Green Wave: Bike Signal Coordination

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Many thanks to
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CITE Edmonton
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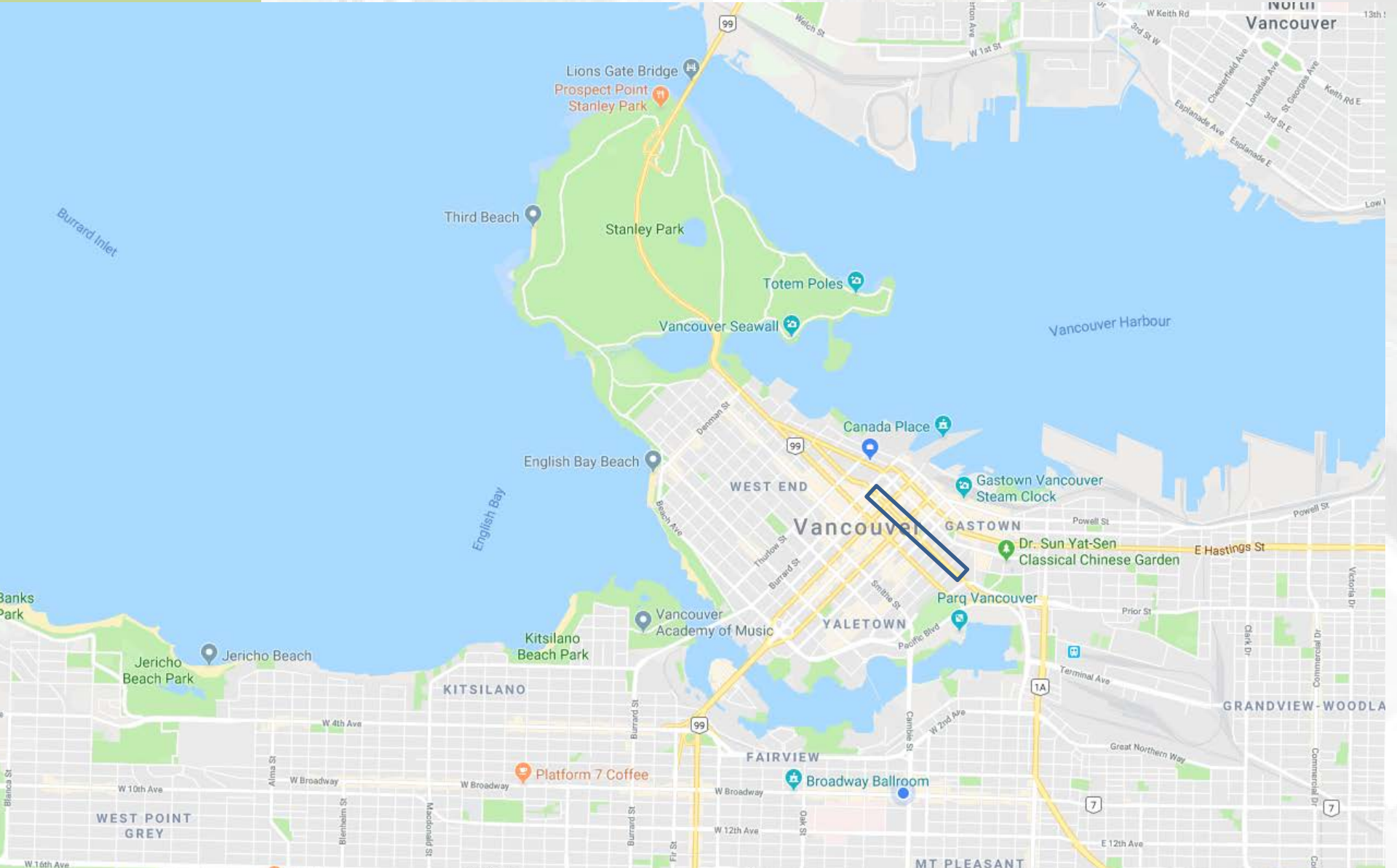
Objectives

- Reduce the number of times a cyclist comes to a stop along a corridor
- Increase bicycle ridership
- Improve cyclist safety
- Mitigate vehicle impact

Scope


Lions Gate Bridge
Prospect Point
Stanley Park
Third Beach
Stanley Park
Totem Poles
Vancouver Seawall
Burrard Inlet
Vancouver Harbour
Canada Place
English Bay Beach
WEST END
Gastown Vancouver
Steam Clock
Vancouver
GASTOWN
Dr. Sun Yat-Sen
Classical Chinese Garden
E Hastings St
English Bay
Parq Vancouver
Vancouver
Academy of Music
YALETOWN
Kitsilano
Beach Park
Jericho
Beach Park
Jericho Beach
KITSILANO
GRANDVIEW-WOODLA
FAIRVIEW
Platform 7 Coffee
Broadway Ballroom
WEST POINT
GREY
MT PLEASANT
North
Vancouver

Scope

- 9 intersections on Dunsmuir (Beatty-Hornby)
- Pre-timed signals
- One way roadway
- Two way separated bike path (North side)

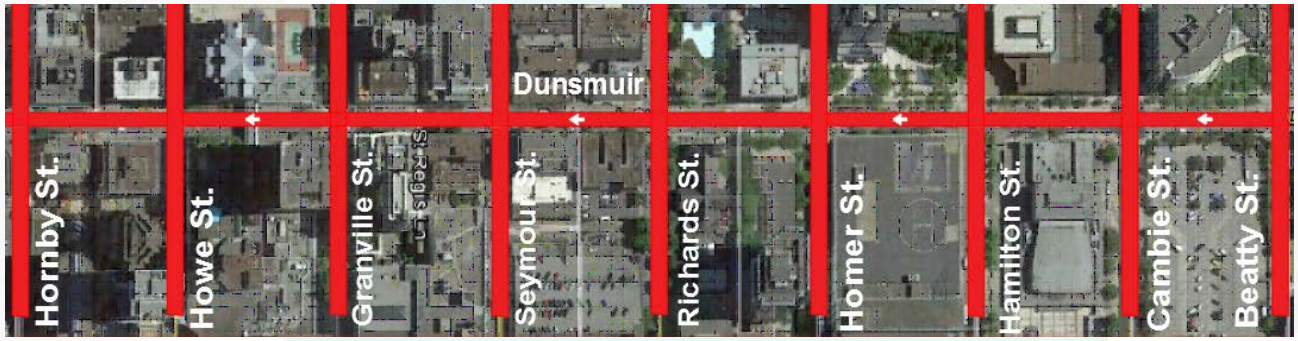


Figure 1. Study Area Map

Methodology

- Graphical optimization of coordination
  - Maintain progression for vehicle
  - Increase link bandwidth for bicycles
  - Decrease total number of stops along the corridor
- AM/PM peak analysis (avg queue, avg delay) with synchro

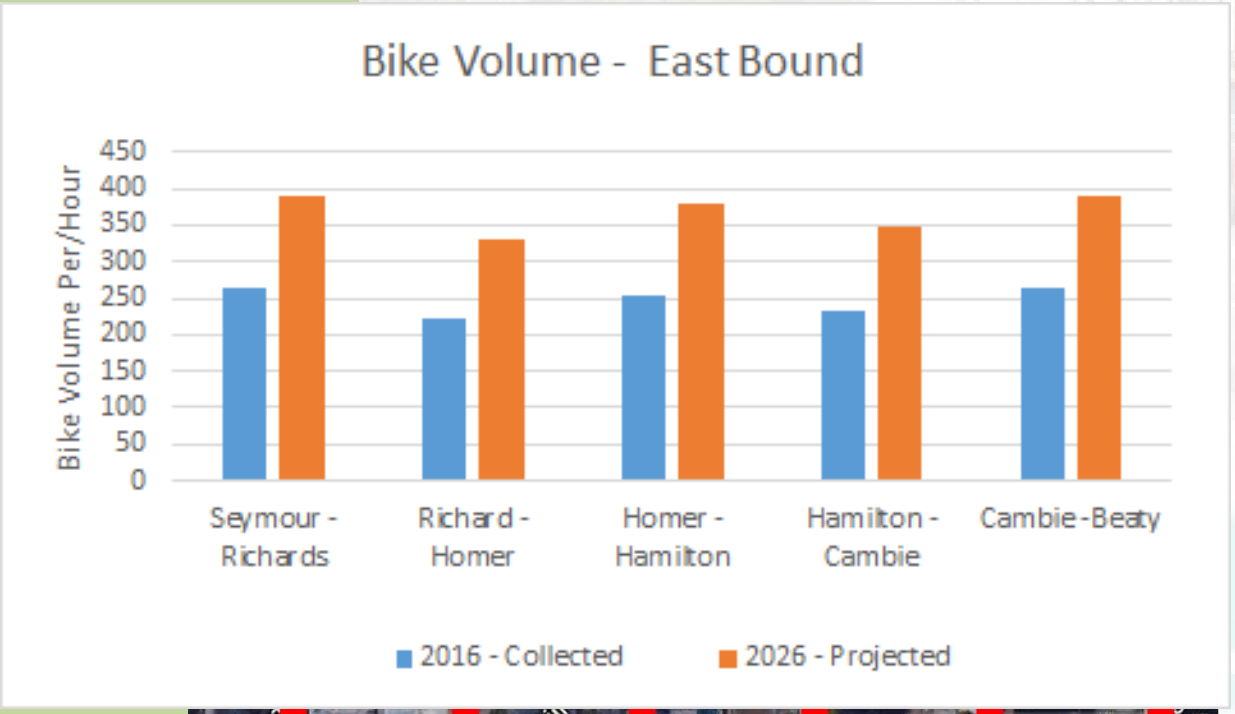
Data collection – Bike volumes

- Traffic data was collected for both bicycle and pedestrian traffic.
- Completed at peak afternoon hours during October

Factors:

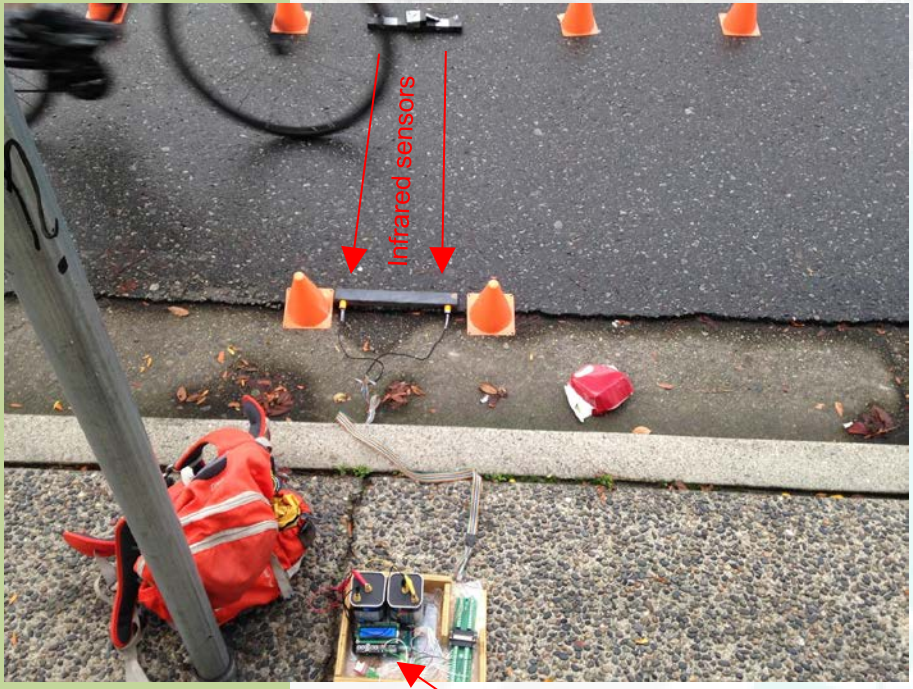
- Weather - Cloudy
- High Volumes
- Imbalanced Values between intersections (Richard - Homer)

Data collection – Bike volumes



- ~4% increase in Cyclist volumes based off data from traffica.ca per year
- This data is used for the synchro analysis to determine effects of Crossing Bikes to traffic flows.

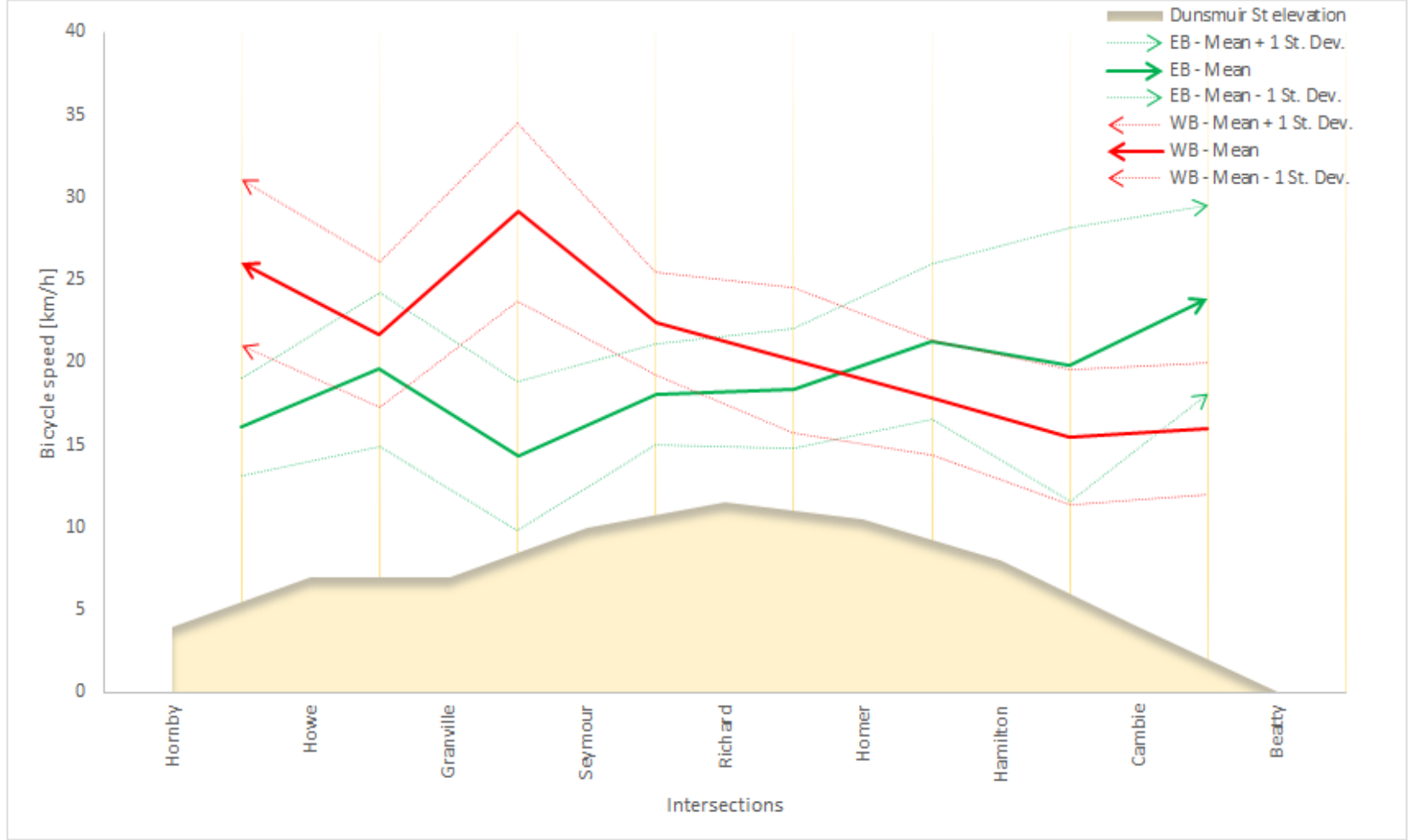
Data collection – Bike speeds



- Time-stamps logged into micro SDcard
- Post-processing to compute bicycle speeds

- Spot Speed Survey
  - Conducted at mid-block
  - Arduino + 2 infrared sensors (similar to pneumatic tubes), 30 cm apart
  - 15 mins collection (~40-50 bikes each segment)

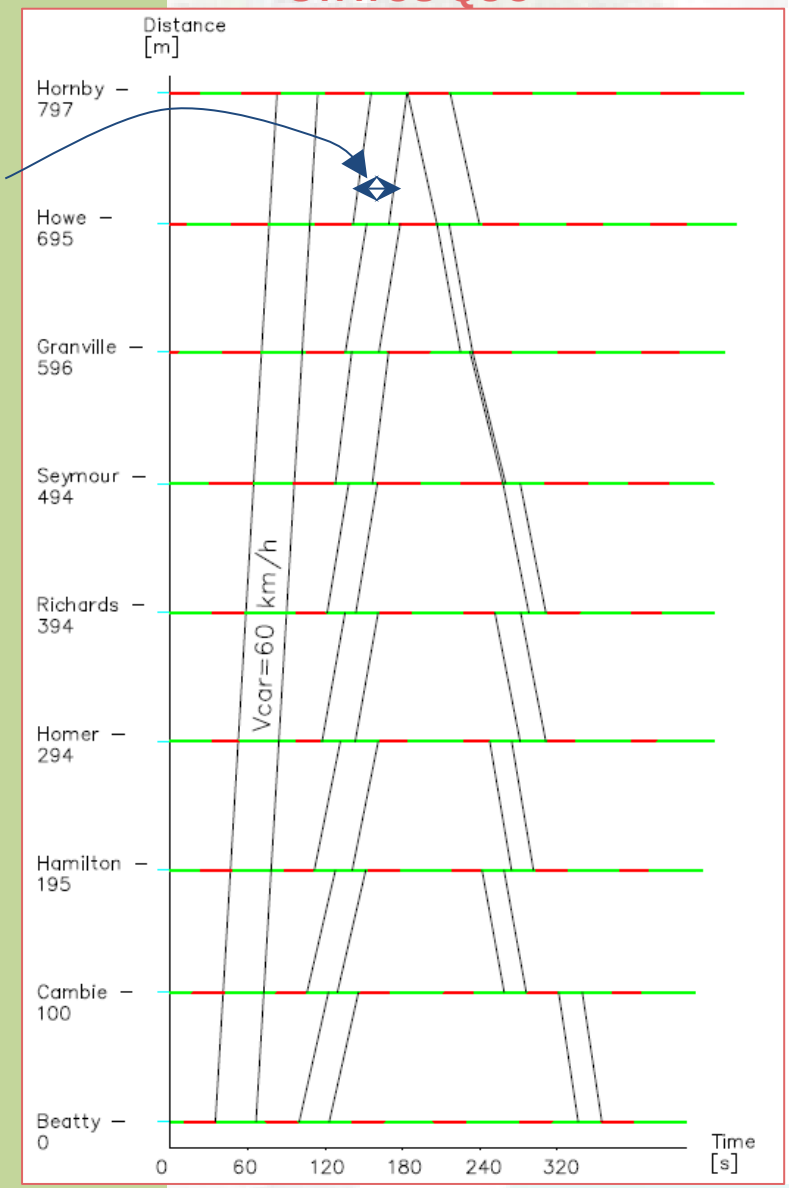
Data collection – Bike speeds

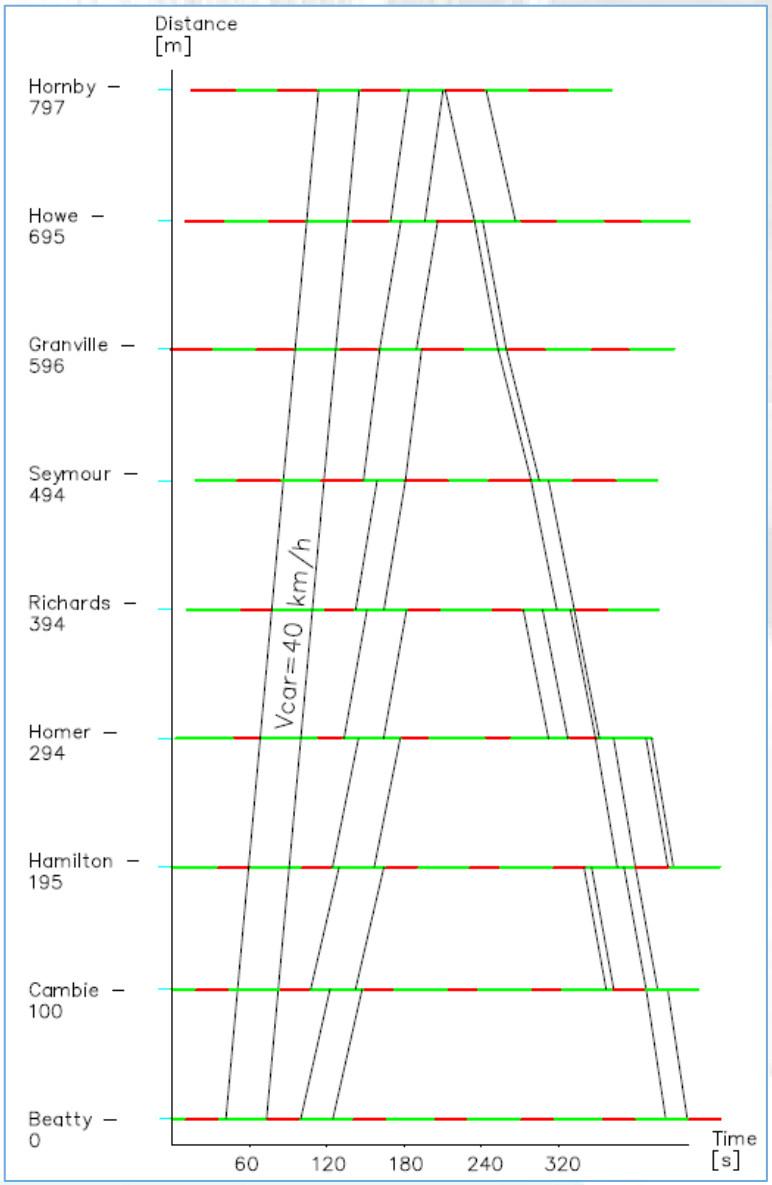


Signal offset graphical optimization - AM

- Bike link Bandwidth

Link BandWidth, given avg bike speed

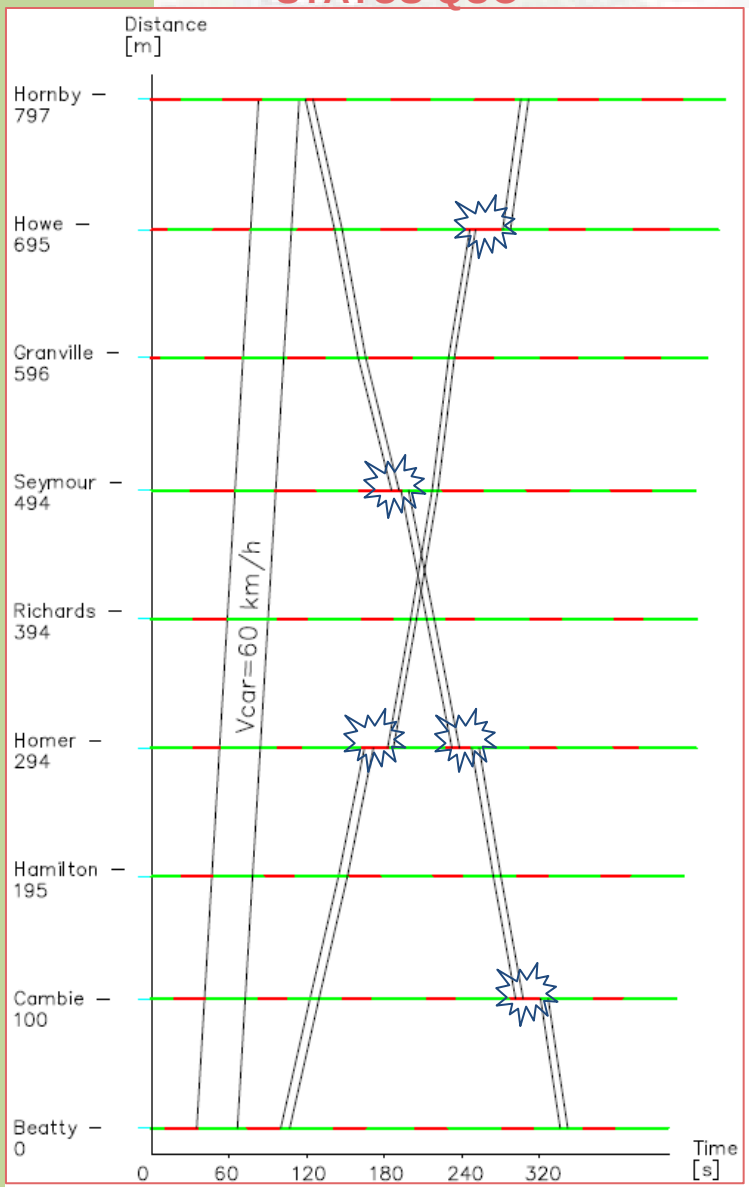




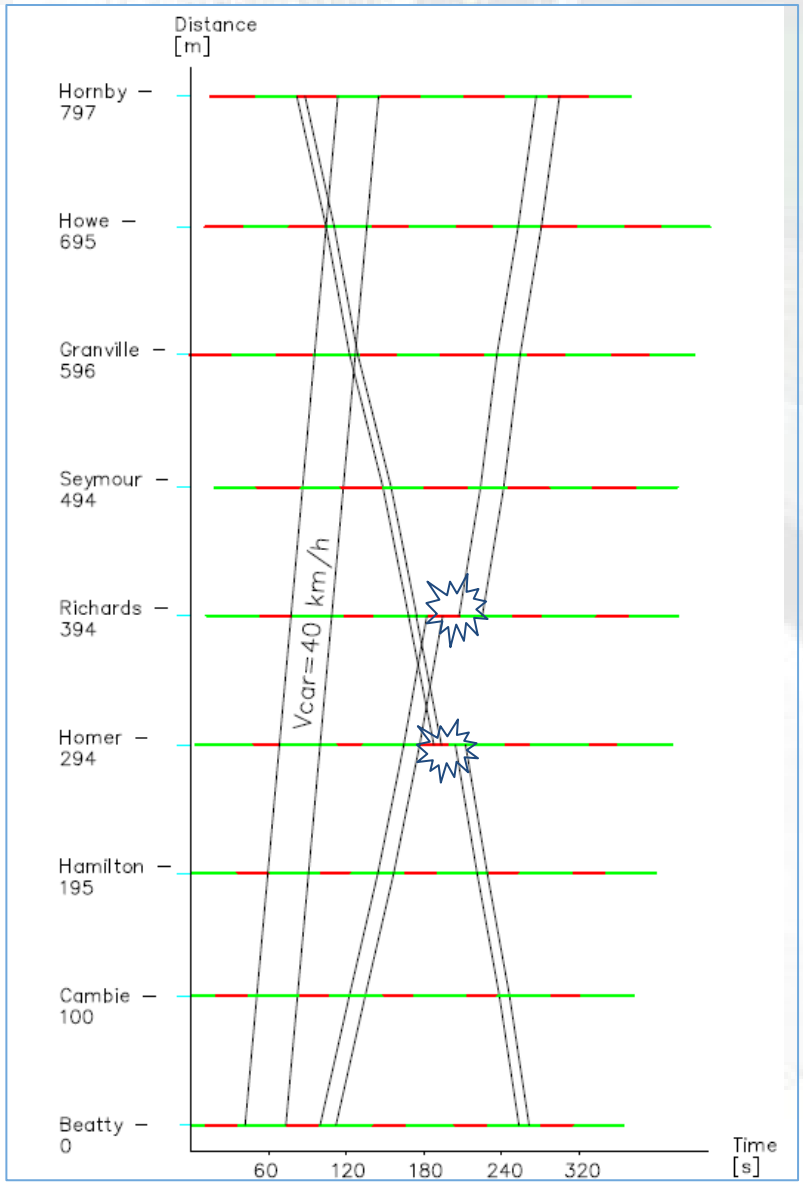
Signal offset graphical optimization - AM

- # stops at avg bike speed

STATUS QUO



OPTIMIZED



Cyclists impacts summary

1) Bicycle travel time

- AM peak
  - EB: -18.5s
  - WB: -25.2
- PM peak
  - EB: -14.0 s
  - WB: -30.1 s

2)Change of # stops at avg speed

- AM peak
  - EB: -2 stops
  - WB: -1 stop
- PM peak
  - EB: -2 stops
  - WB: -1 stop

Synchro traffic analysis

Intersection (at Dunsmuir)	Lane	AM		PM	
		Existing	Green Wave	Existing	Green Wave
		95th Queue	95th Queue	95th Queue	95th Queue
Hornby	WBT	105.5	102.3	39.7	82.1
	NBT	40.4	40.4	40.3	40.3
Howe	WBT	133.2	3.9	133.3	4.5
	SBT	40.8	41.0	58.9	58.9
Granville	WBT	49.4	115	53.3	118
	SBT	11.1	11.1	17.8	17.8
Seymour	WBT	71	47.1	67.2	25.7
	NBT	44.8	44.8	36.5	36.5
Richards	WBT	22	10.7	7.3	0
	SBT	34.3	34.3	42.2	42.2
Homer	WBT	2.9	2.0	13.6	5.3
	NBT	36.4	36.4	26.8	26.8
Hamilton	WB	14.8	130.6	9.7	103.9
	NBT	6.8	6.8	8.8	8.8
	SBT	27.4	27.4	51.8	51.2
Cambie	WB	13.7	7.2	11.1	26.9
	NBT	58.6	58.6	38.3	38.3
	SBT	105.5	105.5	84.1	84.3
Beatty	WB	158.6	158.6	90.9	90.9
	NBT	39.5	39.5	61.4	61.4
	SBT	14.4	14.4	33.5	33.5

Advantages of Design

- Reduced waiting time for cyclists
- Increased safety (progression for ~40kph)
  - for pedestrians
  - for bicycles
- Increased cyclist incentive

Other Elements of Design

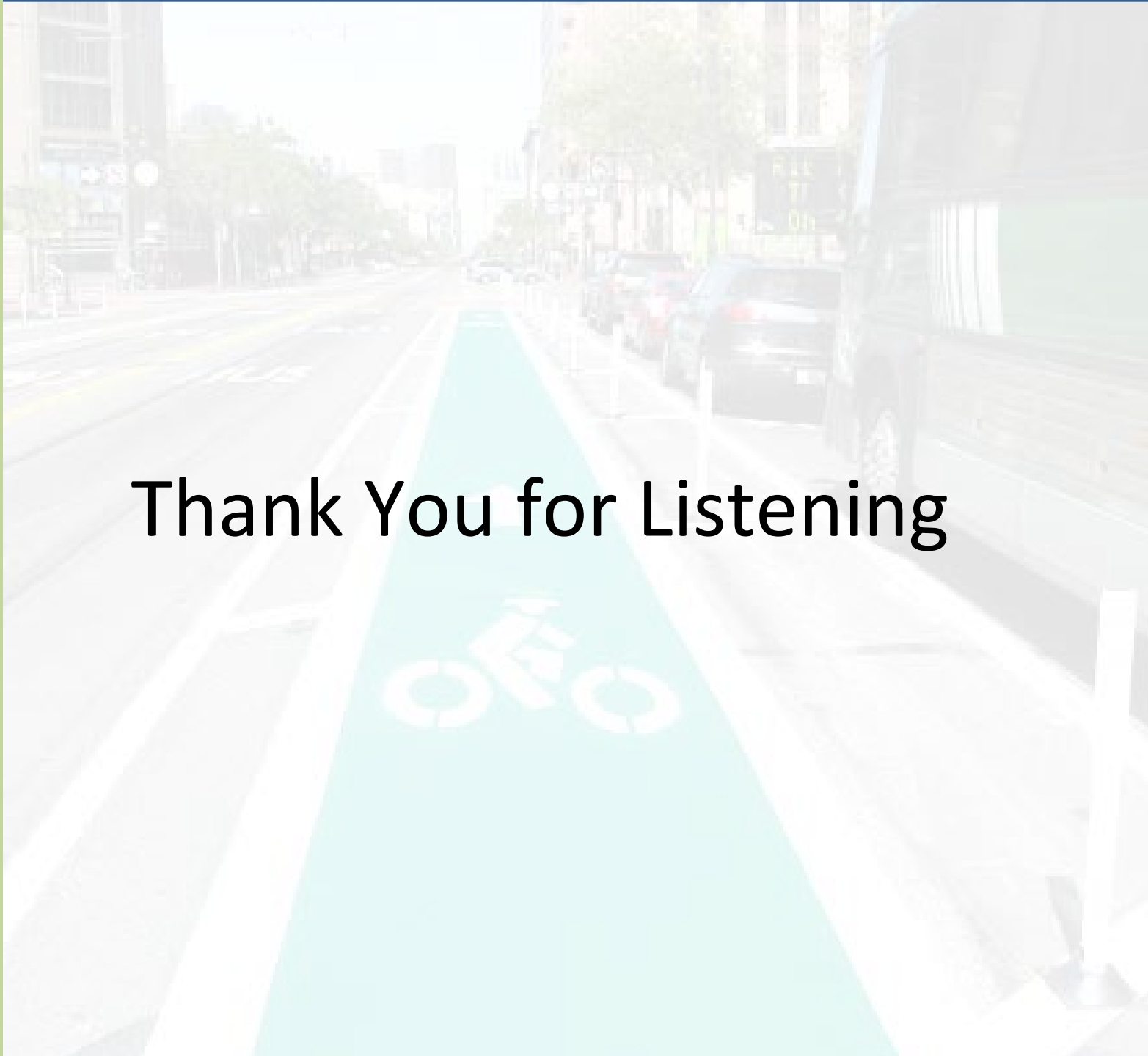
- Reduced vehicle speed

Limitations

- Only Dunsmuir St is considered – no broader network consideration
- Optimization for average bike speed - but high variability was measured (~4 kph)
- Impact minimized by not changing cycle lengths and phases length
- Try to minimize offset changes

Conclusions and last remarks

- Early steps of analysis: coordinating traffic lights for people biking is feasible.
- Further analysis of the entire network.
- Need to consider bicycle speed variation, interactions at heavy pedestrian intersections.



Thank You for Listening