THE INNOVATIVE EMPOWERMENT OF INVERCARGILL'S SLOWER WALKING PEDESTRIAN DEMOGRAPHIC

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ABBREVIATIONS AND ACRONYMS

DPCS	Dual Pedestrian Clearance System
PDU	Pedestrian Driver Unit
PCI	Pedestrian Clearance Interval
SCATS IDM	Sydney Co- ordinated Traffic Signals Intersection Diagnostic Monitor
AGMs	Annual General Meetings

1) BACKGROUND

Cook (2013) concluded from research into pedestrian behaviour at traffic signals that many pedestrians at signalised crosswalks globally and in Invercargill were receiving too much pedestrian clearance interval (PCI) time. Conversely, a small number of slower walking pedestrians were receiving insufficient PCI. The PCI is commonly referred to by sighted pedestrians as the 'red man flashing' period at traffic signals.

These slower walking demographic groups include the elderly, disabled, young children and parents with younger children.

These demographics can find the task of crossing wide, heavily trafficked roads very difficult. Many elderly choose to not venture outside their local neighbourhoods on foot. The barriers that many cities arterial routes pose to them are often too great.

Eldror et al (2012) concluded that elderly people need to be educated to the fact that they are not as fast walking across the road as they used to be. Many elderly persons studied correctly evaluated the road situation but underestimated the time it would take them to cross the road.

Jackson (2014) suggests that Invercargill City Council's population is experiencing 'accelerated ageing' and should use this information to develop applicable and timely policies to cater for elderly persons in their strategic Long Term Planning process

2) PROBLEM IDENTIFICATION

The root cause of this problem is inherent in our current push button pedestrian system. This system cannot differentiate between these fast and slower walkers.

AUSTROADS (2003) Traffic Signals - Part 7, pg. 134, indicates that the recommended clearance speeds of 1.0 and 1.2m/s correspond to the 5^{th} and 15^{th} percentile speeds, respectively of walkers. The *AUSTROADS (2003)* recommended walking speed rate of 1.2m/s used to calculate PCI times in Australasia, recognises that 15% of pedestrians using our signalised crosswalks are in the theoretical sense, not provided enough time to cross the road if they commence crossing at the end of the green man period (i.e. just prior to the start of the PCI).

There are instances when insufficient PCI is provided to our slower walkers at traffic signals. However a balance between safe pedestrian amenity and efficient traffic flow must be reached. Practitioners are aware that using a walking speed rate of 1.0m/s to calculate PCI would generally provide a very safe and amenable service for most pedestrians. However, this action would also have a significant negative cumulative effect on pollution, travel time and fuel use at our crosswalks. If only the push button could differentiate between these slower and faster walkers. The remaining sections of this paper describe a new pedestrian system for signalised crosswalks. The system named the Dual Pedestrian Clearance System (DPCS) has modified the use of the current push button at traffic signals, to differentiate between slower and faster walkers.

3) THE STAKEHOLDER PROCESS

The DPCS is kiwi made, kiwi designed and is designed by the DPCS stakeholder group in Invercargill, the users of the system. The group consisted of representatives from elected members of Council, NZ Police, Southland Deaf Community, The Blind Foundation, The Association of Blind

Citizens, Southland Epilepsy, Disabled Persons Assembly, Disability Resources Centre, IDEA Services, Plunkett, Age Concern, Grey Power, Road Safety Southland, Te Runaka O Waihopai, ACC, Southern DHB, Hearing Southland, National Party MP, Automobile Association, CCS Disability Action, Parent to Parent and RCA Traffic Engineers. The group was formed to discuss the proposed system and recommend changes prior to the launch date of August 4, 2014. Workshops on the 30 April and 10 July 2014 were convened. Outcomes from this process were the introduction of an audible message system and braille labels to assist blind persons and all persons unfamiliar with the system. The group was effective in spreading the message about the new pedestrian system to their members and ensuring that the system catered for the needs and particular disabilities of their members, prior to the DPCS launch date. This extensive, pre-launch consultative process better ensured the success of the DPCS.

4) THE DPCS TRIAL

The DPCS trials a prototype pedestrian driver unit (PDU). The prototype, unlike our conventional pole mounted PDUs, is mounted in the controller unit. It is isolated from harsh weather elements in a secure, easily accessible environ.

Importantly the prototype PDU provides 2 distinct functions.

Function 1 provides the normal crossing functions. Audible tactile facilities for the blind are provided during the green man display. The normal PCI based on 1.2m/s is provided also.

Function 2 also provides the audible tactile facilities and PCI period. However the PCI provided with Function 2 is longer than normal and is based on a walking speed rate of 1.0m/s*. Austroads 2003* recommends the use of 1.0m/s to calculate PCI when there are large numbers of elderly, disabled or slower walkers in the vicinity of the crosswalk. Locations close to hospitals, rest homes or vocational facilities could warrant this. The DPCS uses the 1.0m/s guideline in the calculation of the longer PCI provided by Function 2.

Function 2 is activated by a 3 second push of the pedestrian button. A red LED activates on the pedestrian call unit and an audible 'be beep' sound emits to confirm that the longer PCI has been activated. Braille labels advising blind persons to 'Hold for 3 sec' have been placed on the push buttons.

Anyone unfamiliar with the DPCS receives an audible prompt when they push the button. The audible voice message system advises them that a longer crossing time is available to them if they need it. Signage on the pole for all sighted persons also conveys the same message. Figure 1 shows the integrated DPCS Trial Hardware with audible voice message unit, pole signage and new pedestrian call unit. Figure 2 is a close up view of the audible voice message unit. Figure 3 is a close up view of the signage advising that longer cross time can be chosen, if needed. Figure 4 is a close up view of the activated red LED light indicating a longer crossing time and the braille label advising blind persons to hold for 3 seconds. Figure 5 shows the pole mounted signage and pedestrian call unit with activated red LED light indicating to pedestrians that a longer crossing time has been chosen.

Figure 1 - Integrated DPCS Trial Hardware showing audible voice message unit, signage and new pedestrian call unit with red LED and braille label

Figure 2 - DPCS Audible Voice Message Unit which announces to pedestrians that a longer crossing time can be chosen, if they need it, by holding the button in until it beeps and red LED activates

Figure 3 - DPCS Pole mounted metal signage advising pedestrians that a longer crossing time can be chosen, if they need it, by holding the button in until it beeps and red LED activates

Figure 4 -Red LED indicating longer crossing time chosen and braille label advising 'Hold for 3 sec'

Figure 5 - DPCS Signage and call unit with red LED activated, advising pedestrians that longer crossing time has been chosen

These features, braille and audible voice messaging are common place now , globally. They are located in our modern lifts, modern buses, and public toilets and even at supermarket self-service checkout counters. Invercargill's pedestrians are comfortable with and not intimidated by their use at this trial crosswalk.

The DPCS aims to detect the presence of either a slow or a fast walker.

This form of new, innovative pedestrian detection I refer to as 'Differential Pushbutton Pedestrian Detection'.

The Dual Pedestrian Clearance System (DPCS) Trial commenced at a 'T' intersection, St Andrews Street and Queens Drive, in Invercargill on August 4, 2014.

The DPCS is potentially, a world's first. To the best of my knowledge and research, this innovation has not been used anywhere else in the world at traffic signals.

5) TRIAL GOALS AND DURATION

With Function 1 and Function 2, the primary goals are the safety of our pedestrians and reliability of the hardware and software componentry. A third goal for Function 2 is user comprehension. This function has empowerment capabilities for our slower walking pedestrians. It can empower them with longer crossing time if they need it. It is therefore vitally important that our pedestrians comprehend that there is longer crossing time available and how they activate that option. If the pedestrians interacting with the DPCS do not gain comprehension of Function 2, then the DPCS is not going to work. The system will not provide the pedestrian empowerment benefits it has been designed for.

The trial duration is 6 months and ends on 3 February 2015.

6) FINDINGS

Function 1 and 2 has proved to be safe and reliable for the 16 weeks to date that the DPCS has been operating at the time of preparing this paper.

SCATS IDM data shows that an average of 32% of all pedestrians demands, which approximate to 500 per week, are for the longer PCI. Figure 6 shows the percentage values for the first 16 weeks of operation.

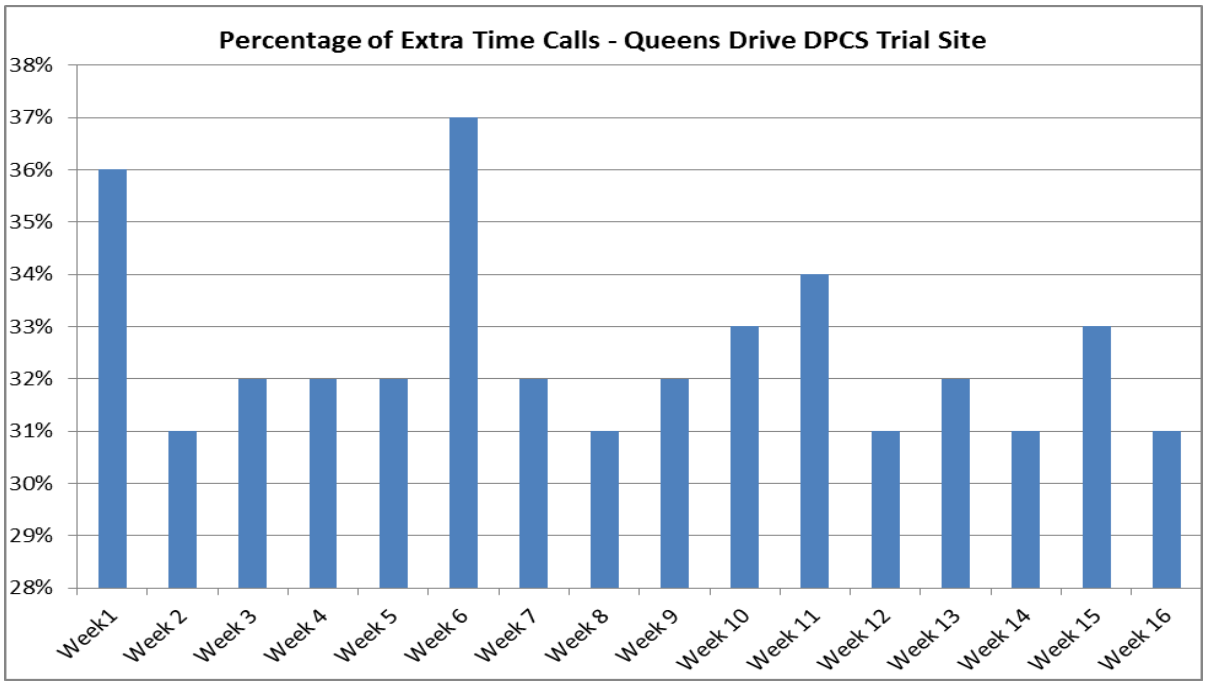

Figure 6 – Percentage of Extra Time Calls, Queens Drive DPCS Trial Site

This statistic strongly indicates a good level of comprehension and respect for the DPCS from all pedestrians interacting with it.

A percentage of 85 to 90% for the long PCI would strongly indicate that the DPCS is comprehended but being abused by the users. The DPCS is being used as a 'toy' to activate the red LED light, 'be beep' sound and to delay traffic intentionally.

Conversely a percentage of 5 to 10% would indicate that the DPCS is not comprehended by users. Our users are either not realising that a longer PCI is being offered or they are realising this and not comprehending the instructions on how to activate the longer PCI.

The result of 32% is in the right vicinity. I estimate that in 12 to 24 months' time, this percentage could reduce to around 25%. There is no right or wrong answer for this percentage value. This value will vary in accordance with the demographical composition of users at each site and the proximity of the crosswalk to places such as rest homes, hospitals, schools and vocational facilities. A reasonable range of percentages could be 15 to 50%. Anything higher or lower than these values could indicate either abuse or non-comprehension of the system in that location.

Video footage from a camera filming pedestrian movements at the crosswalk shows the vast majority of pedestrians calling the long PCI are from the slower walking demographic. These

include mums with young children and prams, young children, elderly and disabled persons. Intuitively, the system appears to be working.

These results and observations indicate that the DPCS is self-explaining. It is a legitimate standalone facility that could be installed in isolation anywhere and still be comprehended. The need to undertake extensive educational and publicity campaigns to better ensure comprehension and correct use is not required with the DPCS. There are many examples of vulnerable user systems that are not self-explaining. Cyclist hook turns are an example. They are a great idea but they are not intuitively understood by all cyclists and motorists. They are not self-explaining and because of this the full benefits from the initiative are not realised.

Our stakeholders from the disability, health, political, early childhood, education, transport, elderly and community sectors, all speak positively about the new system. I have been invited to numerous meetings, functions and AGMs to present this system.

The NZ Police are supportive of the trial. They have observed the crosswalk looking for any signs of driver frustration and abuse by pedestrians. They have observed nothing negative to date from the road user perspective. The DPCS is unobtrusive. It is difficult from a motorist's perspective to even know that a new system for pedestrians is operating.

There have been no reported pedestrian safety incidents with the DPCS and it has been working reliably for the first 16 weeks of operation. The dual push button function provided by the prototype pedestrian driver unit has been operating reliably.

Increase in vehicle delays incurred by the longer crossing times have not been measured in this analysis. It should be noted that longer pedestrian clearance intervals are not always going to produce additional vehicle delays at this trial cross walk. The volume of side road traffic interacting with pedestrians on the crosswalk during the longer clearance interval's, is in many cases sufficient to extend their vehicle green time, past the termination of the pedestrian phase. In these instances, additional vehicle delays for the next signal phase are not produced.

7) CONCLUSIONS

The DPCS is a beneficial step forward for the very old pedestrian push button technology used currently at most signalised crosswalks globally. The DPCS is an adaptation of the current push button system that does not cater adequately for the rapidly increasing number of slower walkers interacting with it, in a changing environment with heavier traffic flows and greater crossing distances.

The PCI imbalance problem for slower walkers inherent in our current pedestrian push button detection system in Invercargill and throughout most crosswalks in the world, is addressed by this system. The DPCS provides pedestrians with a choice of PCI. That choice is based on their own individual walking ability, confidence and speed.

The trial DPCS system is working safely and reliably in Invercargill. There have been no reported safety incidents involving pedestrians and the prototype pedestrian driver unit has been performing reliably.

Users comprehend and respect the DPCS system and there is wide ranging community support within Invercargill for it. The DPCS is self- explaining and is installed in isolation. The DPCS does not require extensive educational campaigns to inform pedestrians of its correct use and purpose. The audible messaging unit announcing to pedestrians that a longer crossing time can be chosen , if they need it, is the key component that enables the comprehension and correct use of the DPCS.

The DPCS can provide the Community Outcomes that many Local Authorities are seeking for their ageing and slower walking demographic.

8) APPLICATIONS

The potential applications of the DPCS are many. They include:

- Asset Management Plans and PDU replacement programmes,
- New signalised installations
- Existing wide carriageways where the physical and psychological task of crossing is greater for our slower walkers
- Crosswalks on steep gradients
- Signalised crosswalks highlighted by crash studies as a risk for vulnerable pedestrians,
- Network Operating Frameworks and Plans, pedestrian priority and 'friendly' zones and routes
- An 'encouragement' measure for accessibility, walking, older persons, vulnerable person's plans and strategies
- Crosswalks in close proximity to hospitals, rest homes, vocational facilities and schools.

9) NEXT STEPS

I will report to the Invercargill City Council on the success or otherwise, of the first trial crosswalk. A full report evaluating the first 6 months of the trial and the meeting of the trial goals, will be provided. Given the results to date, it is likely that I will recommend the introduction of a pedestrian friendly route along the same minor arterial route that the trial DPCS is installed on (Queens Drive). I will recommend installing 5 DPCS crosswalks in succession. This arterial route has many elderly persons living in close proximity. It is a popular walking route to access Invercargill's main CBD and Queens Park, a popular recreational destination. Many children and disabled persons use this corridor also. Council has not formulated a Network Operating Framework and Plan yet. This pedestrian friendly route could be the precursor to its implementation.

The DPCS will be included in Councils Asset Management Planning processes. The new prototype pedestrian driver unit will be used to replace Councils existing pole mounted pedestrian driver units, when they are no longer functional.

Hamilton City Council and Dunedin City Council are also considering installation of the DPCS within their networks.

10) REFERENCES

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