Pedestrian LOS at Signals

Presentation to the SNUG workshop
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VIASTRADA
TRAFFIC ENGINEERING AND PLANNING

Background

- "City for People Action Plan" adopted by CCC
  - Resulting from Jan Gehl study "Public Space Public Life"

ACTION			TARGETS				
#	Public Space Public Life Recommendations	A City for People Action Plan Recommendations	LTCCP 2009-2019	LTCCP 2012-2022	LTCCP 2015-2025	LTCCP 2018-2028	New Aligned Existing
1	Create a high quality walk along Colombo Street from Victoria Square to the new Transport Interchange square	Develop a concept plan for a Colombo Street upgrade from Victoria Square to the new Transport Interchange Square (including investigation of shared priority for pedestrians, cyclists and public transport/pedestrian waiting time displays at traffic lights/excluding private vehicles)	Develop Concept Plan	TOP 5 ACTION			NEW
2	Investigate changing Colombo Street to shared priority for pedestrians, cyclists and public transport (excluding private vehicles)						
3	Provide waiting time displays at traffic lights to increase pedestrian priority						
4	Increase pedestrian priority at intersections including reduced waiting times	Review LTCCP levels of service to provide better recognition of pedestrians	Review levels of service				
		Review traffic light (SCATS) operations with the objective of providing higher pedestrian priority including extended 'green person' crossing times					

- Presentation outlines **methods** of improving ped **level of service** (LOS) at traffic signals in central Christchurch

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Acknowledgements

- Client: Christchurch City Council
  - Susan McLaughlin
- External advice
  - Bill Sissons (Aurecon)

Project

Stage 1

- Refining the LOS process
- Measuring the LOS for the intersections in the study area
- Prepare a toolkit of measures to improve LOS
- Suggest and agree an implementation strategy

Stage 2

- Preferred option for each intersection in the implementation area – could involve network modelling

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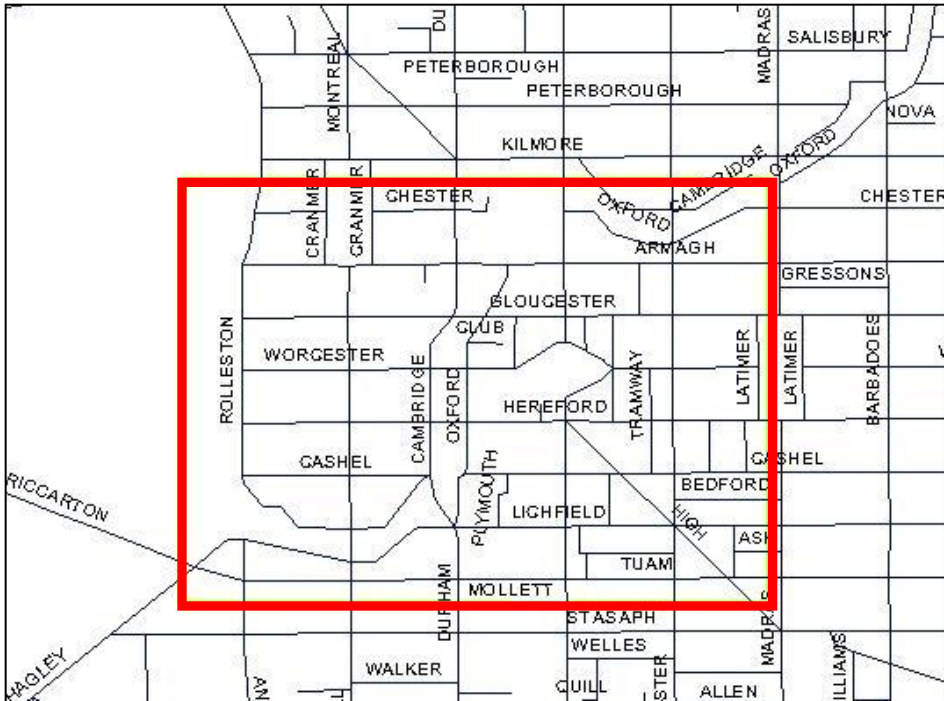
Study Area

- Study area
  - 32 traffic signal sites
  - 110 pedestrian crosswalks



Defining LOS

Final method used in the study

- **Crossing distance**: measured from the point where a crossing pedestrian would first become exposed to passing traffic until the point where the pedestrian is once again clear of the passing stream.
- **Delay time**: The average length of time between walk phases
- **Green time ratio**: Ratio of delay to crossing green time
- **Exposure to risk**: determine risk based on car turning volumes and pedestrian crossing volumes

LOS criterion 1 - Crossing distance

- Obviously the shorter the better
- But what is unacceptable?
- In USA (Dixon) they say less than 60 feet (18.3 m) is good
- The streets in this study area are generally 14 m wide

LOS Criteria	Raw data	Score
Crossing distance	<10	100
	10-13.5	70
	13.5-17	40
	>17	0

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LOS criterion 2 – Pedestrian delay

- Calculated the **average delay per pedestrian** for each crosswalk $D = \frac{(C-G)^2}{2C}$
- Based on cycle length and green time
- Based on random arrivals and all pedestrians comply with signals
- Research indicates risk taking behaviour increases after 30 sec
- Worst case = 34 sec

LOS Criteria	Raw data	Score
Delay	<14	100
	14-22	70
	22-30	40
	>=30	0

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LOS criterion 3 - Green time ratio

- Ratio of delay to green time
- Proxy for how much time system allocates to pedestrians
- Small delay and long green time gives lowest ratio and hence best score
- Crosswalks on one way street approaches have the best green time ratio – an up side of one way streets?

LOS Criteria	Raw data	Score
Green time ratio	<1	100
	1-3.0	70
	3.0-5.5	40
	>=5.5	0

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LOS 4 criterion - Risk

- Considers the conflicting movements pedestrians are exposed to on a cross walk
- Considers vehicle and pedestrian volumes

Vehicle conflicts with pedestrian movements	Peak volume (am + pm)	Score		
Both Right Turn and Left Turn	>600	0	0	0
	250-600	12	18	25
	<250	30	40	50
Right turn only	>400	5	15	25
	150-400	30	40	50
	<150	55	65	75
Left turn only	>500	30	40	50
	150-500	55	65	75
	<150	70	80	90
No conflicting movements	NA	100	100	100
		<6	6-25	>25
		Ped movements per 5 min		

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Weighting of each LOS criterion

- Distances harder to influence
- Delay and green time ratio related to level of service and an influence on safety (impatience, risk taking)
- Risk found to be biggest influence on perceived safety and comfort – more weight

LOS criteria	Weighting
LOS1 - Crossing distance	10%
LOS2 - Delay	25%
LOS3 - Green time ratio	25%
LOS4 - Risk	40%

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LOS Scoring

- LOS A - score of 80-100
- LOS B - score of 60-79
- LOS C - score of 40-59
- LOS D - score of 20-39
- LOS E - score of 10-19
- LOS F - score of 0-9

LOS	Crosswalks
A	10
B	11
C	14
D	33
E	29
F	11

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Measures and influence on LOS

Tool	Crossing distance	Delay	Green time ratio	Risk	Other
Reduce cycle time		++	++		
Lengthen pedestrian phase		++	++	-	
Barnes Dance	+	+	+	++	
Phasing changes				++	
Protection against conflicting movements				++	
Reduce number of turning lanes				++	
Kerb build outs	++				
Green waves		+	+		
Automatic call demands		+			++
Retrofit missing crosswalks				++	
Pedestrian countdown timers					++
Near side signals					++

++ Definite benefit
+ Possible benefit
- Disbenefit

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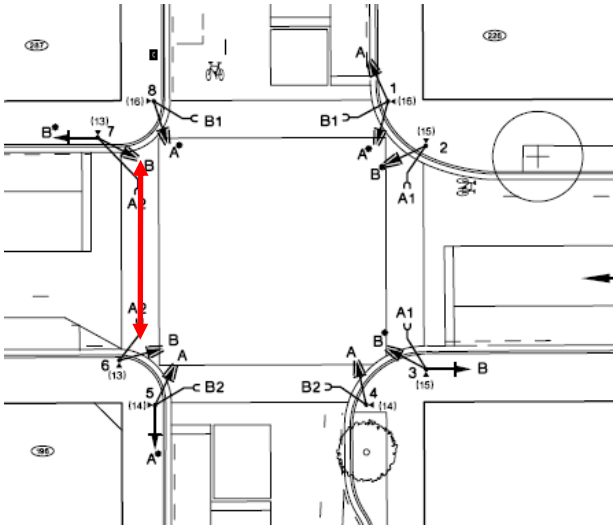
Measure – Reduce cycle time



- Impact
  - Average delay reduced = LOS improved
  - Example: Armagh/Manchester P3 (west)
  - 80 second cycle time = Score 9 (LOS F)
  - 40 second cycle time = Score 44 (LOS C)
- Issues
  - Depends on when cycle time reduction occurs – needs modelling
  - Will increase vehicular delays resulting from increased pedestrian priority at most intersections in the study area

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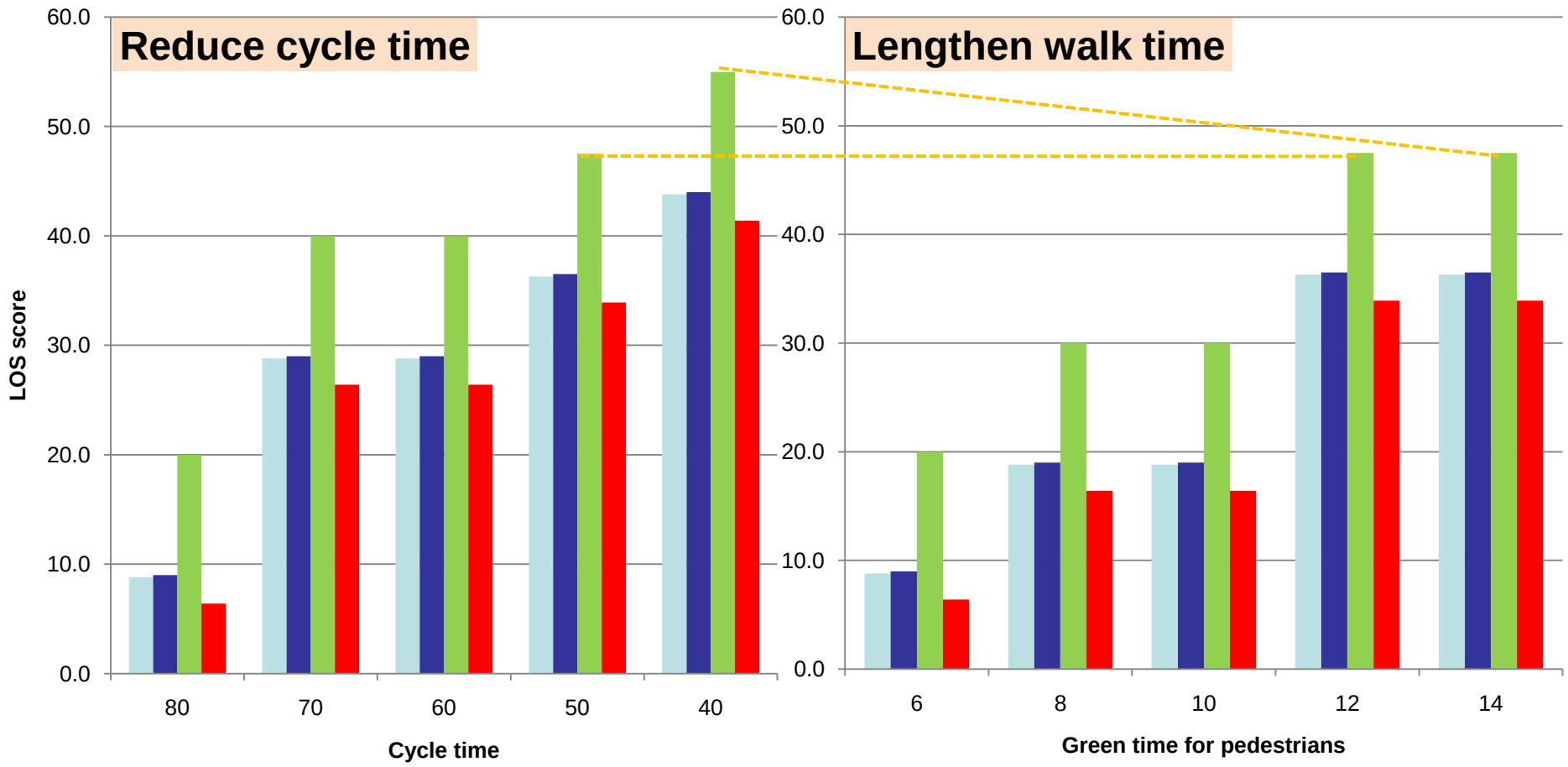
Measure – Increase green walk time

- Impact
  - Improves average delay and green time ratio
  - Example: Armagh/Manchester P3 (west)
  - 6 second green time = Score 9 (LOS F)
  - 10 second green time = Score 19 (LOS E)
  - 12 second green time = Score 36 (LOS D)

- Issues
  - Likely to increase vehicular delays resulting from increased pedestrian priority – but less than reducing cycle time
  - Risk possibly (probably?) increased as exposure to turning traffic increased (not taken into account on spreadsheet)
  - Mutually exclusive measure – can't reduce cycle time as well

Compare cycle time & green time changes



Compare cycle time & green time changes

- Concluded that greatest LOS improvement is achieved through cycle time reduction
- However need to balance with impacts on motor vehicle capacity in the city
  - too much delay unlikely to be accepted
- Next best option increase green walk time

Stage 2 – Implementation

- In Stage 2 assess each crosswalk in the study area and determine how improvements can be achieved
  - consider network effects & may require modelling
  - assess new LOS
- To be done in Nov / Dec 2010
- Implementation in first half of 2011
- Can apply this methodology to other areas

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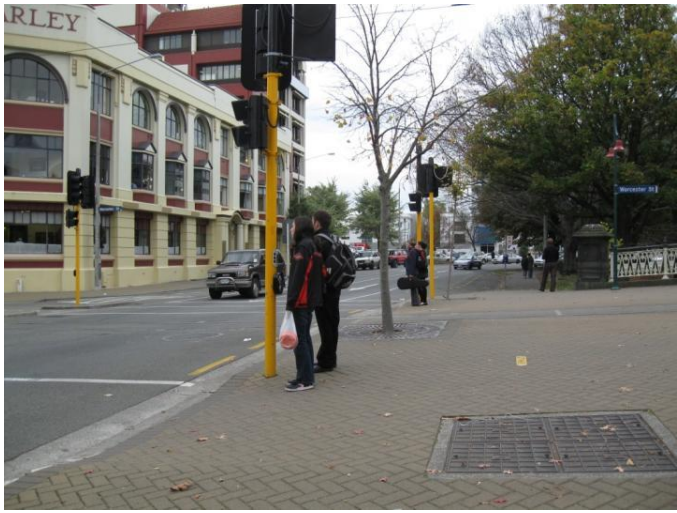
Questions & Contacts

Questions welcome



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