you noticed anything different about the pedestrian signals outside Queensgate?	70	63 (90%)	7 (10%)
2 In your opinion as a pedestrian, does it add or detract from pedestrian safety?	65	51 (73%)	14 (10 of which indicated 'no change') (27%)
3 Do you think the new devices are a good idea? Rate on a scale of 1 – 5 (No – Yes). Favourable = 4,5 Unfavourable = 1,2,3	60	54 (90%)	6 (10%)

The results in table 6.1 show that the public (measured in terms of the Hutt City Council staff) perceived the countdown timers to be positive pedestrian safety measures, with 73% of responses agreeing they added to pedestrian safety, and 90% thinking they were a good idea.

In addition to the above binary responses, respondents provided comments. Of the favourable responses the most common was: 'timer allows me to decide whether it is safe to cross', or similar words. Three respondents added that they used the additional information to decide whether they could complete a diagonal crossing. Two respondents added that they increased their walking speed to cross within the time displayed.

The four unfavourable responses included comments that the countdown timers were a distraction, they created indecision, might force pedestrians to cross in a hurry, increased the number of pedestrians starting to cross late, and raised the question whether it was legal to cross when the flashing red man was showing in addition to the countdown timer.

The caveats around the above results are:

- responses may have been elicited only from those employees who noticed something different at the intersection
- Hutt City Council staff are not a representative sample of the population using the intersection.

Outside of the questionnaire, Hutt City Council staff reported observing young people using the timer as a betting device. This off-site questionnaire allowed the research team to refine the questions for pedestrians at the intersection.

6.2 On-site attitudinal questionnaire surveys

6.2.1 Introduction

Questionnaire surveys took place on Thursday 22 and Friday 23 November 2007. Surveyors were stationed beneath the countdown timers and interviewed pedestrians after they had crossed the diagonal between Queensgate and Gibson Sheat House.

The questions and the design of the survey were based upon the one used in the Auckland city trial. This survey was previously approved by Land Transport NZ (now NZTA). The research team contacted the designer of this survey who noted an improvement to the survey design and this was included in this survey. The second question was altered from 'How did the signals influence you to cross differently?' to 'How did the signals influence your crossing behaviour?'

This revision more easily allowed a 'no change' response.

The categories of response to this question used in the Auckland city trial were:

- Didn't change
- Stopped and waited
- Went slower
- Went quicker

For the Lower Hutt questionnaire an additional response 'Made me cross when I would have waited' was added to complement 'Stopped and waited'.

The questions asked were:

1 Have you noticed anything different about these pedestrian signals recently? And if so, what?

If ‘yes’ and ‘timer’…

2 How did the signals influence your crossing behaviour?

Otherwise…

1 These devices have been recently installed. What do you think the numbers on the timer mean?

2 Do you think the timer is likely to improve pedestrian safety?

3 Please estimate how long it takes to cross diagonally.

4 Which age range do you fall into?

a < 25

b 25 – 65

c 65

The field sheet used on site is attached in appendix A together with a flowchart that describes the logic of the questionnaire.

6.2.2 Method

Two surveyors interviewed pedestrians who had just completed crossing the intersection. Pedestrians who crossed diagonally were interviewed as they had the best view of the timers (refer to figures 4.1 and 4.2). Responses were categorised as shown in table 6.2.

6.2.3 Results

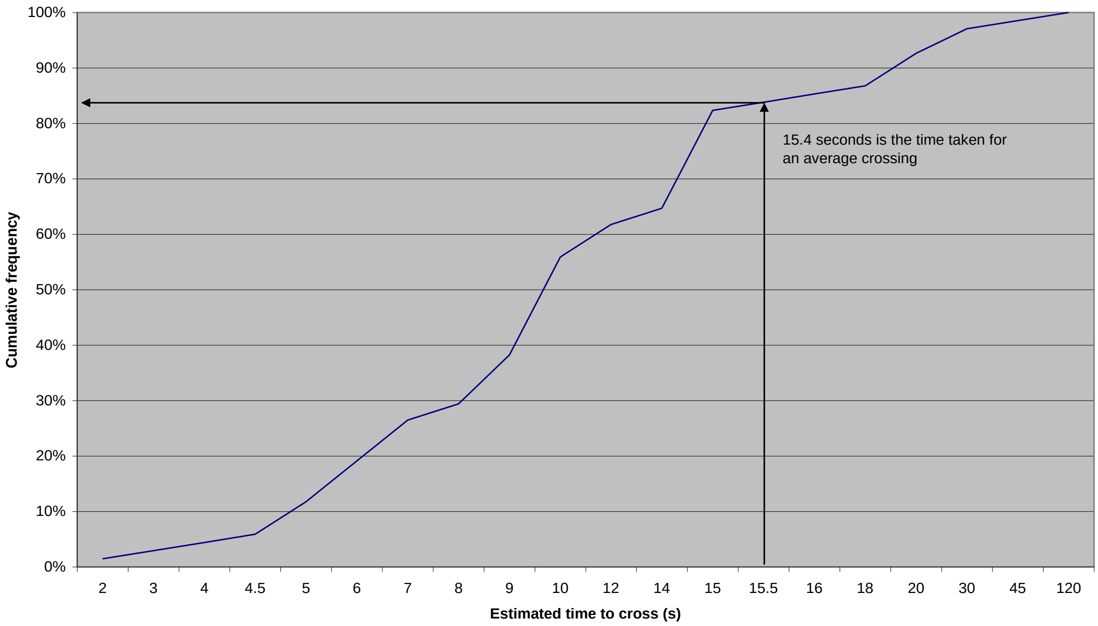
Seventy-nine pedestrians were interviewed. Their responses are summarised in table 6.2.

Table 6.2 On-site questionnaire responses

Question	Number of respondents	Response
1	79	70% of the respondents noticed the countdown timer
2	62	Of those who noticed the countdown timer, 39% did not change behaviour, 31% walked more quickly, 3% more slowly, and 19% stopped and waited, 8% crossed when they should have waited
3	79	86% of respondents thought the numbers indicated the time left to complete crossing
4	78	90% of respondents thought the countdown timers added to pedestrian safety
5	68	The range of responses was 2s to 120s with an average of 14s
6	79	22% of respondents were under 25, 54% of responses were 26–64, and 24% were over 65.

Question five tested pedestrians on the time it took to cross the 23.1m diagonal intersection, with 68 of the 79 respondents providing estimates. At a walking speed of 1.5m/s[1], the time to cross this diagonal is 15.4s. Figure 6.1 shows the cumulative frequency distribution of time estimates for crossing the intersection diagonally.

Figure 6.1 Cumulative frequency distribution of time estimates to cross diagonally



Over 80% of respondents underestimated the diagonal crossing time, based on the average walking speed of 1.5m/s of a fit healthy adult.

The estimates were possibly influenced by the fact that the figures displayed on the countdown timer went from 17s to 0s. However, most estimates were far below the necessary time to cross.

[1] 1.5m/s is the average walking speed of a fit healthy adult (Land Transport NZ 2007)

7 Theoretical analysis

The determination of the time required for a pedestrian to cross a road, and in turn the phase time of a pedestrian signal, is based on the width of the road and pedestrian walking speed. Walking speed varies with pedestrian characteristics, and current guidelines vary in their recommended speeds for designing the crossing interval.

Austroads provides recommended walking speeds to determine pedestrian clearance times through their earlier *Guide to traffic engineering practice - part 7: traffic signals* (Austroads 2003) and *Guide to traffic engineering practice – part 13: pedestrians* (Austroads 1995). These guides state 1.2m/s is an average walking speed used for the design of pedestrian crossing times, and that the unhurried walking speed of a senior is 0.8m/s – this is the 10th percentile walking speed.

Land Transport NZ (2007) states that 1.5m/s is the average walking speed of a healthy adult. The 15th percentile walking speed of a healthy adult is 1.3m/s. The aged travel more slowly averaging around 1.2m/s, with a 15th percentile of 1.0m/s. These speeds are believed to be slower than those observed in Auckland city.

Based on the average clearance time of 18.7s currently in place, table 7.1 presents the minimum walking speeds required to cross the intersection in six possible directions.

Table 7.1 Theoretical minimum walking speeds at Queensgate intersection

Crossing direction	Crossing distance (m)	Minimum walking speed (m/s)
Vodafone corner to AudDi House (diagonal)[2]	28.9	1.6
Queensgate to Gibson Sheat House (diagonal)	23.1	1.2
Vodafone corner to Queensgate (parallel)	16.0	0.9
Queensgate to AudDi House (parallel)	14.8	0.8
Gibson Sheat House to AudDi House (parallel)	13.4	0.7
Gibson Sheat House to Vodafone corner (parallel)	16.0	0.9

The parallel crossings provide adequate crossing times for the low percentile walking speeds of the aged pedestrians. However, the diagonal crossings do not provide as much tolerance. The longer diagonal crossing times are designed for fit healthy adults.

The phasing of the intersection allows for two pedestrian phases per cycle. This means that a pedestrian may complete one parallel crossing, wait for one vehicle phase, and complete another parallel crossing. This 'double phasing' of the pedestrian phase results in an improved pedestrian level of service but due to the resulting pedestrian phase times being shorter than might otherwise have been the case, pedestrians are required to complete a diagonal crossing more quickly than is the norm.

[2] During the video survey, one user crossing in this direction took one entire pedestrian phase and the subsequent vehicle phase (Bunny – Margaret) to complete the crossing; an average of 0.8m/s.

8 Discussion

The installation of countdown timers at a trial site in Lower Hutt appeared at first to have decreased pedestrian safety. The number of pedestrians remaining in the roadway at the end of the pedestrian crossing phase increased, as did the number of pedestrians starting their crossing later. In contrast, perceived pedestrian safety increased based on the results of attitudinal surveys.

The key findings from the video surveys were:

1. A statistically significant increase (all data: 11% to 17%) in the number of pedestrians remaining in the roadway at the end of the pedestrian phase (late finishers)
2. A statistically significant increase (all data: 20% to 23%) in the number of pedestrians commencing their crossing at the display of the flashing red man (late starters)
3. A statistically significant decrease (all data: 7% to 5%) in the number of pedestrians running to complete crossing (late starters)
4. A statistically significant decrease (all data: 4% to 3%) in the number of pedestrians crossing during the vehicle phases (violators).

The key findings from the attitudinal surveys were:

5. Almost all pedestrians interviewed thought the countdown timers added to pedestrian safety and almost all pedestrians (95%) understood their function.
6. Most pedestrians (over 80%) underestimated the time required to cross the intersection diagonally.

The study also showed that:

7. The current phase time for pedestrians was too short for slower pedestrians to cross diagonally.

The findings from the video surveys were initially counter intuitive. Rather than using the additional information of the countdown timers to postpone their crossing, it appeared pedestrians used this information to risk crossing during the flashing red man.

Attitudinal surveys showed that many pedestrians underestimated the time required to cross diagonally. This was reflected in pedestrians taking a risk and crossing the road while they could have waited, and in a decrease in the percentage of runners.

The short phase time and pedestrians consistently underestimating the time to cross were contributory factors to the increased number of pedestrians still crossing when the signal changed to the solid red man. Some of this would be due in part to the fairly high proportion of pedestrians pushing a pram or stroller and in part to pedestrians knowing there was an additional period of time at the end of the flashing red man before the green man allowed motorists to move on again. However, in this particular instance it is understood that Hutt City Council reduced the additional time on the longer diagonal crossing knowing that it would not impact on the other (shorter) crossing paths as the exclusive pedestrian phase could be activated twice per cycle.

It is difficult to know the extent to which the above contributed to the conclusion that pedestrian safety had potentially decreased. It could be that the result was significantly affected by the shortened diagonal crossing time and that a different (neutral or positive) result might have occurred had a more appropriate crossing time been provided.

The Queen Street intersection trialled in Auckland was similar to the Lower Hutt intersection: it was a wide cross intersection with an all-pedestrian movement phase in the heart of a CBD, but was square with diagonal crossings of similar length. The Queen Street trial found an increase in actual pedestrian safety. It appears that independent of the environmental features of the intersection, pedestrians appeared to adopt risk-sympathetic or risk-adverse behaviours. The researchers' opinion is that the pedestrian characteristics of the two trial sites were significantly different, and the Auckland site is thought to have had a more favourable minimum walking speed, in particular for crossing diagonally. The trial intersection in Lower Hutt had two pedestrian phases in one cycle. The pedestrian walk speed was calculated at 1.2m/s for the shorter diagonal and 1.6m/s for the longer diagonal.

Another difference between the two sites was the difference in size and aspects of the display equipment. The equipment used in Auckland trial was a two-aspect 300mm diameter signal with the countdown display in the green man aspect (four sets) while the Lower Hutt study used a three-aspect 300mm equipment (two sets). It is unsure if this contributed to the outcome, but Hutt City Council considered they would have preferred an arrangement similar to that in Auckland city as two-aspect displays are the norm for new installations. Also Hutt City Council wondered whether removing the cowlings might have made the countdown timers more visible (and less ugly).

Sympathy for risk at the Lower Hutt site was reflected in the first three key findings, and anecdotally this was supported by observations of pedestrians using the countdown timer as a sort of 'betting device' in seeing whether they could cross in the remaining time 'plus a bit'.

9 Conclusions and recommendations

9.1 Conclusions

This research evaluated changes in indicators of pedestrian safety at a CBD intersection in Lower Hutt through the introduction of countdown timers. The study shows that these devices might seem to have reduced pedestrian safety by promoting more risky behaviours, but the result could also have been significantly affected by the pedestrian time being too short for the longer diagonal crossing. The study also showed that perceived pedestrian safety increased, with strong public support for the countdown timers.

The Auckland city Queen Street trial concluded that intersections in pedestrian-dominated areas, with all pedestrian movement phases, and located away from time critical generators such as transport nodes, would suit countdown timers. The results from the Lower Hutt study did not reach the same conclusion. The researchers hypothesised that the pedestrian profile at the Auckland city site was significantly different from that at the Lower Hutt site.

The researchers also concluded that the flashing red signal at the Lower Hutt trial site was short even for the shorter diagonal crossing and was likely to have affected the outcome of the study.

Although the conclusions from the study did not support risk reductions in actual pedestrian safety, only one near miss was observed and some other statistics were favourable, which could be considered to vindicate the decision of Hutt City Council to balance the various factors and compromise on the pedestrian crossing time for the longer diagonal crossing.

Countdown timers are applicable for use in certain environments. The site in Lower Hutt, despite requiring some fairly fast walk speeds to cross diagonally appears to be working to the satisfaction of the pedestrians using it, as seems to be the case for the two Auckland sites.

9.2 Recommendations

Although the conclusions from the study did not necessarily support a reduction in pedestrian safety, the results from the attitudinal surveys indicated strong public support. It is recommended that:

- road controlling authorities be allowed to introduce countdown timers at sites with high pedestrian flows and wide crossings particularly where there is an exclusive pedestrian phase
- two aspect sets are used in preference to three aspects and that the size and number of sets are larger rather than smaller. There should not be stringent rules given the different geometry, vehicle and pedestrian flow patterns and phase timings that can occur
- the rules should allow the use of animated displays as installed elsewhere, including ones where the speed of the animation increases when the remaining countdown time is below a certain value
- the Hutt City Council re-considers the current pedestrian phase times at the trial site to reduce the risk element for pedestrians making the longer diagonal crossing (although pedestrians may continue to make their decision to cross based on the time left to complete their crossing rather than the total phase time)
- the Hutt City Council undertakes further study should it choose to significantly adjust the pedestrian phase timings at the trial site.

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Appendix A: Survey questionnaires and logic flowchart

Hutt City Council questionnaire (field sheet used off site)

Date: 2 - 6 November
Time:
Surveyor: Wayne King

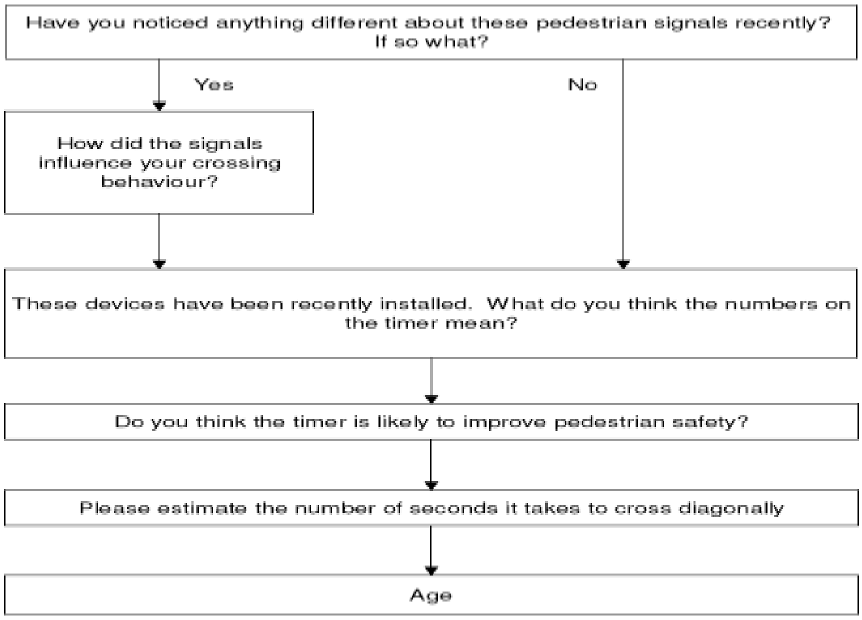
	Question 1							Question 2											Question 3					
	During the last 3 months, have you noticed anything different about the pedestrian signals outside Queensgate?							In your opinion as a pedestrian, does it add or detract from pedestrian safety?											Do you think the new devices area a good idea? Rate on a scale of 1 - 5					
		Yes, I noticed						Adds, How?								Detracts, How?								
Participant No.	Yes	Countdown timer	Brighter bulbs / New Light	More pedestrian crossing opportunities	More Time	Walking Graphic	No	Know / don't have to guess how long left for safe crossing	Know when you can start crossing	I went Quicker	I can now walk diagonally	Drivers can see when lights will change	Incresed Safety	Easy to Understand	No Change	People think twice about crossing	Causes people to rush and fall	Traffic builds up	1	2	3	4	5	Question 2. Other answers
1																								
2																								
3																								

Survey questionnaire (field sheet used on site)

Date:
Time:
Surveyor:

		Question 1				**If timers were noticed then** Question 2					Question 3				Question 4		Question 5	Question 6			
		Have you noticed anything different about these pedestrian signals recently? If so what?				How did the signals influence your crossing behaviour?					These devices have been recently installed. What do you think the numbers on the timer mean?				Do you think the timer is likely to improve pedestrian safety?		Please estimate the number of seconds it takes to cross diagonally	Age			
		Yes																			
Participant No.	Diagonal Crossing?	Countdown timer	Brighter bulbs	Paint markings	No **(go to Q3)**	Didn't change	Stopped & waited	Made me cross when I would have waited	Went slower	Went quicker	Time left to complete crossing	Time left to start crossing	Time until start of next crossing	Don't know/care	Yes	No		< 25	26-64	65+	Other answers

Logic flowchart for the above on site questionnaire


Have you noticed anything different about these pedestrian signals recently? If so what?
Yes
No
How did the signals influence your crossing behaviour?
These devices have been recently installed. What do you think the numbers on the timer mean?
Do you think the timer is likely to improve pedestrian safety?
Please estimate the number of seconds it takes to cross diagonally
Age