REDUCING PEDESTRIAN DELAYS AT TRAFFIC SIGNALS

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1 ABSTRACT

As urban growth leads to Australasian society progressively becoming more urbanised, the challenge of balancing the needs of different transport users becomes more complex. Too often, pedestrians are overlooked by a desire to move more people as fast as possible as far as possible. Once people reach CBD areas and start walking, the urban environment tends to be defined by wide busy roads that can be intimidating and difficult to cross.

The traditional approach to road management has been to only focus on improving the carrying capacity relating to vehicles, with an emphasis towards maximising the speed and volume of motorised traffic that can move around the network. This approach overlooks the economic and environmental benefits of allowing urban areas to become more pedestrian and cycle friendly.

Recent research sponsored by the NZTA has focused on reducing pedestrian delays. This research project focused on a number of intersections in central Wellington, Christchurch and Auckland. Micro-simulation models were developed to model pedestrian and vehicle delays during the 'lunchtime' 12pm to 1:30 pedestrian peak periods.

This paper outlines each of the case study sites considered in the research, the benefit that was achieved in terms of optimising the signals for per person delay and also the benefits of the various improvement options. The paper also gives an overview of the pedestrian attitude surveys.

Walking is a sustainable mode of travel. Most journeys involve a walking component, regardless of whether the main portion of the trip is made by foot, car, or using public transport. In New Zealand, around 40 percent of short journeys (less than 2 km) are made entirely on foot (ARTA, 2007) and most trips include a walking component as some part of the journey. A key issue of any pedestrian trip is the ability to safely and efficiently cross roads. It is estimated that pedestrians make 2.4 billion road crossings each year in New Zealand (ARTA, 2007).

2 PEDESTRIAN JOURNEYS

Walking is an environmentally sustainable mode of travel and is also one of the most common forms of transportation. Most journeys involve a walking component, regardless of whether the main portion of the trip is made by foot, car, or using public transport. Although mode-share for active modes has been in decline, mode-share itself only considers the main part of the journey. Very few trips in urban areas can be made 'door to door' and as urban environments grow, pedestrian trips become an important means of connecting parking, public transport, commerce, entertainment, and employment.

The continued reliance on walking has been highlighted by the Auckland Regional Authority (ARTA) Sustainable Transport Plan 2006-2016 (ARTA 2007), which found that around 40 percent of short journeys (less than 2 km) are made entirely on foot and most trips include a walking component as some part of the journey. The plan also estimated that pedestrians make 2.4 billion road crossings each year in New Zealand. A key issue of any pedestrian trip, therefore, is the ability to safely and efficiently cross roads. Delays at crossing locations, whether controlled (traffic signals) or passive (crossing aides), can be a major deterrent to walking, particularly in built-up areas, such as the centre of our major cities, or across busy multi-lane roads. Poorly designed or poorly operated crossings facilities may act as a possible deterrent to pedestrian modes and potentially increase the segregation / cleavage caused by busy road corridors. Waiting time can be significant and can deter people from walking or lead to unsafe crossing behaviour.

Like cyclists, pedestrians have often been marginalised in road management within New Zealand, with the focus typically being to increase the carrying capacity of the roads and intersections for motor vehicles only. The aim has generally been to maximise the speed and throughput volume for vehicular traffic. It can be argued that pedestrian level of service has gradually eroded over time due to increasing competition for road space, and a lack of balance in designing roads for all modes of travel. This is consistent with a steady decline in pedestrian mode share. Where pedestrians have been factored into the roading design, as might occur at traffic signals, often pedestrians are accommodated so that there is the least amount of interruption to motorised traffic. In such circumstances signal cycle times can be long and pedestrian waiting times can be excessive.

The key document in terms of national transportation policy is the Government Policy Statement 2009 (the GPS). A secondary document is the New Zealand Transport Strategy 2008 (the NZTS), which is a non-statutory document described by the GPS as being "developed to give long-term perspective and direction to the transport sector". The NZTS has several components relevant for pedestrian planning. Of these, the most important is the target of increasing walking, cycling and other active modes to 30% of the total trips in urban areas, from the current level of 18%. The GPS also retains the objectives of the Land Transport Management Act 2003, to provide "an affordable, integrated, safe, responsive and sustainable transport system." Such a system could not exist without incorporating pedestrians, who outnumber other road users in many urban environments.

A primary means of improving the desirability and safety of pedestrian trips in urban environments is to reduce delays created by traffic signals. As the findings of this research will indicate, it is possible to achieve this without significant capital cost and, in many cases, without adversely affecting other mode choices.

In Australasian cities, pedestrians have tended to be marginalised. To some extent this reflects the ease with which motorised traffic data can be captured (i.e. through SCATS or SCOOT) and the limitations of modelled software, which generally factors pedestrians only in terms of delay to traffic. It is more difficult to automate data capture for pedestrians, and also more difficult to model their behaviour.

It is considered that if walking were more attractive, the transport system would be better integrated, because walking is an essential link between the transport network (both public and private) and the destination.

Since the passing of the Land Transport Management Act 2003, there has been a gradual shift in policy toward more sustainable and more integrated approaches to transportation. Recent regional land transport strategies, regional and local government policies have tended to favour an increasing emphasis on stimulating active modes and integrating modes.

It is fair to say that at all levels of government there is a desire to implement policy goals without any significant additional costs. The most effective means of keeping costs down is to look for changes that can come about through increased performance efficiencies and purely operational changes, rather than expensive infrastructure improvements. It is for these reasons that signal optimisation is an area that should be given more emphasis as it can achieve results with relatively little cost.

3 VALUE OF TIME

When it comes to funding projects, a necessary step is to derive a Benefit Cost Ratio (BCR) to obtain funding. Value of time is essentially the value that policy makers are willing to place on efforts to reduce delays. In some cases, this is derived from the values that people place on their own time (referred to as willingness to pay) in other cases it is a value derived as a means of focusing policy by determining values for the public cost or benefit. The primary source for measuring these benefits in New Zealand is the Economic Evaluation Manual 2008 (the EEM).

The revised EEM took effect on the 1st of January 2009. This has new calculations for pedestrian and cycling projects, which will aid in providing guidance for cost benefit calculations for specific projects. However, the value of time for specific modes remains the same as the value of time figures used in 2002. The 2002 values for pedestrians are actually less favourable than those of the Transfund Project Evaluation Manual 1998 (the PEM). This suggests that pedestrian interests have actually been marginalised by policy values since 1998. PEM values are in $1998, and therefore the difference between the EEM 1998 and the PEM 2008 could be expected to represent inflation to 2002 (the last time these figures were updated). However, the value for time for pedestrians and cyclists on work related trips (e.g. commuting to work) has barely moved, and for non-work trips it has fallen substantially. This means that, when inflation is taken into account, a pedestrians time is valued considerably less now then it was in 1998.

Table 1: New Zealand travel time values since 1998

Car, motorcycle driver (work)	$21.30	$23.85	+12%
Car, motorcycle driver (non-work)	$ 7.00	$ 7.80	+11%
Pedestrian and Cyclist (work)	$21.30	$21.70	+2%
Pedestrian and Cyclist (non-work)	$10.55	$ 6.60	-37%

It is interesting to note that in 1998, the value of time for pedestrians involved in work related trips was the same as for car drivers and for the non-work related trips the pedestrian's time was actually valued more highly, as occurs in numerous other countries. Since 2002 the value of time for pedestrians has been lower than that of car occupants.

Given that this is a key mechanism for obtaining pedestrian funding, it is interesting to note that the international literature reviewed during the course of the research suggests that international best practice is that value of time for pedestrians should be higher than for car occupants. In some jurisdictions, pedestrian value of time is as much as three times higher than non-active mode shares.

There may be a number of reasons why other countries have a higher value of time for pedestrians. It may be due to the fact that a pedestrian is exposed to the elements and has a greater exposure to harmful exhaust fumes. It may simply be that other countries use the value of time to promote pedestrian trips for health reasons or as an aid to decongestion. Whatever the reason, it is unlikely that the issue of pedestrian delay will be adequately resolved while the value of time for pedestrians is less than that of vehicles.

It should also be noted that the failure to collect pedestrian data for a project will mean it is difficult to accurately estimate the value of time for pedestrians affected by a project, which means that pedestrians may not be properly considered for transportation projects. When it comes to signalised intersections, vehicle volumes can readily be obtained from SCATS or SCOOT. However, in most urban areas, very little information is collected regarding pedestrian crossing movements and volumes.

Where data is not collected as part of a regular programme, pedestrian volumes need to be collected on a case by case basis, which increases the costs associated with including pedestrians into BCR calculations. This additional cost associated with pedestrian data increases the likelihood that pedestrians will be ignored, or included as an assumed factor. This is likely to result in a bias against pedestrian traffic, as benefits to vehicles will be more tangible.

4 PEDESTRIAN SURVEYS

Pedestrian attitude surveys were conducted in Auckland, Wellington and Christchurch. Each pedestrian was asked ten questions. More than 800 interview surveys were conducted. At the same time, almost 1,500 observational surveys were undertaken to learn more about pedestrian behaviour.

The research steering group selected a number of intersections in Auckland, Wellington and Christchurch. These intersections were then used as the collection points for both observational and questionnaire surveys. One of the most important findings related to the comparative delay in each city. It became apparent that the questionnaire answers were influenced by the average delay. Table 2 provides an overview of the data collected for each city.

Table 2 Pedestrian data collection

Auckland	5	289	53
Wellington	2	333	45
Christchurch	7	843	25
Combined Results	**14**	**1,465**	**41**

The international literature reviewed suggested that the maximum pedestrians would be willing to wait is 30 seconds. Table 2 suggests that (for the intersections surveyed) pedestrians in Auckland and Wellington are having to wait on average much longer than recommended.

One of the questions asked of pedestrians was “do you think more priority should be given to pedestrians. While roughly half of pedestrians across the country answered ‘yes’ the total for Auckland was 75%. This suggests that Auckland pedestrians are not happy with the delays they’re currently facing.

Respondents at each intersection were asked how long they felt they had to wait before crossing the road. The average perceived delay times was found to be, on average, double the actual average delay times for the intersection. This is consistent with delay being a subjective experience that is difficult to quantify. It is also consistent with the level of frustration being higher than the actual quantifiable loss of time.

Having been asked how long the respondent thought a typical wait time was, the respondents were then asked how long they thought was a reasonable waiting time at each intersection. Given the disparity between the perceived and actual wait times, it would not be fair to compare the ‘reasonable’ with ‘actual’ wait times, as the respondents were basing their answers on how long they thought they were waiting rather than the actual cycle times of the intersection.

The perceived waiting times were generally longer than those considered reasonable by respondents. Although respondents had difficulty in quantifying the experience of delay, a common response was that delays should be reduced, although this varied significantly between cities.

By comparing the average perceived wait time with the perception of a reasonable wait time it is possible to gain an understanding of the level of frustration and the desire for improved pedestrian priority.

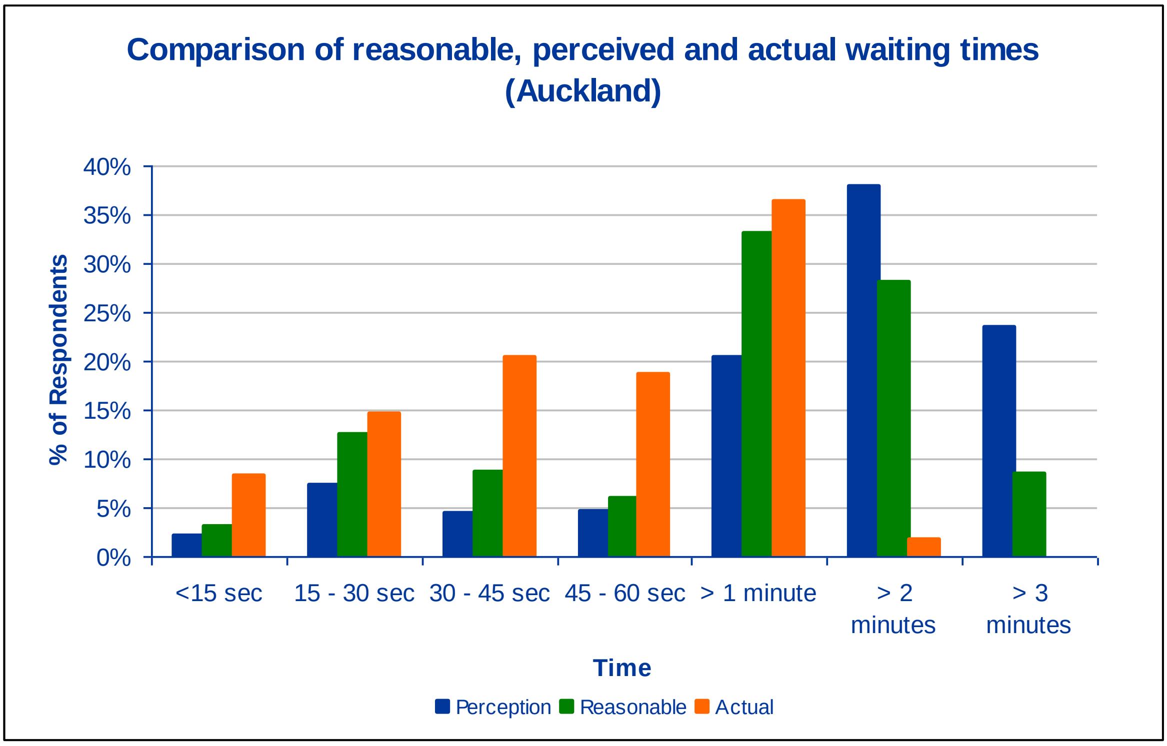

Figure 1: Comparison of perceived, reasonable and actual waiting times for Auckland

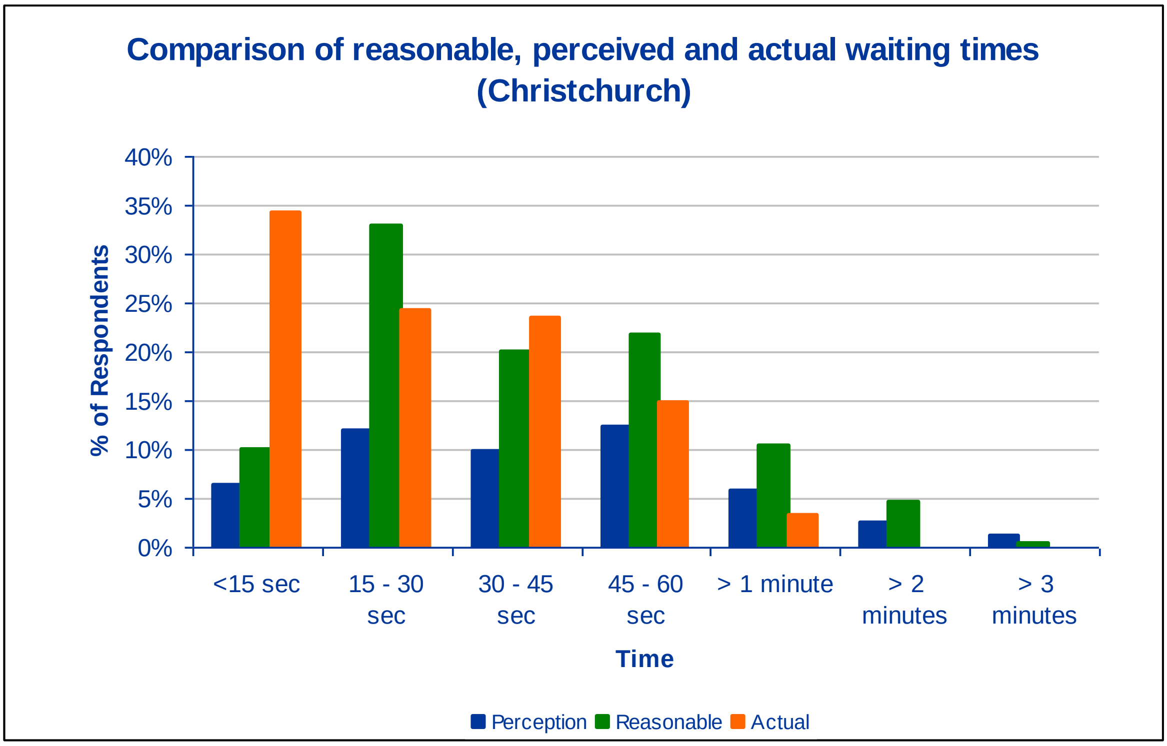

Figure 2: Comparison of perceived, reasonable and actual waiting times for Christchurch

A comparison of **Figure 1** and **Figure 2** shows how differently pedestrians in Christchurch perceive delay as compared to pedestrians in Auckland. In Auckland, where actual delay was longer, the difference between perceived and reasonable delay was much greater than for Christchurch. In Auckland, the length of time people perceived themselves to be waiting was significantly longer than the actual wait times, and frustration is likely to be a key influence in this difference. By contrast, the Christchurch average delays were within international recommended maximums, and as a result Christchurch pedestrians appear to have far more accurately gauged the wait times for their intersection.

When comparing the times pedestrians considered 'reasonable' the values for Auckland were higher than that of Christchurch. This is possibly an indication that pedestrians are realistic about delays and that, while not happy with the current delays, Auckland pedestrians acknowledge a competition for road space makes some delay inevitable.

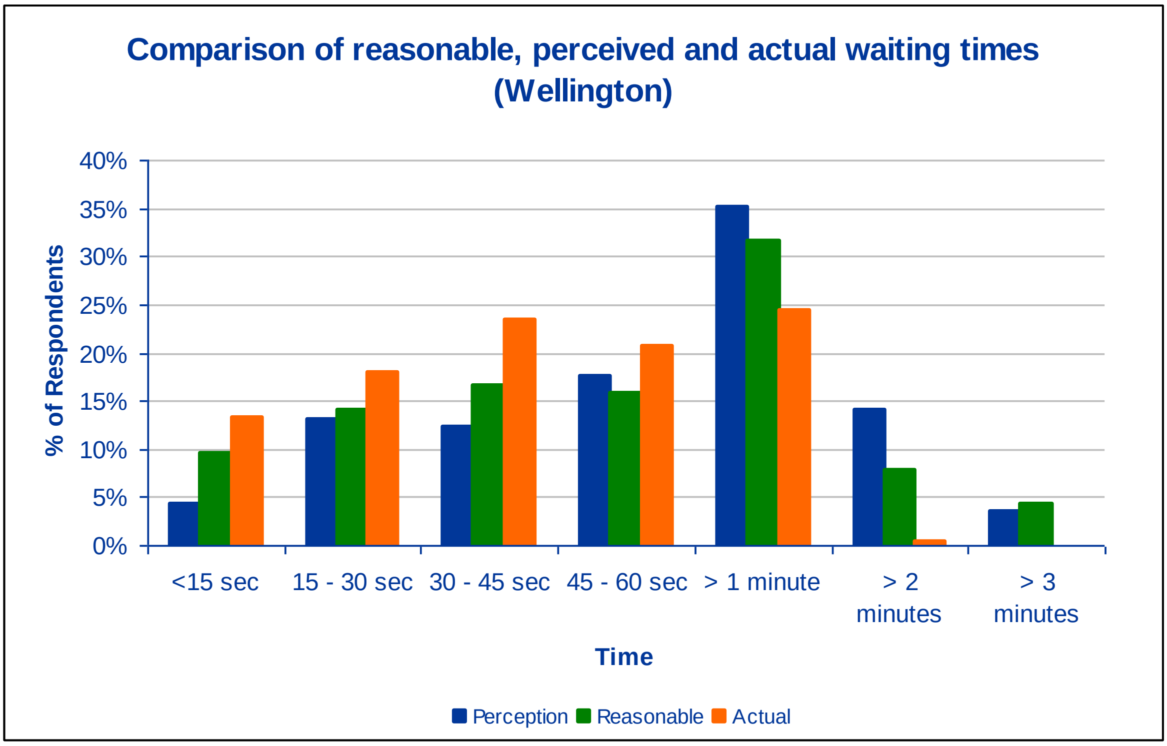

Figure 3 Comparison of perceived, reasonable and actual waiting times for Wellington

As can be seen from **Figure 3**, Wellington falls midway between Auckland and Wellington in terms of perceived, reasonable and actual delays. As with Auckland, the average delay is longer than recommended by international literature. The perceived delay is longer than the actual delay, however, this is less pronounced than Auckland, where the actual delays are longer than Wellington and the perceived delays are considerably longer. This difference between actual and perceived delay for Wellington is likely to be the result of pedestrians at the surveyed Wellington intersections being frustrated, but less frustrated than the pedestrians facing delays at the intersections selected in Auckland.

One measure of frustration caused by signals is the frequency with which they are violated by pedestrians. This is not a perfect test as it is affected by traffic volume. However, across New Zealand, almost half of pedestrians admitted to crossing ‘occasionally’ on a solid red man and a further 21% admitted to regularly crossing on a solid red. Observational studies indicated that compliance rates at intersections were similar to those reported by survey respondents. The findings confirmed that crossing compliance at intersections can be an issue in New Zealand, and this in turn may have safety consequences.

5 PEDESTRIAN MODELLING

The micro-simulation tools available to model pedestrians are developing rapidly. Software platforms such as Vissim and Legion now allow modellers to include pedestrians with far more ease than previously possible, and it is likely that modelling software will continue to develop as demand for truly multimodal software increases. For the purposes of this research, the software packages Aimsun and S-Paramics were used to build the intersections and corridors, while Sidra was used for optimisation.

Modelling was undertaken for time periods between 12noon and 1:30pm. This is a time period in which there are high pedestrian volumes, but is considered 'off-peak' for vehicles, and therefore a time period in which the most benefits could potentially be gained as signals are often set up to cater to peak vehicle loading.

In order to use the versions of Aimsun and S-Paramics available to the modelling team, the following steps were taken:

- Car traffic was modelled as normal
- Pedestrians were added as 'a separate vehicle class, essentially mini car's with their own driving lanes (footpaths)
- To replicate the ability for multiple pedestrians to leave a curb simultaneously (rather than queuing like cars), multiple 'pedestrian lanes' were provided at each intersection.
- Pedestrians arriving at an intersection could queue at any queuing lane
- Each pedestrian queuing lane had signals to indicate to the pedestrian when they could cross
- Pedestrian speed parameters were amended to replicate pedestrian walk speeds
- Optimisation was undertaken on a 'per person' rather than per vehicle basis
- Vehicle occupancy was assumed to be 1.3 people per vehicle

Safety factors were also considered when modelling different scenarios, using observational assessments by trained micro-simulation modellers. As a result, some scenarios were discarded due to perceived safety implications.

Survey data was collected for each intersection during the modelled time periods. This included pedestrian volumes and crossing movements, signal timing information from SCATS, vehicle turning movement counts and observed vehicle queue lengths.

The following intersections and corridors were modelled:

Aimsun Models:

- Lake Rd / Hurstmere Rd / The Strand, North Shore City
- Albert Street / Customs Street / Fanshawe Street, Auckland
- Vincent Street / Mayoral Drive, Auckland

S-Paramics Models:

- Taranaki / Courtenay Place Intersection, Wellington
- Jervois Quay, Wellington
- Manchester & Hereford Street Corridors, Christchurch

The per person optimisation was conducted using Sidra. This optimisation led to cycle times that were suitable during the modelled time period, but might be shorter than required during vehicle peak periods.

The intersections selected by the steering committee were, in some cases, linked to other intersections through SCATS (to aid vehicle flow), meaning that the ability to achieve optimum cycle times in practice may be constrained by adjacent intersections. SCATS has the ability for signals to 'marry' and 'divorce' when set criteria are met, so the solution to this is to have intersections linked during vehicle peak periods, and optimised to a more pedestrian friendly independent arrangement during vehicle off-peak periods.

6 Per person delay

Unlike traditional signal optimisation, which focuses on vehicles capacity, the research modelling team looked at the 'per person' effects of changes to signal timings.

Signals were optimised in Sidra, and then modelled to test capacity and safety issues and the per person effect was compared to a base model using the existing queue lengths, vehicle volumes and turning movements, pedestrian volumes and movements, and signal phasings. Per person delay was calculated for both pedestrians and car occupants using a vehicle occupancy of 1.3 people per vehicle. The assumed occupancy has a direct impact on the 'per-person' delay. A lower assumed occupancy will weight the total number of people at an intersection toward pedestrians, although the effects of occupancy will also be influenced by the number of vehicles and pedestrians at any given intersection (i.e. vehicle occupancy becomes more influential the higher than number of vehicles as compared to pedestrians). Vehicle occupancy could therefore be assessed on a case by case basis when other pedestrian and traffic data is collected for the intersection.

The per person outcomes were more reflective of the needs of all road users, rather than just vehicles. It was found that in some cases the base scenario had much greater delay for pedestrians than for vehicles. In these circumstances, a fairer allocation of road space toward pedestrians resulted in a substantial drop of per person delay. However, this did not necessarily disadvantage drivers. The result of optimisation during the 12pm-1:30pm modelled period often improved vehicle delay as well, suggesting there is spare capacity on the network that could be better allocated.

Table 3 and **Table 4** below show the impacts of optimisation and other measures on the per person delay at three intersections, first in absolute values, and then as a proportion of the base model.

Table 3 Three case studies in reducing per person delay (time in seconds)

Lake Road, The Strand, North Shore City	52	-13	-21
Albert Street & Customs Street, Auckland City	39	-12	-15
Taranaki Street & Courtney Place, Wellington City	36	-10	-14

Table 4 Three case studies in reducing per person delay (proportional change)

Lake Road, The Strand, North Shore City	52	- 25%	- 40%
Albert Street & Customs Street, Auckland City	39	- 31%	- 38%
Taranaki Street & Courtney Place, Wellington City	36	- 28%	- 39%

As can be seen from **Table 3** and **Table 4**, the result of optimisation and other measures substantially reduced per person delay, improved the performance of the intersections, and in doing so improved the environment for pedestrians using the transportation system.

The research team looked at decreasing the per person delay through optimisation. It was also considered that this technique could be pro-actively used to more fairly distribute road space based on the mode choice at the intersection. For instance, where delay to one mode choice (such as walking) is disproportionate to the numbers of people using the signals. Changes to the signals that more fairly distribute the road space would therefore result in a drop in the per person delay. Where initial optimisation modelling has been overzealous in benefiting a specific modeshare, at the expense of another, this will be reflected in an *increase* in per person delay.

It would also be possible to work backwards, for example, to establish how much time can be dropped from vehicles to provide pedestrians with a fairer share, without unfairly disadvantaging vehicle occupants as a proportion of road users.

7 Pedestrian Corridor models

In order to understand the delays experienced by pedestrians travelling along the length of a road with multiple signalised intersections, an S-Paramics corridor model was developed for two streets in Christchurch; Manchester Street and Hereford Street. The Manchester corridor was selected by the steering group as this route has more of an "access" function and is to provide for active modes like walking and cycling. The parrallel one-way street pair is promoted as the through-route for traffic wanting to pass through the city. Although two corridors were modelled, the Manchester corridor is provided here as an example.

The Base Model set up using traffic and pedestrian counts, turning movements and vehicle queues. It was then populated with two different speeds of pedestrian, 1.1m/s and 1.4m/s, to gain an understanding of how a single corridor could offer differing levels of delay for pedestrians of different walk speeds. The cycle times did not change between the two Base Model Options, but the model was populated by pedestrians of two different speeds:

- Option 1 consisted of the Base Model populated by pedestrians with a walk speed of 1.1m/s;
- Option 2 consisted of the Base Model populated by pedestrians with a walk speed of 1.4m/s;

The two options are shown in **Table 5** and **Table 6** below.

Table 5: Pedestrian journey times walking at 1.1m/s on Manchester Street

	Min	Max	Ave			%
Armagh Street to Cashel Street	621	694	638	440	198	31
Cashel Street to Armagh Street	626	676	641	440	201	31
Average time	623	685	639	440	199	31

Table 6: Pedestrian journey times walking at 1.4m/s on Manchester Street

	Min	Max	Ave			%
Armagh Street to Cashel Street	422	484	453	346	107	24
Cashel Street to Armagh Street	427	478	450	346	104	23
Average time	424	481	452	346	106	23

From Table 5 and Table 6 above, it can be seen that the current traffic configuration along Manchester Street (signal cycles times of approximately 77 seconds at each intersection) results in an average cumulative delay at intersections of 199 seconds for pedestrians travelling at 1.1m/s and 106 seconds for pedestrians at 1.4m/s. Note that this does not include any delays caused by lack of footpath capacity or street furniture, which can be an issue on busy pedestrian corridors such as Manchester Street.

Pedestrians travelling at the slower speed not only take longer to complete the route due to their slower speed, but also incur a substantially higher penalty at intersections along the way. This additional delay amounts to an average of 93 seconds above those travelling at 1.4m/s.

Based on observation of the models, and of intersections in action, it is thought that the reason for this is relatively straight forward. A pedestrian arriving slightly early to an intersection will have to wait a short length of time before the walk phase is activated. A pedestrian arriving late to an intersection will have to wait for the entire cycle before the beginning of the next crossing phase enables them to cross. This was also confirmed when looking at two adjacent intersections in Auckland.

This has implications for areas where one might implement a green wave or provide pedestrian coordination, such as where central city areas are linked to public transport terminals via a route with signalised intersections. When engineering a pedestrian green wave, or providing pedestrian coordination between two sets of signals, it is preferable to underestimate the speed of pedestrians rather than over estimate their speed. If the speed is overestimated more people may arrive just after the walk phase and have to wait longer overall. This means that the average delay may actually be increased rather than reduced through a poorly implemented pedestrian coordination system.

It was also found during the course of modelling that it is preferable to reduce cycle times rather than extend green times. Extending a green phase can be logical for cars where there is a need to clear queues, which may exceed the capacity of the intersection if unchecked.

However, in the case of pedestrians, the 'queues' are cleared almost instantly. Extending green times provided less improvement than reducing cycle times. This is likely to be because the benefits of extending green times are experienced only by those arriving during the extended green phase, where as a reduction in cycle times will benefit all those arriving outside of the walk phase as they will have less time to wait until the next walk phase. Where cycle times are dependent on adjacent intersections, extending the pedestrian green phases may be easier than altering cycle times. This would still provide a benefit for pedestrians, but would be less effective than allowing signals to operate independently with a short cycle time during periods of low vehicle flows.

8 CONCLUSIONS

The results of international literature review, modelling, and pedestrian surveys, indicate that there is substantial room for improvement when it comes to improving pedestrian delays and that the current system of weighting delay toward vehicles actually increases the overall delays of road users at intersections.

The pedestrian surveys confirmed concepts encountered through international research, including the fact that beyond about 20-30 seconds the level of frustration associated with delay grows disproportionately to the actual delay itself (as evidenced by disproportionate perceptions of delay). This frustration can in turn lead to traffic safety implications if pedestrians cross between pedestrian cycles.

The research has also confirmed that it is possible to improve the performance of signals to decrease pedestrian delay. This is particularly true outside of vehicle peak periods, where the existing spare capacity means that this can be achieved without a significant increase in delay for vehicles, and in some cases at a benefit to vehicle occupants as well as pedestrians.

When engineering signal design, the overall capacity of the intersection for all users should be considered, not just the vehicle count, as this will have a fairer and more positive effect on per person delay, i.e. allow the road space to be more evenly distributed among the actual road users. The modelling identified that the current delays caused to pedestrians can account for a significant amount of the ‘per person’ delay generated by a signalised intersection. In some of the high pedestrian areas modelled, the pedestrian delay was more than double that of the vehicle delay. This has safety implications as people will avoid waiting if possible, including avoiding signals and crossing informally, a practice known to have safety implications as most pedestrian injuries occur during informal crossing of busy arterials. Reducing delay will make it easier to safely regulate the interaction between pedestrians and vehicles as it will encourage compliance at signals and improve willingness to cross at signalised intersections rather than using less safe alternatives.

The results of the modelling indicated that optimising signals would have a significant benefit for pedestrians and vehicle occupants. The model period was from 12noon to 1:30pm during traditionally busy pedestrian periods. Almost all of the sites studied showed improvement to pedestrian times without adversely effecting vehicle delays. While it is true that the results might have been different during traditional vehicle peaks, this does indicate that there is room to improve pedestrian delays without a cost to vehicles during pedestrian peak periods.

Intersections set up with phase profiles and / or fix timings designed to cater for vehicle peak loading may be under utilised during off peak periods. By creating separate “off peak” settings it would be possible to reduce delays for both pedestrians and vehicles, and this improve the through-put of the intersections at relatively little cost. Signals ‘married’ to adjacent signals to improve peak period vehicle flow could be allowed to operate independently during periods of low vehicle flow, as this would allow for a decrease in cycle length.

In areas where pedestrian volumes are high, consideration should be given to double cycles for Barnes dance settings, even if one of the cross phases is only called during vehicle ‘off-peak’ periods.

However, the modelling indicated that poorly implemented pedestrian priority along a corridor can have a negative impact on pedestrian journey times. To improve pedestrian speeds along a corridor, it may therefore be simpler to look at increasing cycle times of adjacent intersections to reduce average delay, rather than going through a slightly more onerous task of assuming an average walk speed and trying to engineer SCATs to coordinate signals to match that walk speed.

Finally, it has been identified that in order to improve pedestrian travel times there needs to be a change of policy focus. The results of the literature view suggested that the value for time for pedestrians in this country is low by world standards, but it would be hard to argue that our pedestrians contribute any less to the economy than in other countries. As long as pedestrians are disadvantaged through central government value of time policy there will be little incentive for local government agencies to reduce pedestrian delay, as the economic gain will be considered marginal. It is therefore an appropriate time to consider whether the EEM value of time for pedestrians, which was not been updated in a number of years, should be revisited. A review could be undertaken to determine if New Zealand’s approach is consistent with international best practice, as well as determining if the current value is still appropriate given the New Zealand Transport Strategy objective of increasing active modes to 30% of total mode share in urban areas.

At a local government level, standard practice does not yet involve a requirement to consider pedestrians when optimising traffic signals. As a result the effects of signal phasings on pedestrians are not considered. The delay and the economic costs or benefits for pedestrians are unknown. Another way of looking at this is to consider that if pedestrians are not included, the value of time of pedestrians defaults to zero, and their true economic value is overlooked.

It is therefore appropriate to suggest that to improve pedestrian delay, even to a point where their value of time is considered at the current EEM rates, a shift in local government policy is needed to include pedestrians in optimisation and cost benefit formulas. Such a policy would require pedestrian counts and surveys to be included when undertaking any signals optimisation, cost benefit calculations or modelling in CBD areas. To be effective this requirement would need to extend to network consultants and other consultant contracts. Failure to provide this requirement means that the true economic and performance benefits of optimisation will remain unknown.

Serious consideration should also be given to developing local policies of providing separate phasings for vehicle peaks and for off-peak periods where this does not exist already. This would not only reduce pedestrian delay by making better use of spare capacity, but would also likely reduce vehicle delays caused by ‘green wastage’.

The issue of pedestrian delay therefore moves beyond a purely technical issue, as improving the status quo will rely on a policy focus that is genuinely multimodal in its strategic approach and in its local government implementation.

9 References

The primary resource for preparing this paper was the (currently unpublished) draft research report: *Reducing Pedestrian Delay at Traffic Signals*, being produced by Beca Infrastructure on behalf of the New Zealand Transport Agency (the NZTA).

The following resources have also been used in preparing this paper:

- The *Economic Evaluation Manual, Volume 1* (NZTA, updated as of September 2008)
- The *Government Policy Statement 2009* (MOT, 2009)
- The Land Transport Management Act 2003
- The *New Zealand Transport Strategy 2008* (NZTA, 2008)
- The *Project Evaluation Manual* (Transfund 1998)
- The *Sustainable Transport Plan 2006-2016* (ARTA 2007)