SNUG Workshop - 21 November 2008

Right Turn Protection
Christchurch Policy Development

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VIASTRADA

TRAFFIC ENGINEERING AND PLANNING

Presentation Outline

- Background
- Phase One - complete
  - process and draft criteria
  - a test case using process and criteria
- Phase Two – in progress
  - analysis of all Chch intersections
- Conclusions (so far)

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Background

- Requests from the public/politicians/engineers for right turn protection
  - delay, frustration and safety concerns
  - LOS issues in network
- Current policy 10 years old
  - cites safety and efficiency but with no thresholds
  - public expect quantifiable investigation these days
- Greater focus on safety (GPS, NZTS)
- CCC commissioned ViaStrada
  - to come up with process and criteria, and
  - to test these on two intersections

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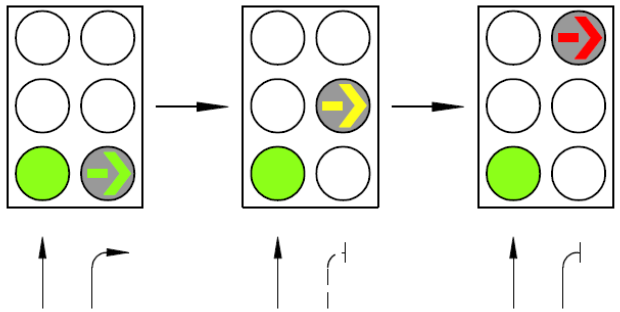
Phase 1 of the study

- Process and Criteria development
  - Look at national practices
    - Some RCAs have historically not allowed filtering
    - Manukau City had the most developed set of safety criteria
    - Northshore City had useful volumes related criteria
  - National and international literature review
    - Some overseas warrants – efficiency based
    - Varying estimates of crash reduction from protection
  - Design standards (Austroads)
    - Geometry related issues

- 90 percent reduction for a lead right turn, followed by a red arrow (no filter).



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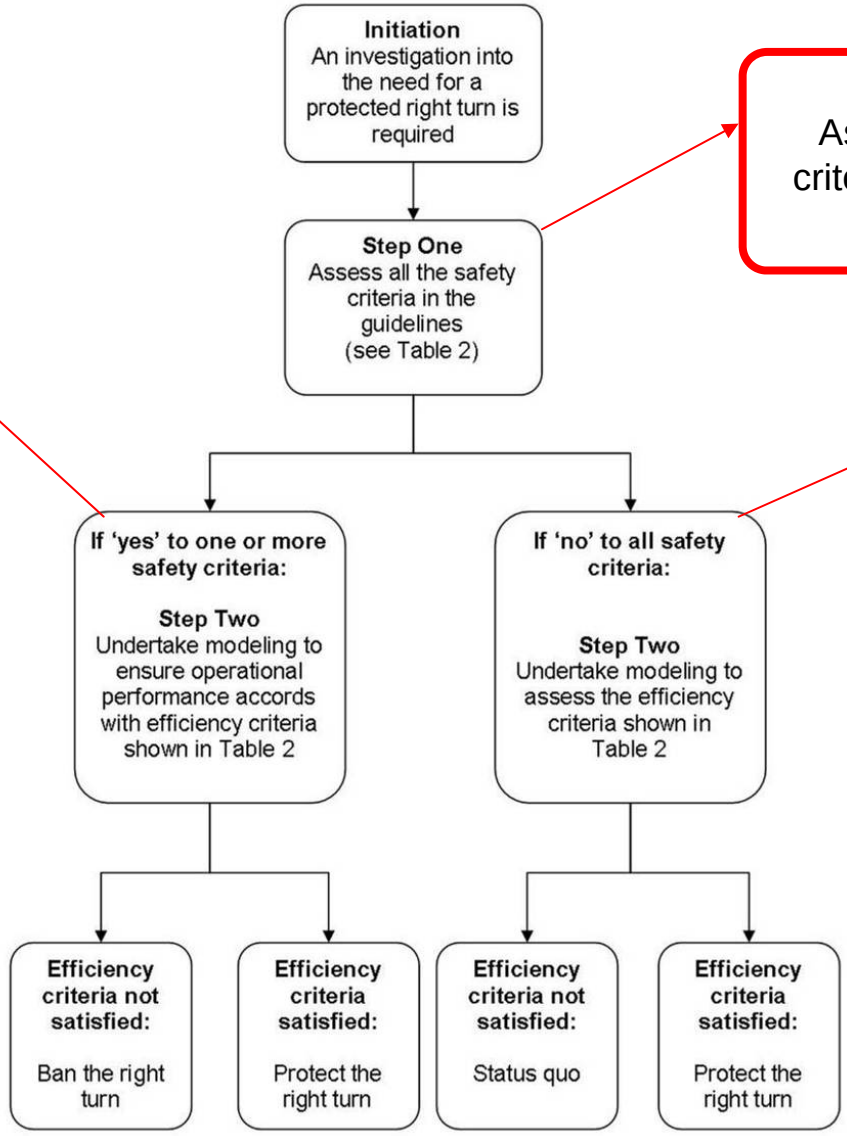
Phase 1 – draft criteria

Criteria for protected right turn	
Safety	More than five injury right turn against crashes at the approach of interest in the last five years.
	More than fifteen reported non-injury crashes at the approach of interest in the last five years.
	Inadequate visibility (taking into account horizontal and vertical alignment) and approaching through traffic hidden from view by queued right turning traffic.
	More than two through lanes opposing the right turn.
	Two or more right turn lanes.
	Two or more opposing left turn lanes.
	The 85th percentile operating speed of the opposing traffic is equal or greater than 70 km/h.
	The right turn flow is more than 120 vehicles per hour and is opposed by more than: ○ 900 vehicles per hour when there is one opposing traffic lane; or ○ 700 vehicles per hour in any one lane when there are two or more opposing traffic lanes.
	A need to protect pedestrians on a pedestrian crossing phase, identified by: ○ Three pedestrian crashes on the departure crosswalk of the right turn movement of interest in the last five years; or ○ A high proportion of vulnerable pedestrians using the crosswalk.
Efficiency	The average intersection delay is not increased more than 20%.
	The average intersection delay is not greater than 55 seconds per person.
	The practical spare capacity of the intersection is not reduced below -5%.
	The proposal may achieve bus priority.

Phase 1 – draft process



Step One
Assess all the safety criteria in the guidelines (see Table)

If 'yes' to one or more safety criteria:

Step Two
Undertake modeling to ensure operational performance accords with efficiency criteria shown in Table

If 'no' to all safety criteria:

Step Two
Undertake modeling to assess the efficiency criteria shown in Table

Efficiency criteria not satisfied:

Ban the right turn

Efficiency criteria satisfied:

Protect the right turn

Efficiency criteria not satisfied:

Status quo

Efficiency criteria satisfied:

Protect the right turn

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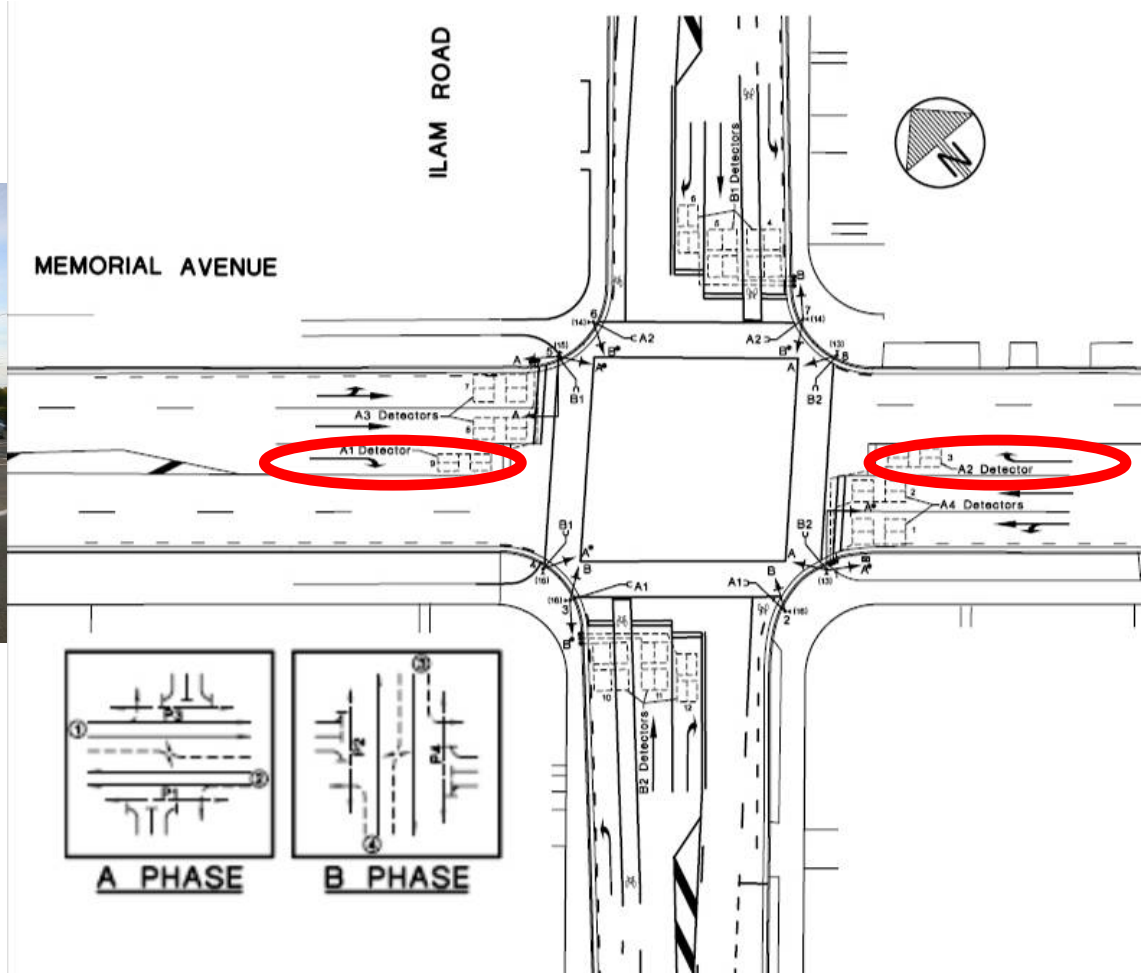
Test case

- Memorial Ave / Ilam Road intersection



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Test case 1 - outcomes

	Criteria for protected right turn	Criteria met?
Safety	More than five injury right turn against crashes at the approach of interest in the last five years.	X
	More than fifteen reported non-injury crashes at the approach of interest in the last five years.	X
	Inadequate visibility (taking into account horizontal and vertical alignment) and approaching through traffic hidden from view by queued right turning traffic.	X
	More than two through lanes opposing the right turn.	X
	Two or more right turn lanes.	X
	Two or more opposing left turn lanes.	X
	The 85th percentile operating speed of the opposing traffic is greater than 70 km/h.	X
	The right turn flow is more than 120 vehicles per hour and is opposed by more than: o 900 vehicles per hour when there is one opposing traffic lane; or o 700 vehicles per hour in any one lane when there are two or more opposing traffic lanes.	X
	A need to protect pedestrians on a pedestrian crossing phase, identified by: o Three pedestrian crashes on the departure crosswalk of the right turn movement of interest in the last five years; or o A high proportion of vulnerable pedestrians using the crosswalk.	X

		Opt 1 am	Opt 2 am	Opt 3 am	Opt 4 am
Am Efficiency	The average intersection delay remains within 20% of the existing average intersection delay.	X	X	X	√
	The average intersection delay is not greater than 55 seconds per person.	√	√	√	√
	The capacity of the intersection is not reduced below -5%.	√	√	√	√
	Bus priority is achieved.	√	√	√	√
		Opt 1 pm	Opt 2 pm	Opt 3 pm	Opt 4 pm
Pm Efficiency	The average intersection delay remains within 20% of the existing average intersection delay.	√	√	√	√
	The average intersection delay is not greater than 55 seconds per person.	√	√	√	√
	The capacity of the intersection is not reduced below -5%.	√	√	√	√
	Bus priority is achieved.	√	√	√	√

Conclusions:

Implement a lead right turn for the western Memorial Ave approach, then filtering on both approaches

This improved efficiency and provides bus priority for the bus service

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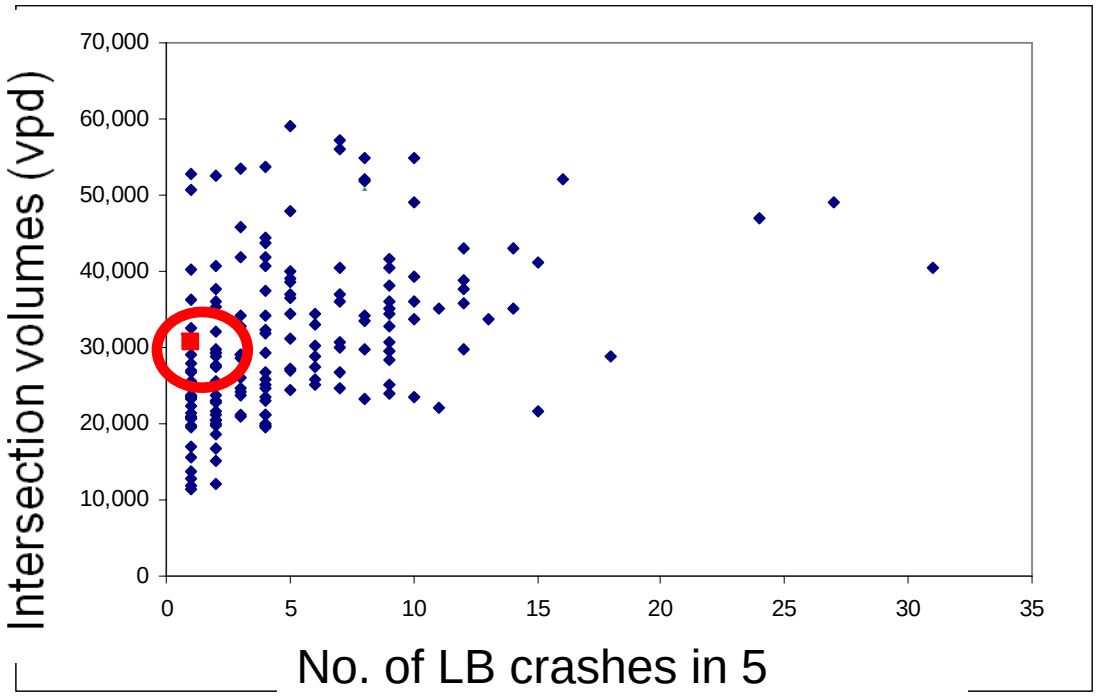
Phase 1 – basic citywide analysis

- Comparison with all other signals in Chch



- This analysis is not ‘legs’ based

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Phase 1 conclusions

- Safety criteria
  - Maybe 5 crashes in 5 years too high for Chch
  - Need to consider pedestrian exposure better (risk)
- Efficiency criteria need to be fine tuned, could be different for different road types/routes
- Most cost effective approach is to treat intersections with greatest potential to reduce crashes – also meets safety targets

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Phase 2 Study

- Objectives:
  - To study RT crashes and crashes between peds and turning vehicles for each leg
  - To rank intersections in Chch in terms of priority for RT treatment, based on safety needs
  - To refine process and criteria thresholds

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Phase 2 – data required

- Use GIS to present spatially
- Crashes from CAS, but needed some manipulation
  - LB crash type for right turn crashes
  - NC, ND, NE and NF ped crashes
  - determining which road was the side road, some inconsistencies in recording crashes
  - Transfer results to Excel to manipulate
- Ped volumes from IDM as proxy measure

  (IDM = intersection diagnostic monitor)

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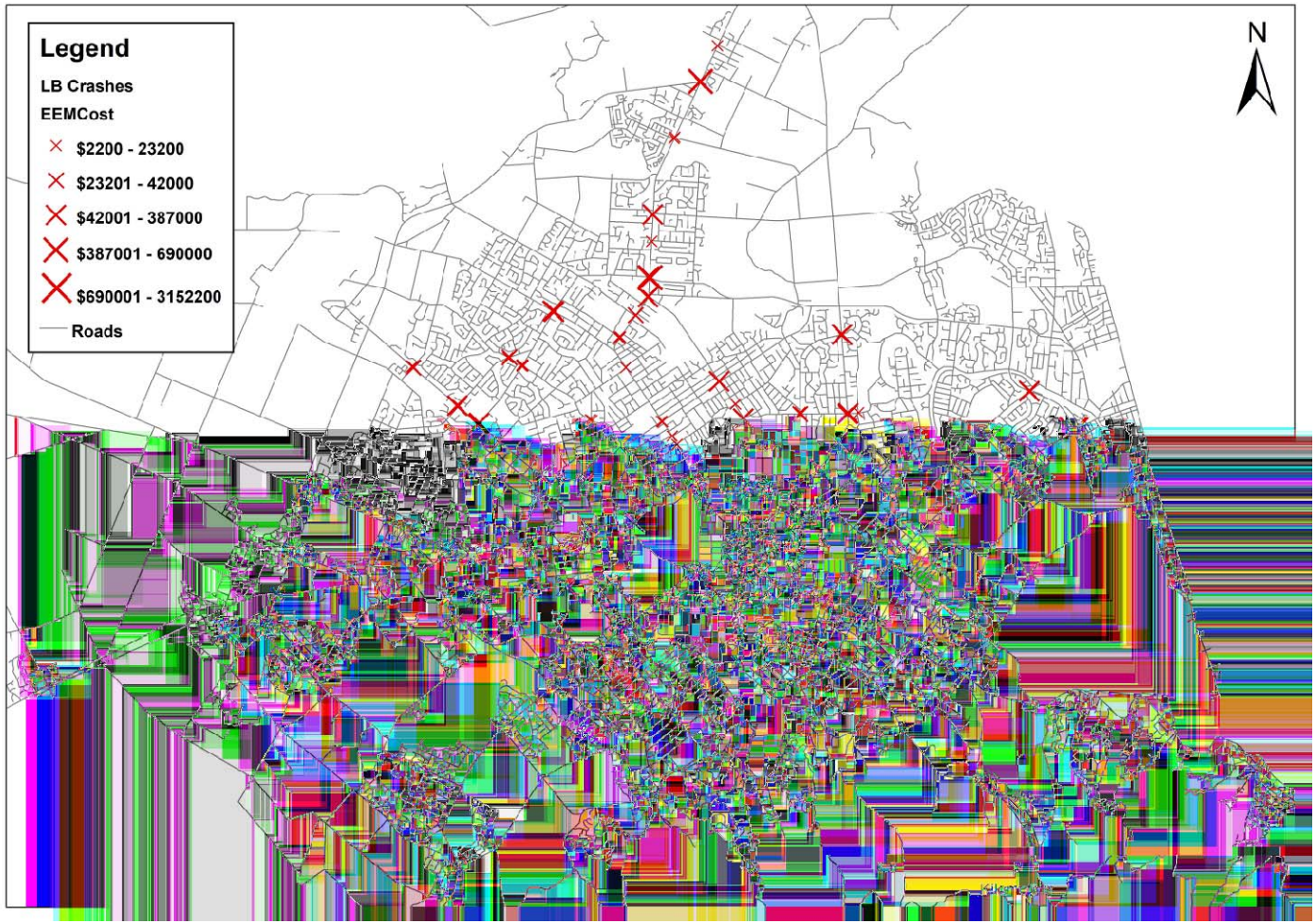
Phase 2 - LB crashes (ranked by cost)

- First method of ranking based on EEM costs
  - ($3.15 mill for fatal, $345,000 for serious, etc)



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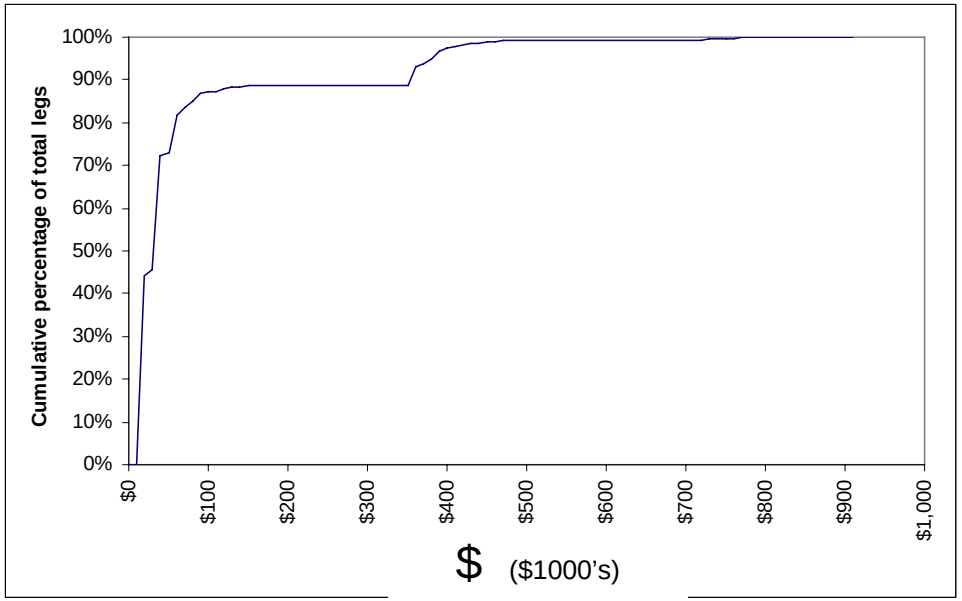
Phase 2 - ranking system

- It was observed that this method gave undesirable distributions
  - several clusters of legs with very little variation within clusters
  - great variation between clusters.



- We needed a new ranking system!

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Phase 2 - new ranking system

- No suitable existing system was found, use engineering judgement and understanding of Chch intersections
- Requirements of the points system:
  - points values should be more closely spaced than EEM crash costs
  - points values for pedestrian crashes should be more closely spaced than those of LB crashes
  - points for a pedestrian injury (except fatal) should be higher than points for LB crash of same severity

	Fatal	Serious	Minor	Non-Injury
Pedestrian	8	7	5	4
LB	8	6	4	2

Phase 2 – refinement of the ranking

- Low numbers of pedestrian crashes
- High degree of randomness involved in the occurrence of pedestrian crashes
- No clear relationship between ped crashes and predictor variables such as demand was found
- It seemed logical to combine the LB and pedestrian data

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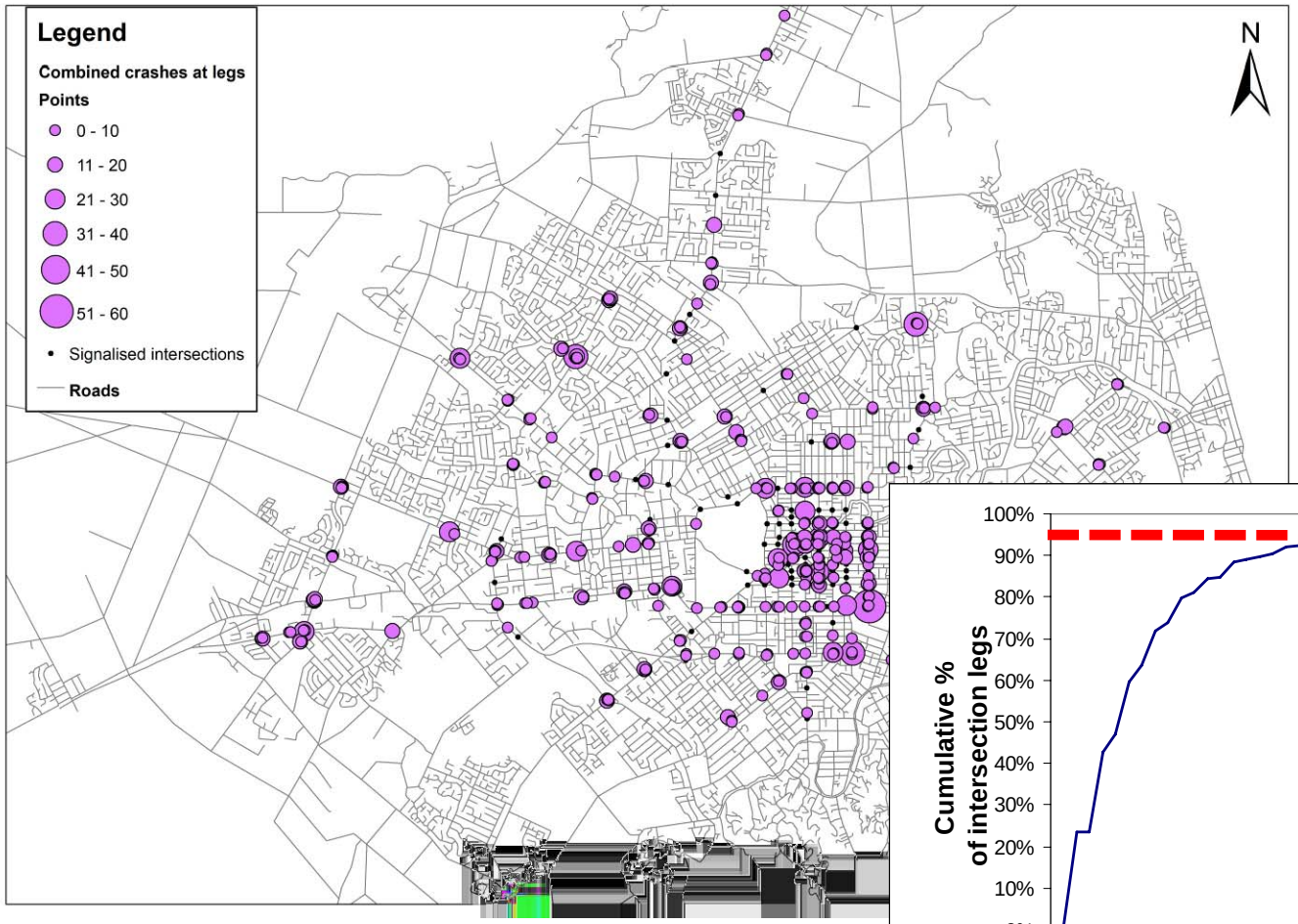
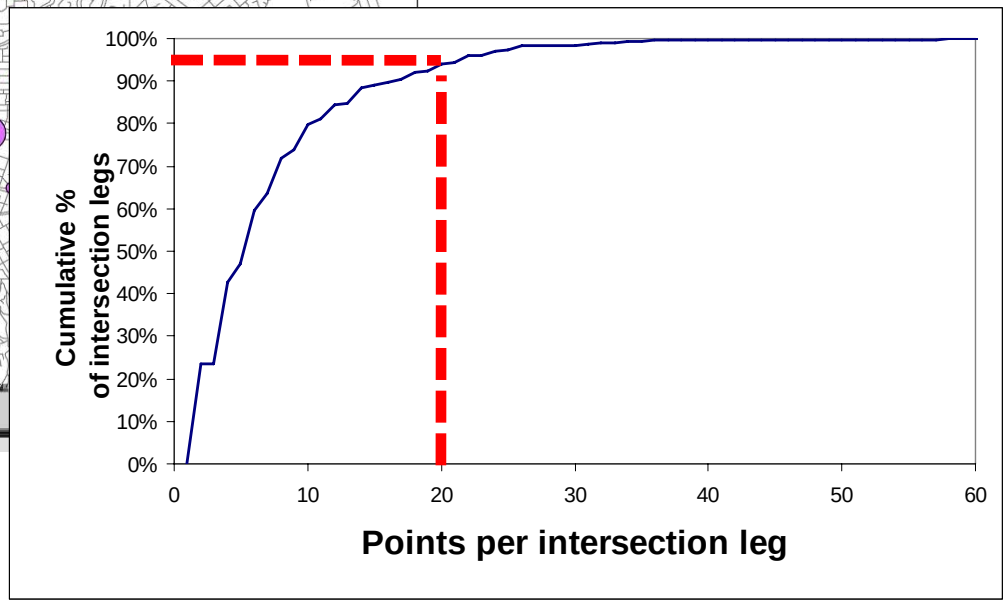
Phase 2 – combined LB and ped points





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Phase 2 – combined LB and ped crashes

Intersection Name	Leg	LB Injuries	LB NI	Total Ped	TotalCrashes	Combined EEM Cost	Combined EEM Rank	Total Points	Total Points Rank	Meets criteria? >5 injury crashes	Meets criteria? >15 NI crashes	Meets criteria? > 3 ped crashes
Manchester/Moorhouse/Pilgrim	E	10	9	0	19	$ 229,800	27	58	1	√	X	X
Main North/Northcote/Queen Elizabeth II	E	3	11	0	14	$ 411,200	9	36	2	X	X	X
Bealey/Manchester	W	2	14	0	16	$ 72,800	35	36	2	X	X	X
Gloucester/Latimer East/Madras	E	6	5	0	11	$ 137,000	28	34	3	√	X	X
Johns/Main North	N	6	3	0	9	$ 456,600	7	32	4	√	X	X
Brougham/Waltham	N	5	1	1	7	$ 776,200	2	31	5	X	X	X
Fitzgerald/Gloucester	S	2	7	1	10	$ 402,400	11	29	6	X	X	X
Dyers/Linwood	W	3	6	0	9	$ 400,200	12	26	7	X	X	X
Clarence/Riccarton/Straven	S	5	3	0	8	$ 111,600	29	26	7	√	X	X
Antigua/Tuam	S	2	2	2	6	$ 736,400	3	26	7	X	X	X

Note: No.1 under EEM was Carmen / Waterloo (ped fatality), now 18th under points system

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Conclusions (so far)

- Points system for ranking gives better distribution
- Proposal to combine ped and LB crashes
- Initial safety thresholds too high for Chch
- The results of ranking are a snapshot in time
- Still need to assess efficiency at each intersection (efficiency criteria still a work in progress)

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Thank you

Questions & discussion

Any further queries or feedback to:

Jeanette Ward

Megan Fowler, or

Axel Wilke

www.viastrada.co.nz

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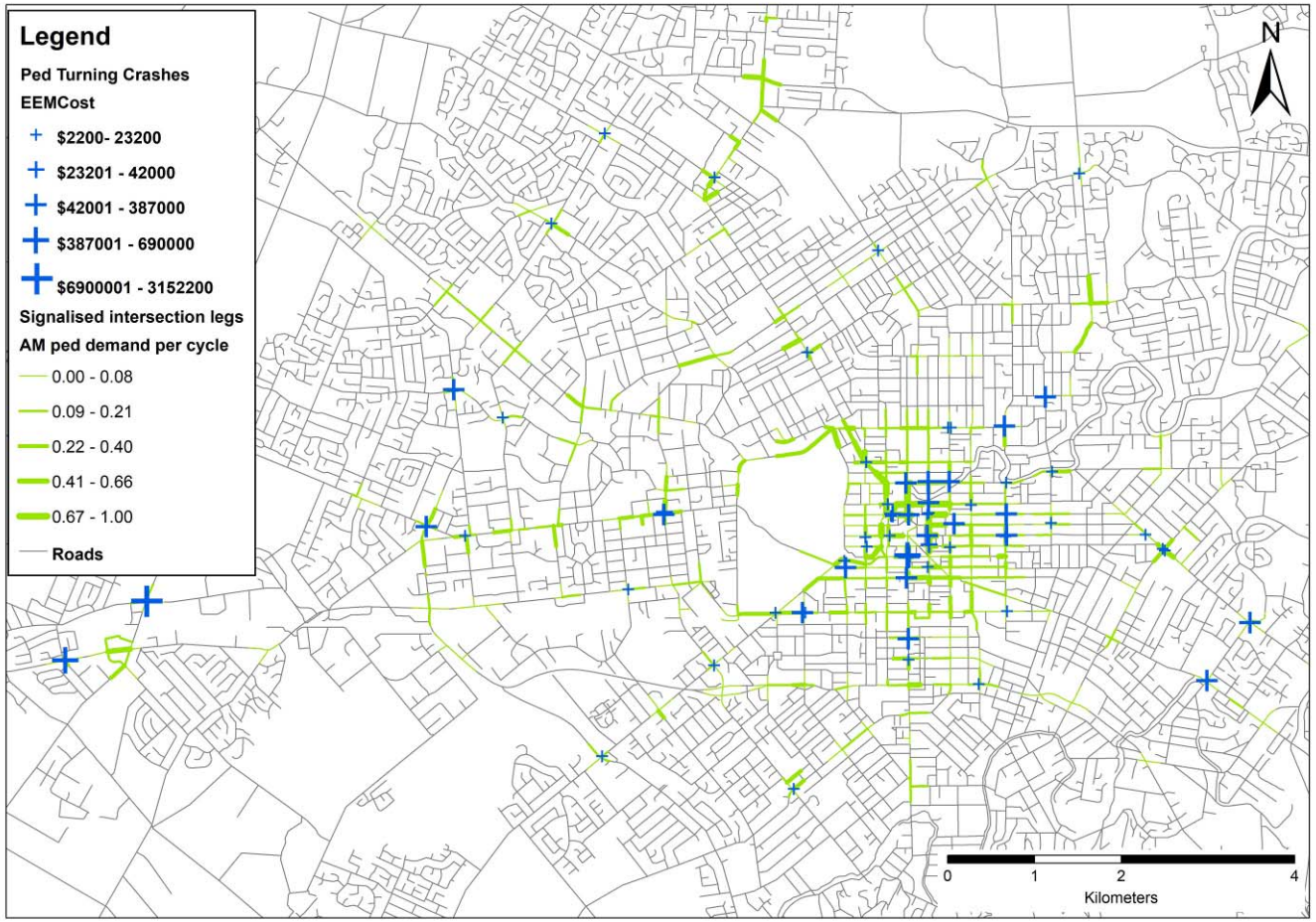
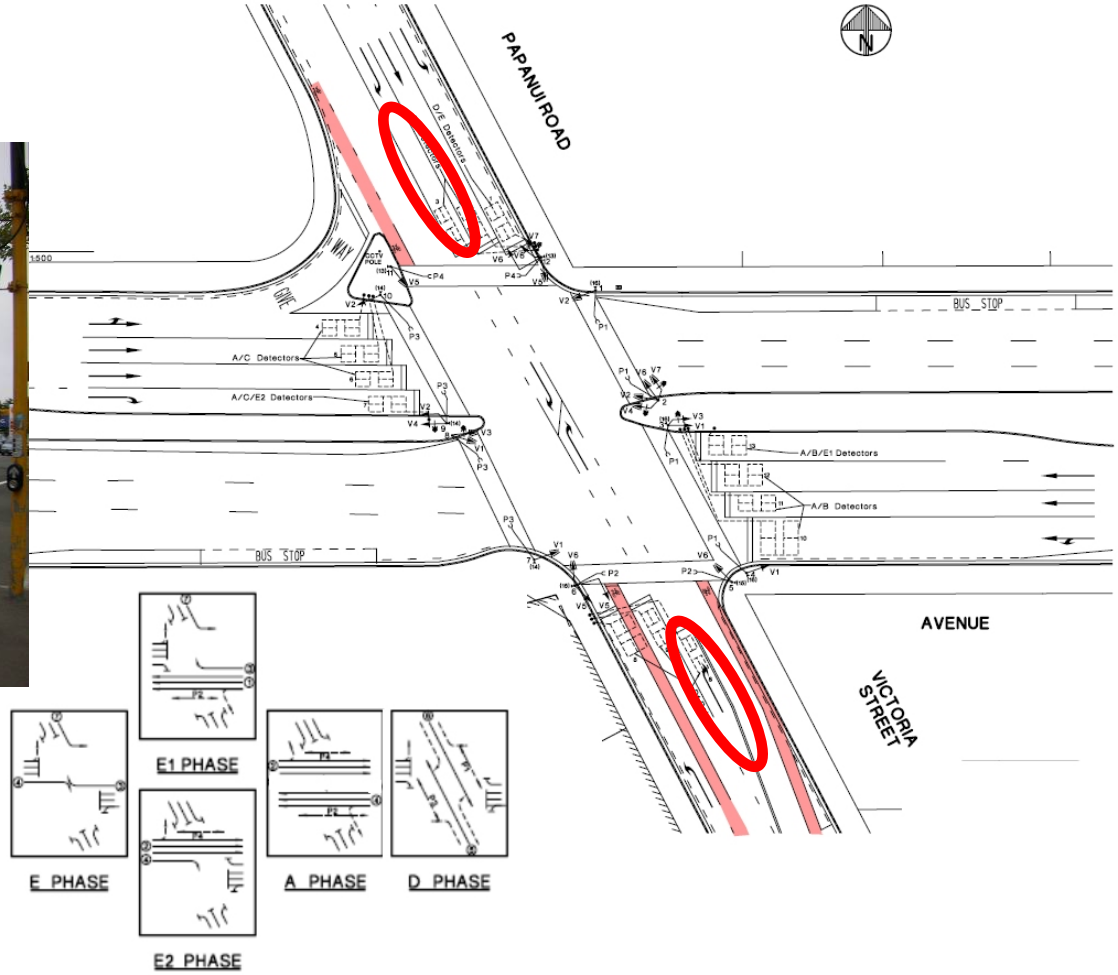
Phase 2 – ped crashes (demand & EEM)



Test case 2

- Bealey Ave/Papanui Road/Victoria Street



Test case 2 - outcomes

	Criteria for protected right turn	Criteria met?		
Safety	More than five injury right turn against crashes at the approach of interest in the last five years.	No		
	More than fifteen reported non-injury crashes at the approach of interest in the last five years.	No		
	Inadequate visibility (taking into account horizontal and vertical alignment) and approaching through traffic hidden from view by queued right turning traffic.	No		
	More than two through lanes opposing the right turn.	No		
	Two or more right turn lanes.	No		
	Two or more opposing left turn lanes.	No		
	The 85th percentile operating speed of the opposing traffic is greater than 70 km/h.	No		
	The right turn flow is more than 120 vehicles per hour and is opposed by more than: ○ 900 vehicles per hour when there is one opposing traffic lane; or ○ 700 vehicles per hour in any one lane when there are two or more opposing traffic lanes.	No		
	A need to protect pedestrians on a pedestrian crossing phase, identified by: ○ Three pedestrian crashes on the departure crosswalk of the right turn movement of interest in the last five years; or ○ A high proportion of vulnerable pedestrians using the crosswalk.	No		
		Opt 1 am	**Opt 1 pm**	**Opt 2 pm**
Efficiency	The average intersection delay remains within 20% of the existing average intersection delay.	Yes	No	No
	The average intersection delay is not greater than 55 seconds per person.	No	No	No
	The capacity of the intersection is not reduced below -5%.	No	No	No
	Bus priority is achieved.	n/a	n/a	n/a

Conclusion:

No significant safety problem associated with turning movements issues, no options modeled improved efficiency of the intersection.