Monitoring cycling:
you can't manage what you don't measure

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VIASTRADA
TRANSPORT PLANNING AND DESIGN

WSP | OPUS

Beca

2 WALK and CYCLE
moving toward healthy communities

Palmerston North 30 July – 1 August 2018

Presentation overview

1. Why monitor
2. Crash data, apps & manual counts
3. Automatic counts
4. Data analysis
5. Reporting and next steps

If we don’t count it, it doesn’t count

- Many variations on this theme…
  …what gets measured, gets managed
- Many uses for the data

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Why monitor?

Data uses
Funding
Facility design
Network planning
Health impact assessments
Safety analysis
Travel demand models

Social license to operate	The case for investment and helps address the common misperception that there are no cyclists out there

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Do many people actually ride here?
Yes!
About 410 on a typical fine day
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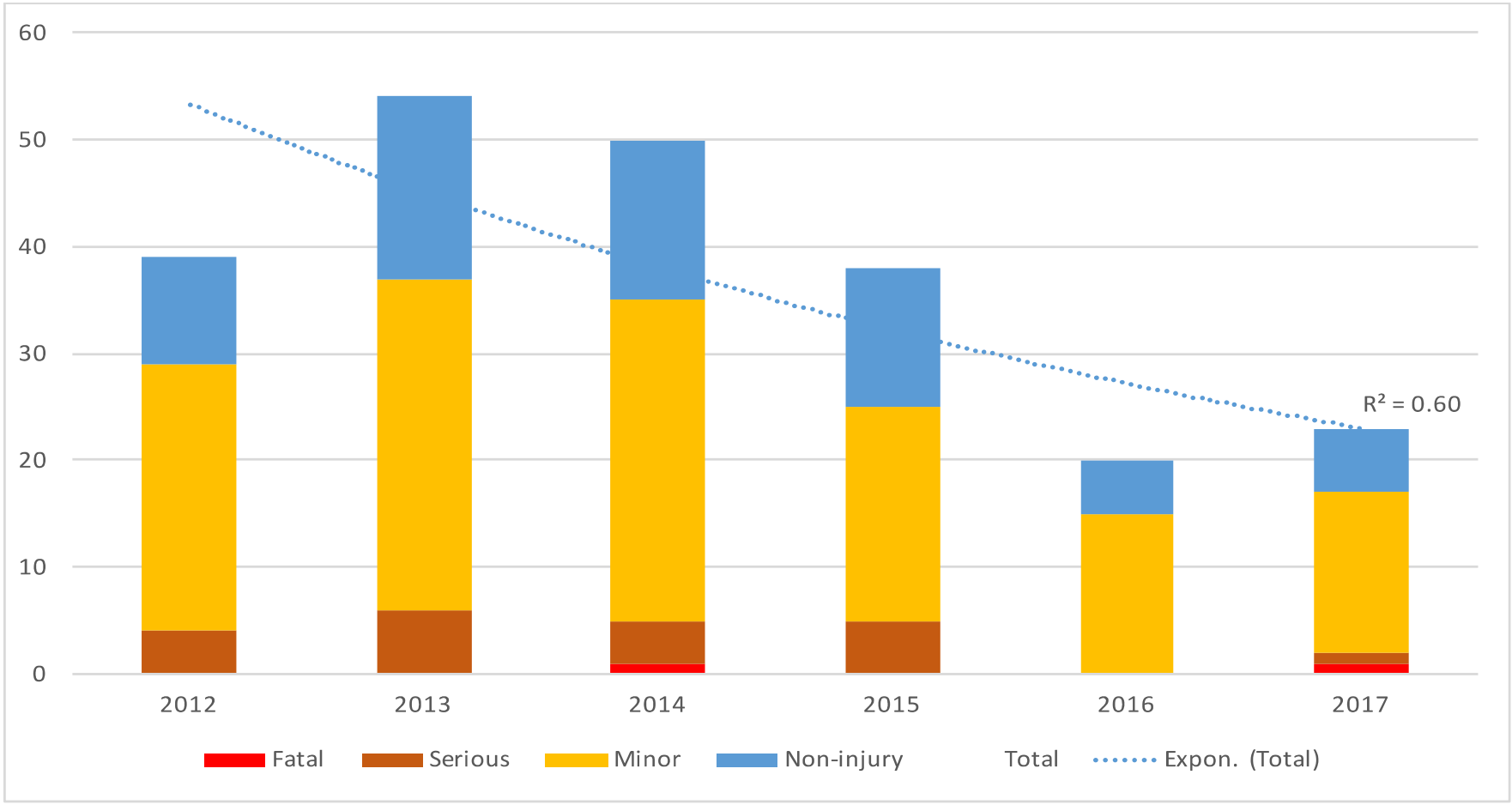
Safety analysis

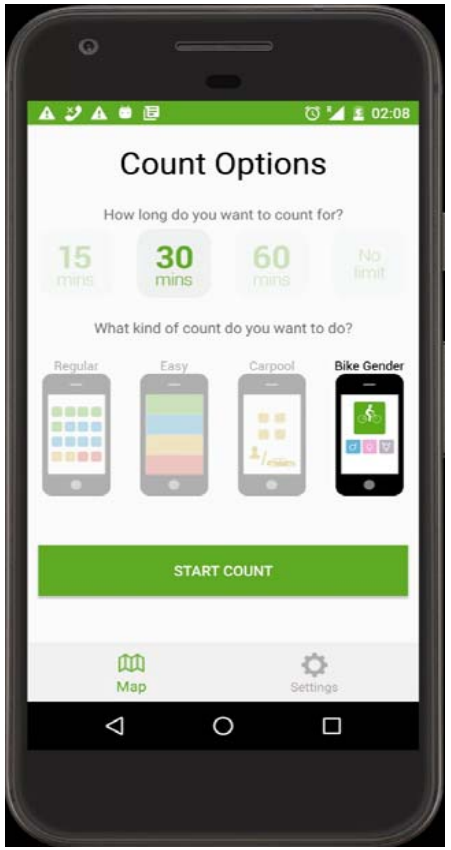


Crowdsourcing methods…

fitness apps

bikesharing data

counting apps



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Manual counts

Female	Adults	Footpath riding
17%	59%	8%

Urban Cycle Network Monitoring

*Town/City name	Palmerston North		
*Weather	Fine/Overcast	*Count date	21/03/2017

Cordon/screen line survey (7.00am - 9.00am)	
*Total Morning Peak Trips in to CBD	440
Total Morning Peak Trips out of CBD	85
Sub total	**525**
Additional count sites ?	
	Morning peak count
	Morning peak count
	Morning peak count
Total number of Morning Peak Trips recorded (raw data) (07:00-09:00)	**525**

Gender Split %	M 93.0	F 7.0
Comments		
Upload file		

1. Why monitor
2. Crash data, apps & manual counts
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4. Reporting and next steps

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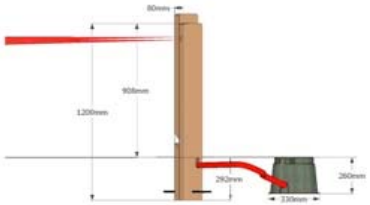
Inductive Loops	Active Infrared	Pneumatic Tubes
Shared-use path Cycle lanes Mixed traffic	Footpath Shared-use path	Shared-use path Cycle lanes Mixed traffic (EcoCounter)
Detects bikes through a break in magnetic field	*Detects people through a break in infrared beam*	*Detects bikes through a change in tube air pressure*
		
Short term 'rotating' (30 – 60 days) or permanent (365 days) 		
	Short term mobile (7 – 60 days) 	

Siting is harder than it would seem

Optimising the programme

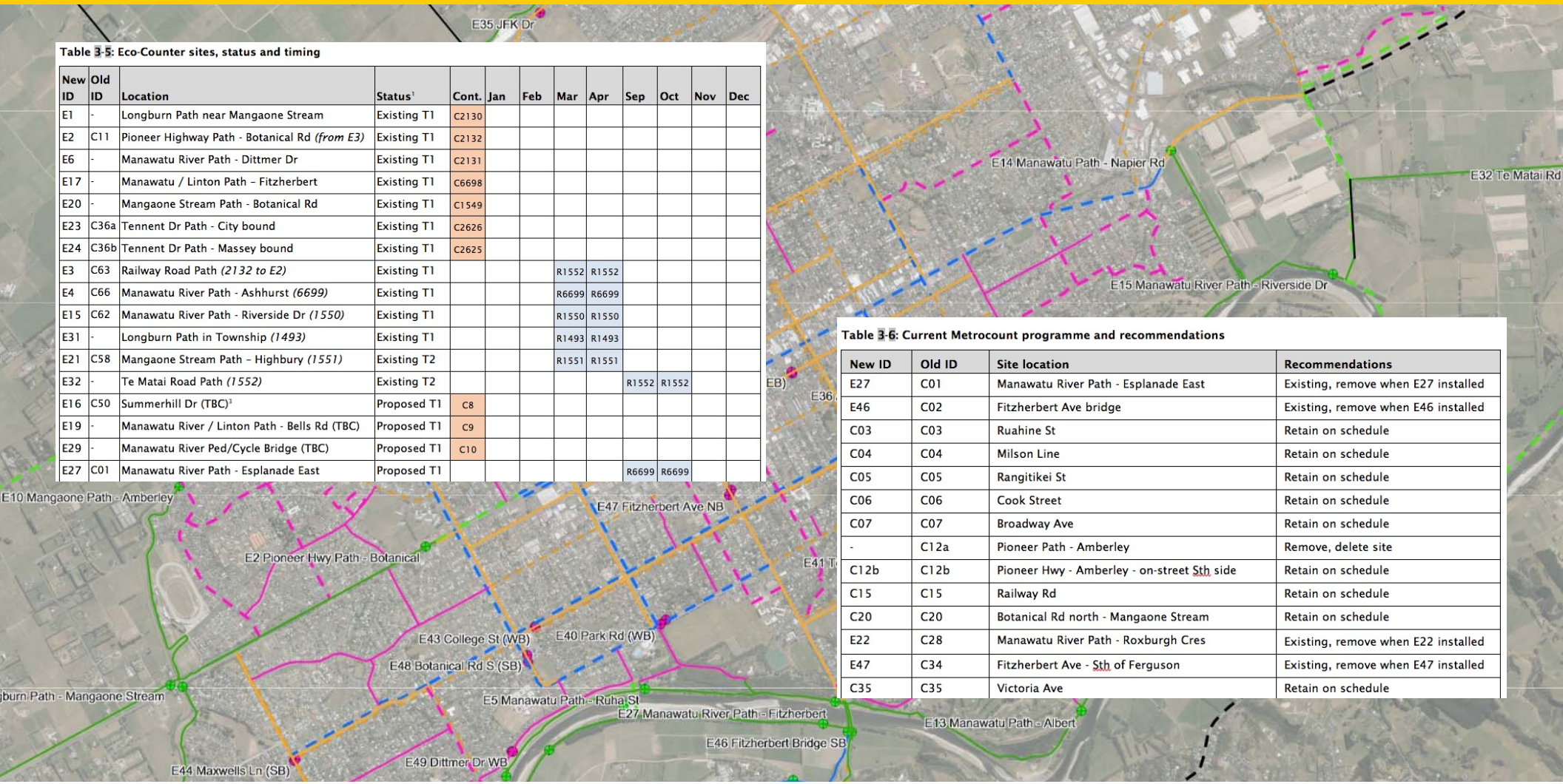


Table 3-5: Eco-Counter sites, status and timing

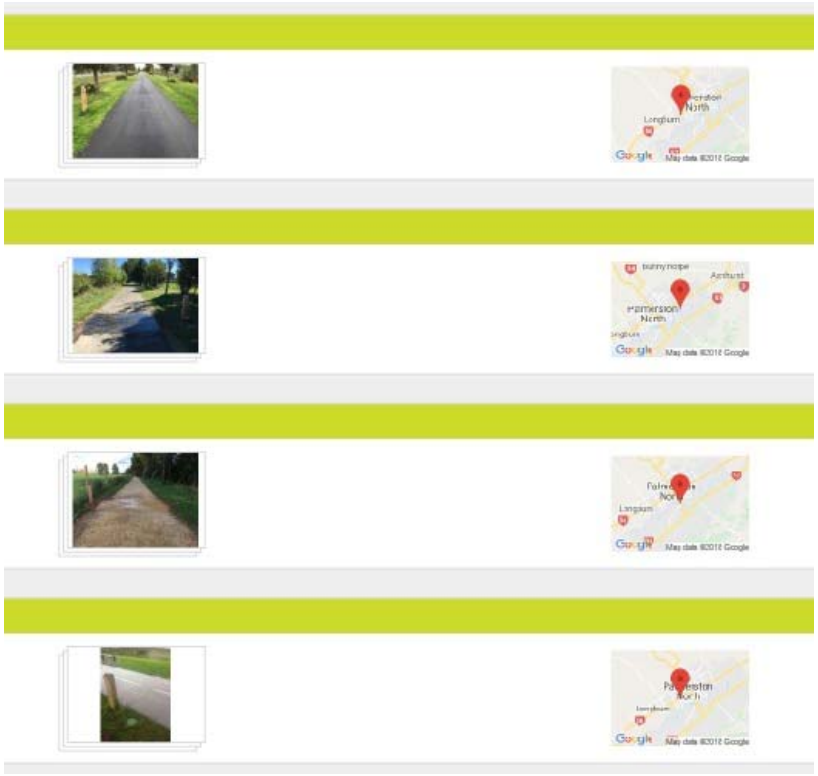
New ID	Old ID	Location	Status[1]	Cont.	Jan	Feb	Mar	Apr	Sep	Oct	Nov	Dec
E1	-	Longburn Path near Mangaone Stream	Existing T1	C2130								
E2	C11	Pioneer Highway Path - Botanical Rd *(from E3)*	Existing T1	C2132								
E6	-	Manawatu River Path - Dittmer Dr	Existing T1	C2131								
E17	-	Manawatu / Linton Path – Fitzherbert	Existing T1	C6698								
E20	-	Mangaone Stream Path - Botanical Rd	Existing T1	C1549								
E23	C36a	Tennent Dr Path - City bound	Existing T1	C2626								
E24	C36b	Tennent Dr Path - Massey bound	Existing T1	C2625								
E3	C63	Railway Road Path *(2132 to E2)*	Existing T1				R1552	R1552				
E4	C66	Manawatu River Path - Ashhurst *(6699)*	Existing T1				R6699	R6699				
E15	C62	Manawatu River Path - Riverside Dr *(1550)*	Existing T1				R1550	R1550				
E31	-	Longburn Path in Township *(1493)*	Existing T1				R1493	R1493				
E21	C58	Mangaone Stream Path – Highbury *(1551)*	Existing T2				R1551	R1551				
E32	-	Te Matai Road Path *(1552)*	Existing T2						R1552	R1552		
E16	C50	Summerhill Dr (TBC)[3]	Proposed T1	C8								
E19	-	Manawatu River / Linton Path - Bells Rd (TBC)	Proposed T1	C9								
E29	-	Manawatu River Ped/Cycle Bridge (TBC)	Proposed T1	C10								
E27	C01	Manawatu River Path - Esplanade East	Proposed T1						R6699	R6699		

Table 3-6: Current Metrocount programme and recommendations

New ID	Old ID	Site location	Recommendations
E27	C01	Manawatu River Path - Esplanade East	Existing, remove when E27 installed
E46	C02	Fitzherbert Ave bridge	Existing, remove when E46 installed
C03	C03	Ruahine St	Retain on schedule
C04	C04	Milson Line	Retain on schedule
C05	C05	Rangitikei St	Retain on schedule
C06	C06	Cook Street	Retain on schedule
C07	C07	Broadway Ave	Retain on schedule
-	C12a	Pioneer Path - Amberley	Remove, delete site
C12b	C12b	Pioneer Hwy - Amberley - on-street Sth side	Retain on schedule
C15	C15	Railway Rd	Retain on schedule
C20	C20	Botanical Rd north - Mangaone Stream	Retain on schedule
E22	C28	Manawatu River Path - Roxburgh Cres	Existing, remove when E22 installed
E47	C34	Fitzherbert Ave - Sth of Ferguson	Existing, remove when E47 installed
C35	C35	Victoria Ave	Retain on schedule

Document everything…

Photos & locations (EcoVisio)



Photos & locations (everything else)

Dublin Rd shared-use path near Twin Rivers Dr		
Broad St & Warren Ave		

Rotating programme info

	Rotation 1 - Installed by: Jane Doe						
Serial	Location	Install Date	Install Notes	Install Time	Removal Date	Removal Time	Removal Notes
TUBE 5969							
TUBE 5970							
TUBE 5971							
TUBE 5972							

This format repeats for subsequent rotations

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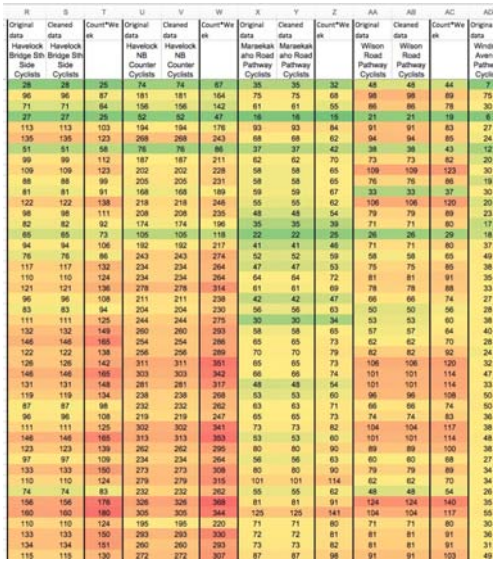
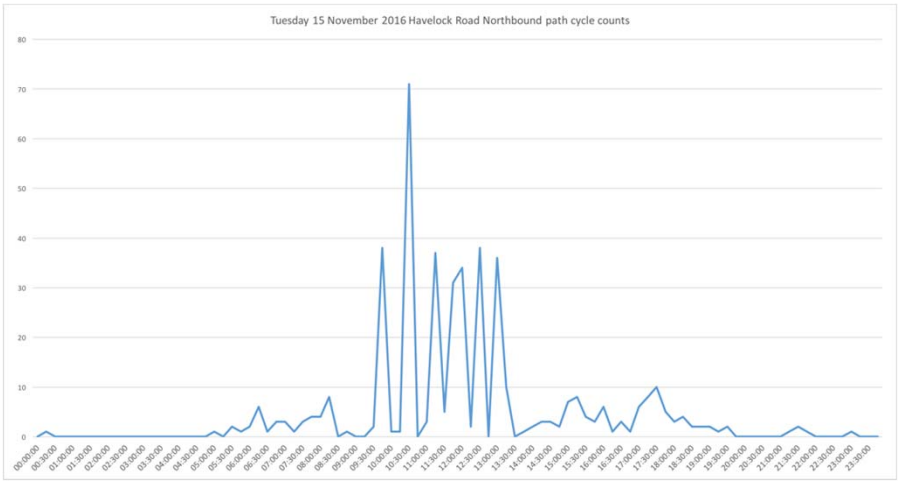
Data cleaning

1. Conditional formatting of table or view graphs to identify anomalies
2. Determine if outlier is a machine error
3. Impute from surrounding data

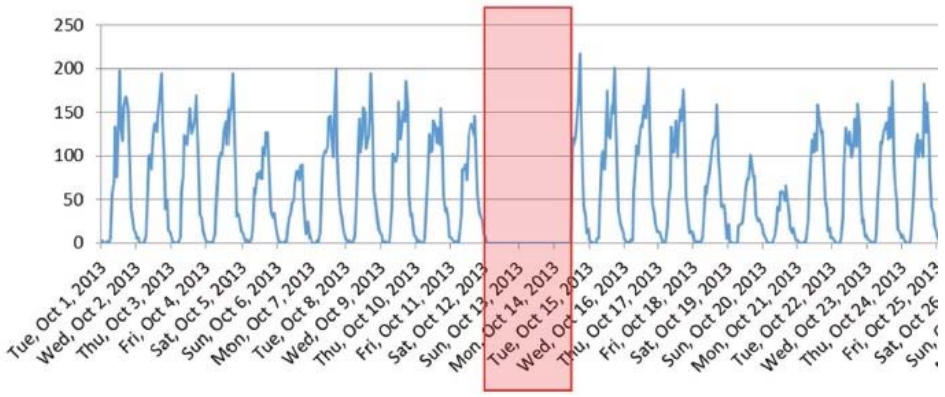
– *See NCHRP Guidebook.*



Excessive values



Zero values



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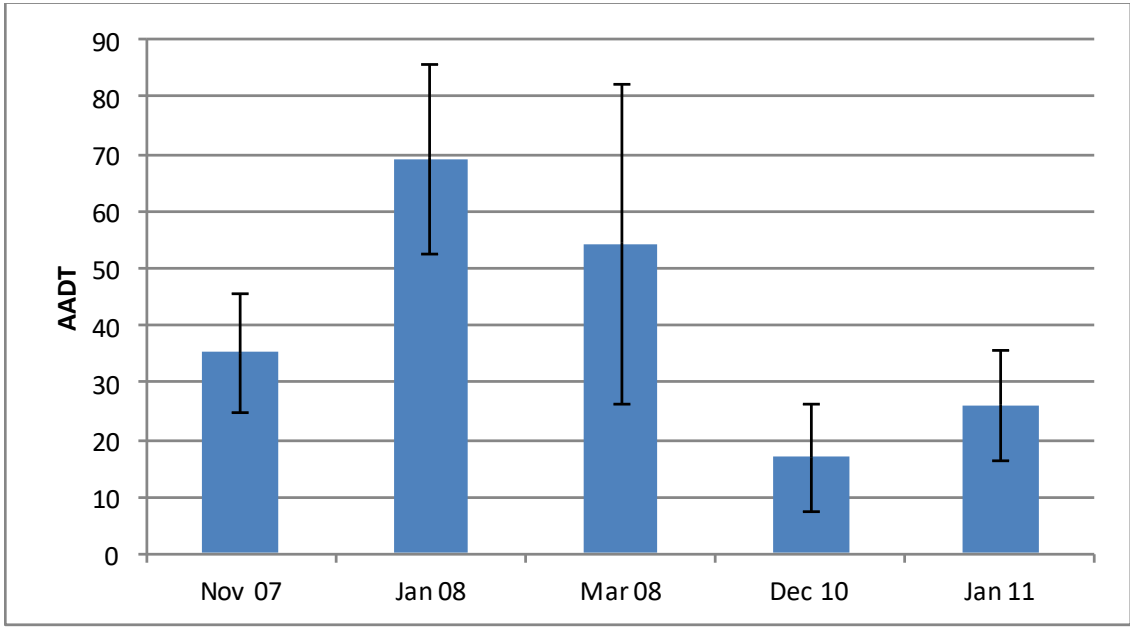
Statistics

- Calculate standard deviation, CoV, p-value
- Present confidence interval
- Round when reporting



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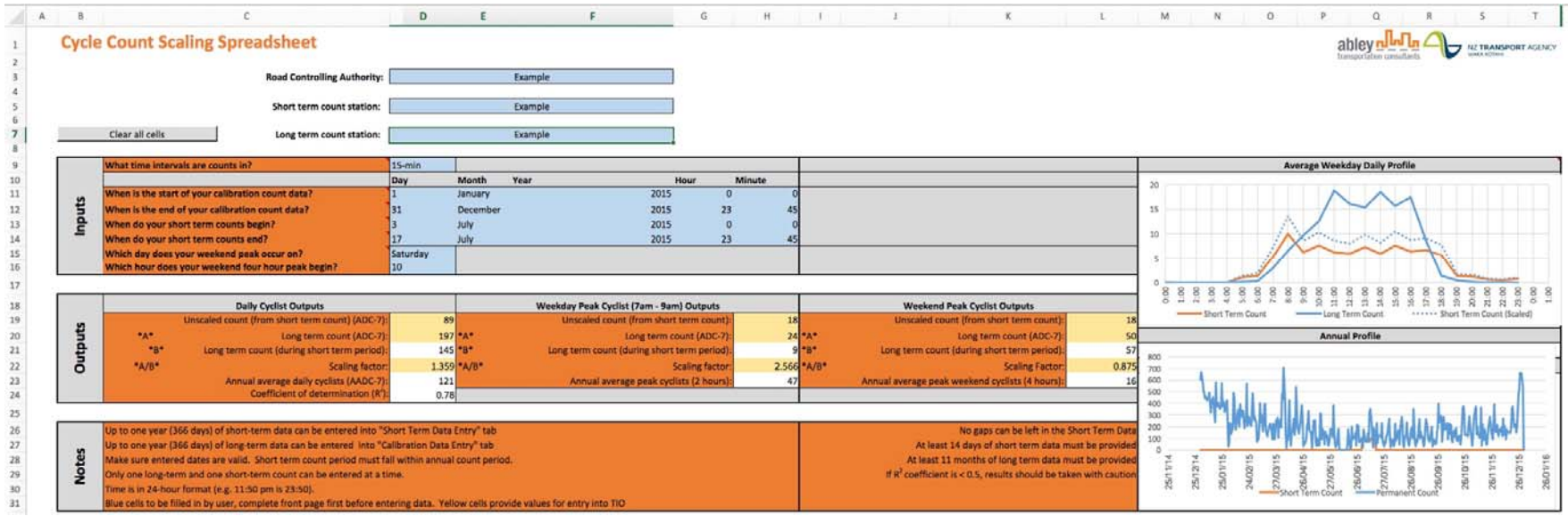
Scaling

- Manual count scaling
  - Aggregate counts and scale together. Doesn't work if you need to apply different scaling factors
  - Don't try to compare values from a specific site year-on-year
- Automatic short term counts
  - The CNG has a scaling workbook for >14 day counts only



Cycle Count Scaling Spreadsheet

Road Controlling Authority: Example

Short term count station: Example

Clear all cells

Long term count station: Example

Inputs

What time intervals are counts in?	15-min				
	Day	Month	Year	Hour	Minute
When is the start of your calibration count data?	1	January	2015	0	0
When is the end of your calibration count data?	31	December	2015	23	45
When do your short term counts begin?	3	July	2015	0	0
When do your short term counts end?	17	July	2015	23	45
Which day does your weekend peak occur on?	Saturday				
Which hour does your weekend four hour peak begin?	10				

Outputs

Daily Cyclist Outputs			Weekday Peak Cyclist (7am - 9am) Outputs			Weekend Peak Cyclist Outputs		
	Unscaled count (from short term count) (ADC-7):	89		Unscaled count (from short term count):	18		Unscaled count (from short term count):	18
A	Long term count (ADC-7):	197	*A*	Long term count (ADC-7):	24	*A*	Long term count (ADC-7):	50
B	Long term count (during short term period):	145	*B*	Long term count (during short term period):	9	*B*	Long term count (during short term period):	57
A/B	Scaling factor:	1.359	*A/B*	Scaling factor:	2.566	*A/B*	Scaling Factor:	0.875
	Annual average daily cyclists (AADC-7):	121		Annual average peak cyclists (2 hours):	47		Annual average peak weekend cyclists (4 hours):	16
	Coefficient of determination (R^2):	0.78						

Notes

Up to one year (366 days) of short-term data can be entered into "Short Term Data Entry" tab
Up to one year (366 days) of long-term data can be entered into "Calibration Data Entry" tab
Make sure entered dates are valid. Short term count period must fall within annual count period.
Only one long-term and one short-term count can be entered at a time.
Time is in 24-hour format (e.g. 11:50 pm is 23:50).
Blue cells to be filled in by user, complete front page first before entering data. Yellow cells provide values for entry into TIO

No gaps can be left in the Short Term Data
At least 14 days of short term data must be provided
At least 11 months of long term data must be provided
If R^2 coefficient is < 0.5, results should be taken with caution

Average Weekday Daily Profile

Short Term Count | Long Term Count | Short Term Count (Scaled)

Annual Profile

Short Term Count | Permanent Count

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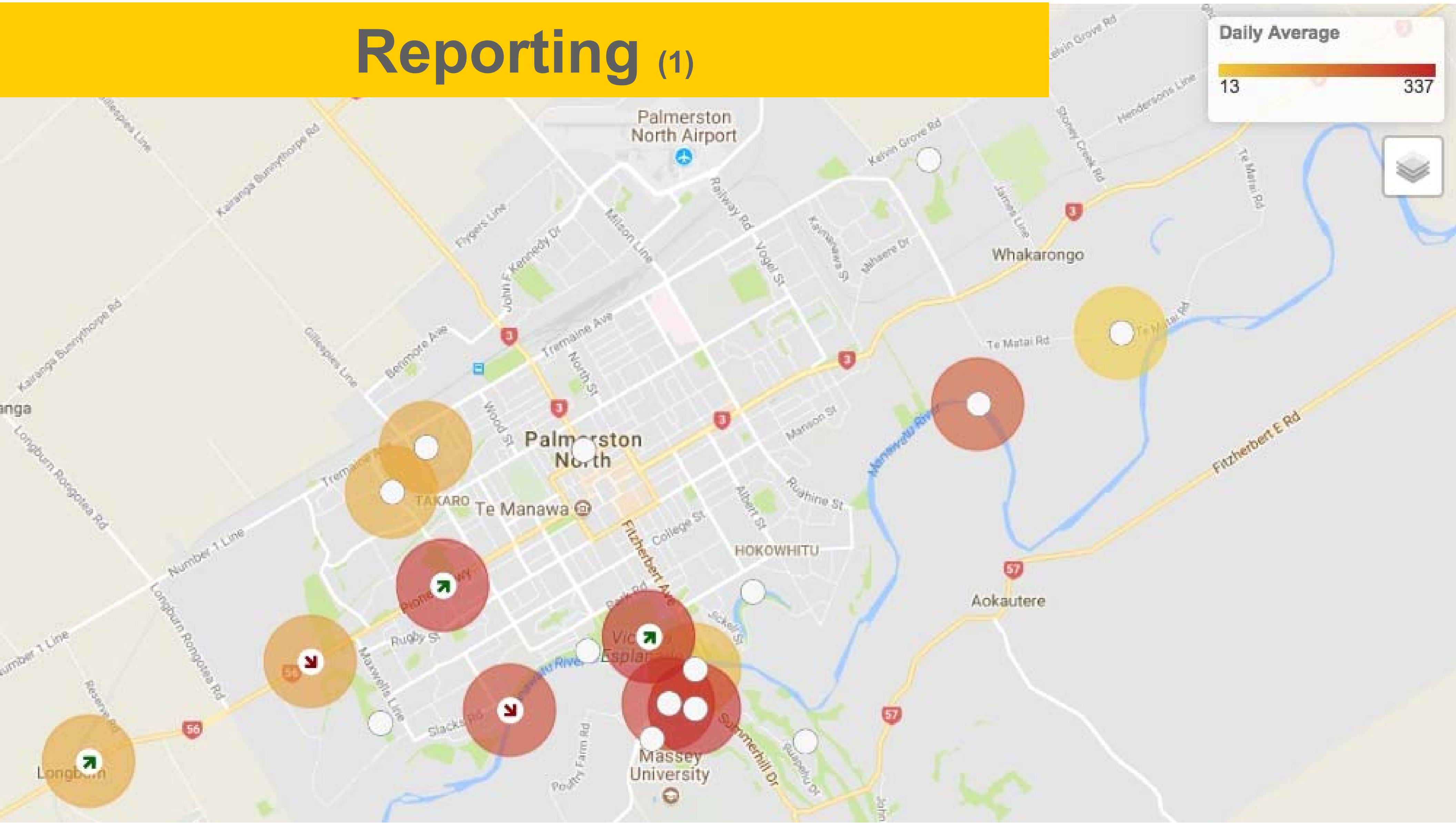
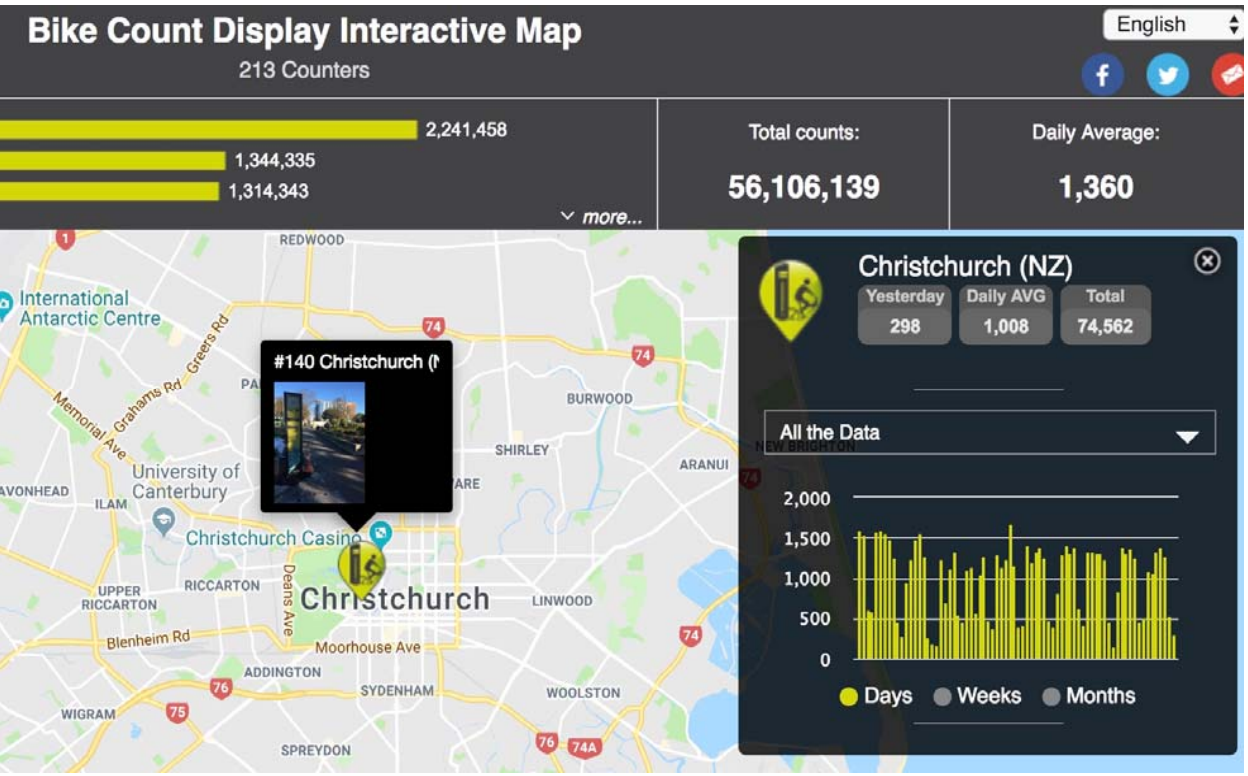
Reporting (1)


Daily Average
13
337
Palmerston North Airport
Whakarongo
Palmerston North
Te Manawa
TAKARO
HOKOWHITU
Aokautere
Massey University
Kelvin Grove Rd
Hendersons Line
Stoney Creek Rd
Te Matai Rd
James Line
Railway Rd
Vogel St
Milson Line
Flygers Line
John F Kennedy Dr
Kairanga Bunnythorpe Rd
Gillespies Line
Benmore Ave
Tremaine Ave
North St
Wood St
Manson St
Ruahine St
Albert St
College St
Fitzherbert Ave
Fitzherbert E Rd
Manawatu River
Longburn Rongotea Rd
Number 1 Line
Rugby St
Maxwells Line
Slacks Rd
Poultry Farm Rd
Summerhill Dr
Longburn

Reporting – real time displays



http://data.eco-counter.com/ParcPublic/?id=4586

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Report cards

Palmerston North City – Annual Cycle Report Card – 2017/18[1]

561	People cycling in the *central city* on an average *morning* (2h)[2]
667	People cycling along *Tennent Drive* on average *weekday*[3]
540 (-21%)	People cycling at nine *on-street* count stations *daily*[4]
129,480 (+3.1%)	People cycling at four *path* count stations *yearly*[5]
1.7 million	Estimated cycling *trips* per *year* in Palmerston North[6]
5%	Decline in reported cycle crashes from 2012 to 2017
Future metric	Palmerston North residents interested but concerned about riding to work or school
To be reported in 2018/19	Walk and cycle mode share at participating schools
70 km	Length of cycle lanes and shared paths in Palmerston North[7]

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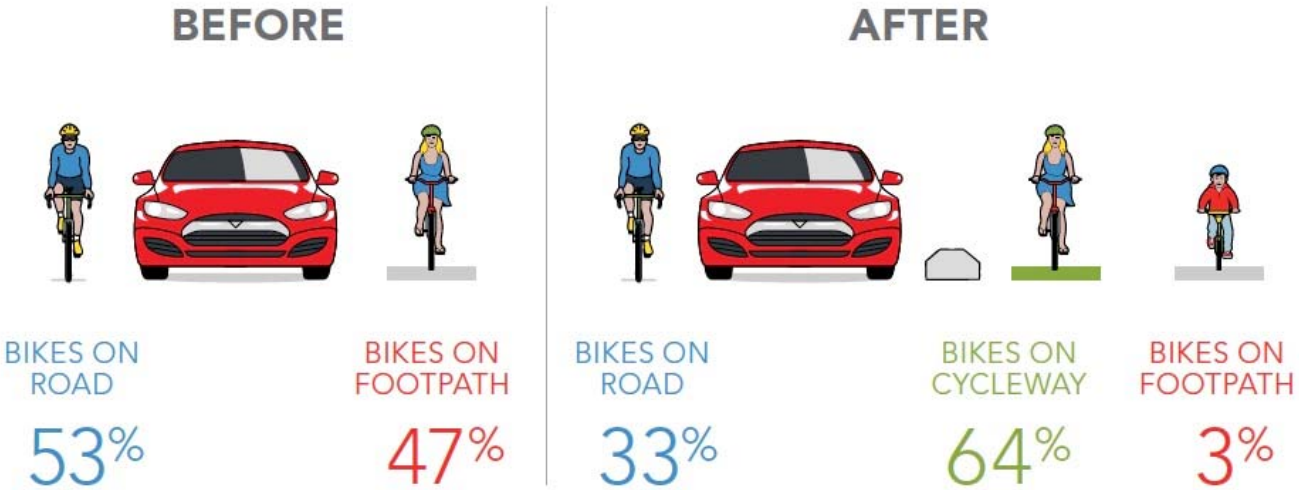
Reporting – report cards / accounts



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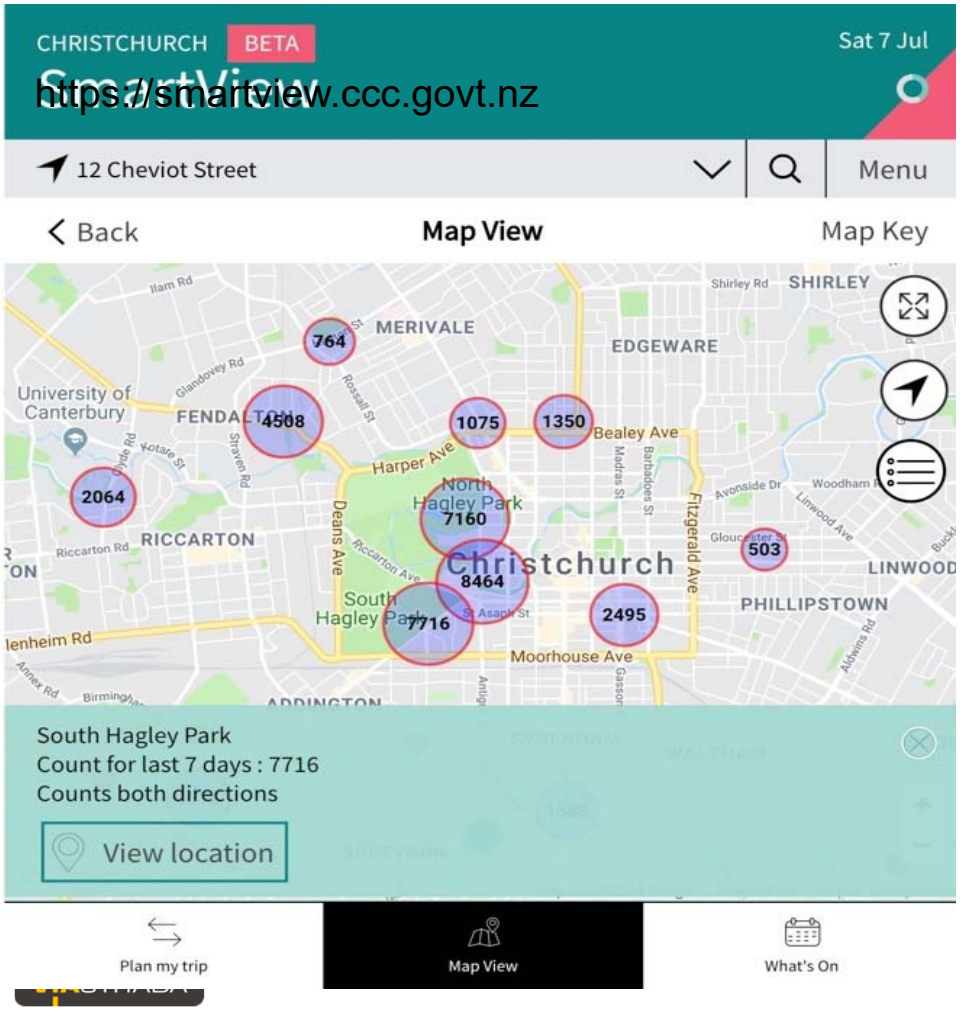
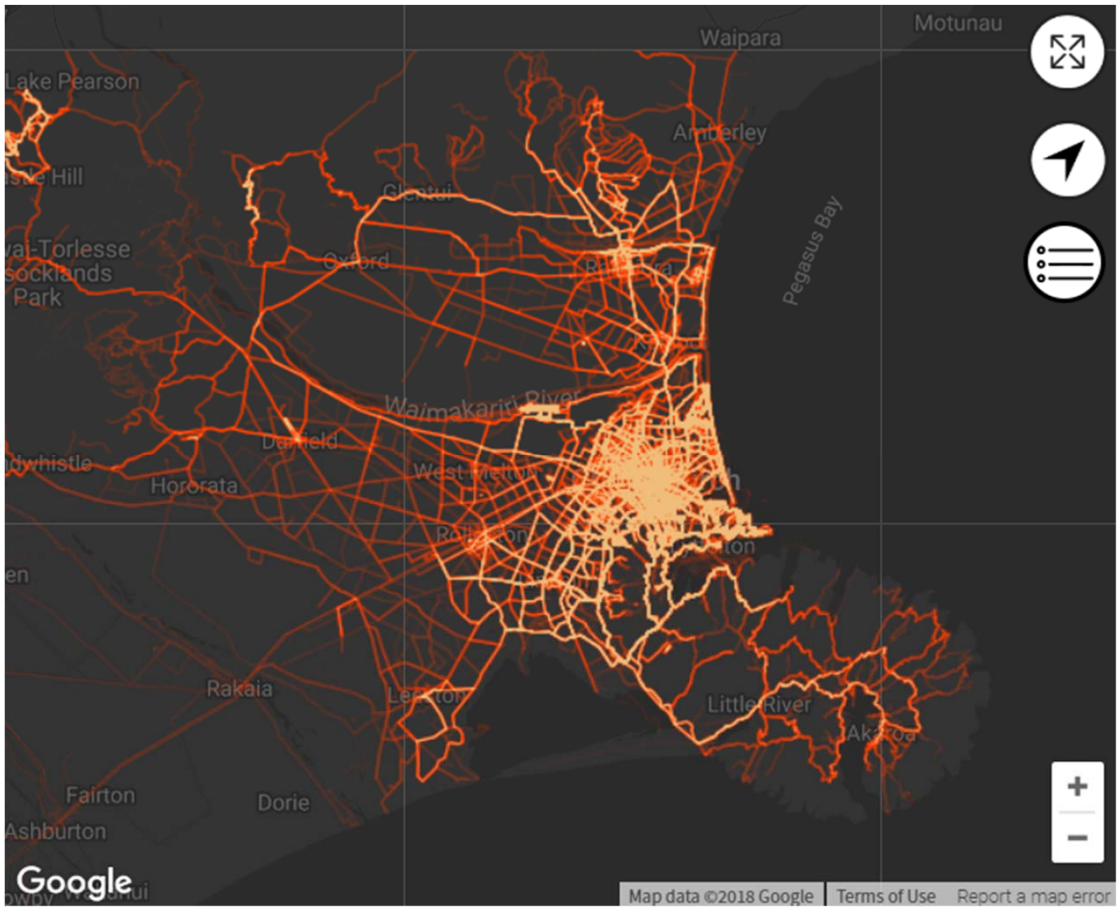
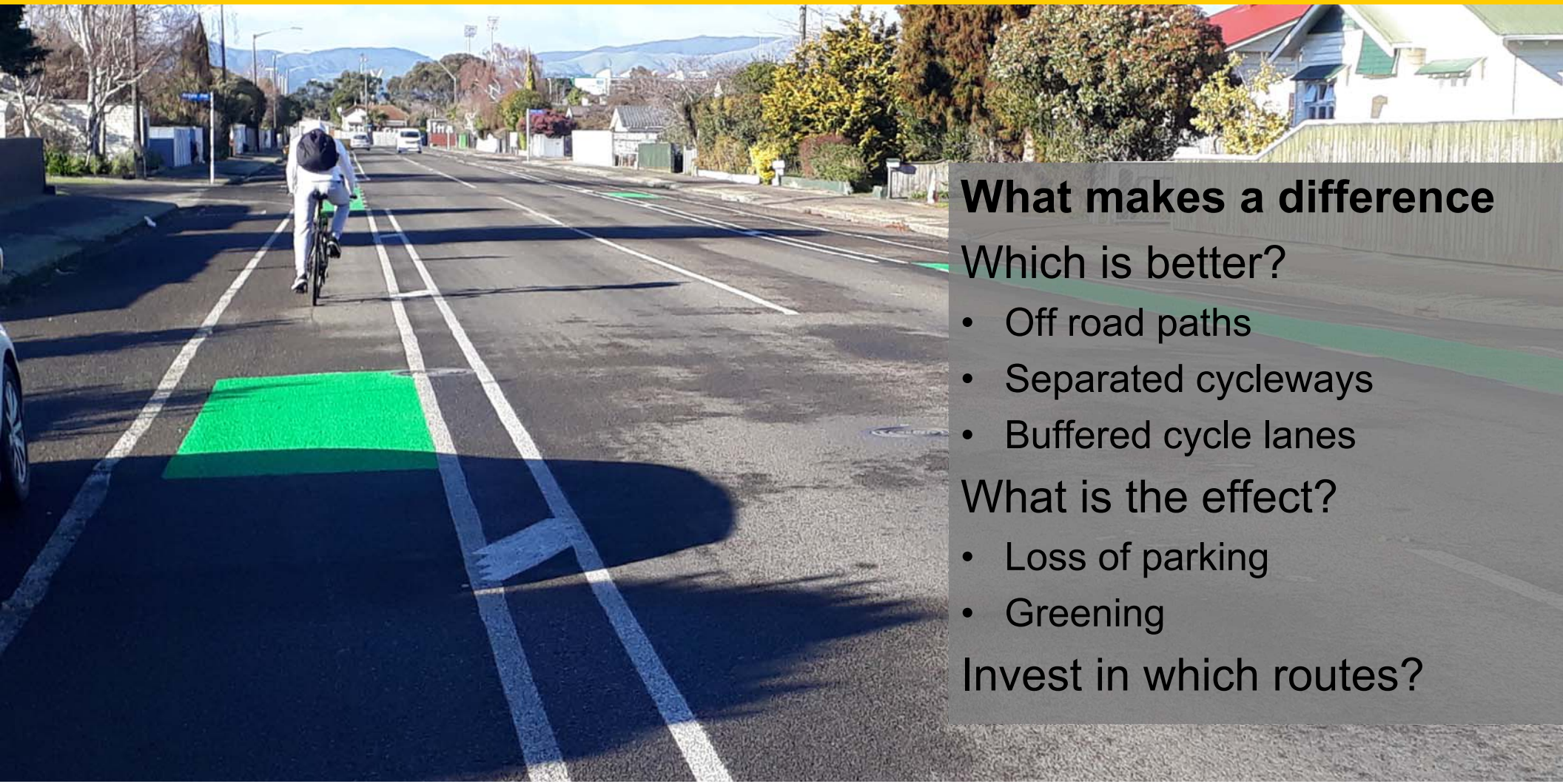
Reporting – web apps





Using the data



What makes a difference

Which is better?

- Off road paths
- Separated cycleways
- Buffered cycle lanes

What is the effect?

- Loss of parking
- Greening

Invest in which routes?

Budgeting

- Invested >$100K capital in permanent path counters
- Now budgeting $40K p.a.
  - Maintenance
  - Rotating on-street counters
  - Analysis & reporting
  - Real-time display

Description	Equip.	Install.	Existing	Tier 1	Tier 2	Exist + T1	T2
CAPEX							
Mobile multi with tubes and pyro	$ 7,350			1	1	$ 7,350	$ 14,700
Urban Zelt on-road 2 loops	$ 5,027	$ 3,500				$ -	$ -
Urban Zelt on-road 4 loops	$ 5,800	$ 3,800				$ -	$ -
Urban Zelt off-road 1 loop	$ 4,290	$ 2,300				$ -	$ -
Urban Zelt off-road 2 loop	$ 4,572	$ 2,600				$ -	$ -
Urban Zelt off-road 2 loops	$ 5,027	$ 2,650				$ -	$ -
Urban Zelt off-road 4 loops	$ 5,800	$ 3,000				$ -	$ -
Multi for path with loops & pyro (continuous sites)	$ 7,650	$ 3,000		3		$ 31,950	$ 31,950
Short term loggers (all five already owned)	$ 5,000					$ -	$ -
Short term sites - install loops & bollard	$ 1,337	$ 1,175		3	13	$ 7,536	$ 40,193
Bike count display only		$ 20,000				$ -	$ -
Bike count display with counter		$ 35,000			1	$ -	$ 35,000
					CAPEX TOTAL (rounded)	$ 46,900	$ 121,900
OPEX							
Eco-Count							
Eco-Visio license per counter per year		$ 510	12	4	2	$ 8,160	$ 9,180
Sensor battery (2 loop counter)		$ 90	4	1	1	$ 450	$ 540
Sensor battery (4 loop counter)		$ 180	8	3	1	$ 1,980	$ 2,160
Continous sites - bi-annual maintenance check		$ 180	7	3		$ 1,800	$ 1,800
Rotating 2mo loop sites - cycle count labour		$ 260		9	13	$ 2,340	$ 5,720
Rotating 14 day tube sites - cycle count labour		$ 260		10	5	$ 2,600	$ 3,900
Metrocount						$ -	
Routine maintenance		$ 120				$ -	$ -
Traffic control and signage		$ 300				$ -	$ -
Hardware charge		$ 100				$ -	$ -
Cycle count - 1 cycle lane (one side of the road)		$ 130				$ -	$ -
Cycle count – pair (both sides of a road)		$ 160	13			$ 2,080	$ 2,080
Cycle count - shared path		$ 130	1			$ 130	$ 130
Extra checks (i.e. one more if duration 2 weeks)		$ 75	14			$ 1,050	$ 1,050
Metrocount data analysis & reporting						$ -	$ -
Other						$ -	
Video 12 hour turning movement count all modes		$ 1,860	As required			$ -	
Manual count annual central city cordon		$ 88	17			$ 1,488	$ 1,488
Analysis, reporting							
Annual data collation, cleaning, report card		$ 170	60			$ 10,200	$ 10,200
Graphic design for public facing report documents		$ 110	24			$ 2,640	$ 2,640
Analysis and reporting for all indicators		$ 170	20			$ 3,400	$ 3,400
					OPEX TOTAL (rounded)	$ 38,400	$ 44,300

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Thank you

Questions & discussion

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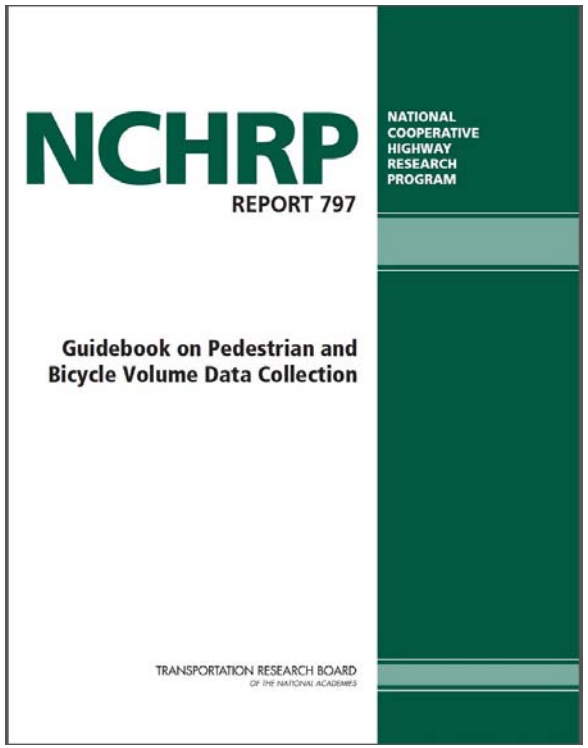
EXTRA SLIDES

Resources

NCHRP



CNG

Table 3: Technology Summary

Technology Type	Product Name (NB may not be an exhaustive list, focuses on known technology used currently or trialled in New Zealand)	Duration			Facility Type						
		Temporary (< 1 month)	Semi-Permanent	Permanent (Year Round)	On road cycle lane	Segregated cycle lanes / cycleway	Off road shared path	On road mix use with no cycle lane	Shared Bicycle/Bus Lane	Off road Cycle Path / Track	Pedestrians
Radar Detector	RadioBeam Bicycle Counter(Chambers Electronics)		✓	✓			✓			✓	✓
	SDR Bike (datacollect)	✓	✓	✓			✓				✓
In-ground Pressure Detector	MC5720 (MetroCount)		✓	✓	✓	✓	✓	✓	✓	✓	
Inductive Loop Detector	Bicycle Recorder (Counters and Accessories)		✓	✓			✓			✓	
	ZELT (Eco-Counter)		✓	✓	✓	✓	✓	✓	✓	✓	
Passive Infrared Detector [8]	PYRO (Eco-Counter)	✓	✓	✓							✓
Pneumatic Tube Detector[9]	MC5620 (MetroCount)	✓	✓		✓	✓	✓	✓	✓	✓	
	TUBE (Eco-Counter)	✓	✓		✓	✓	✓	✓	✓	✓	
Above Ground Pressure Detector	eTube bike (datacollect)	✓	✓		✓	✓	✓			✓	
Video Image Processing[10]	Mio-Vision[11]	✓			✓	✓		✓			
	Signal Cameras in local Transport Operations Centre – may require special technology.	✓[12]	✓	✓	✓	✓		✓			

https://www.nzta.govt.nz/assets/Walking-Cycling-and-Public-Transport/img/cycle-network-guidance/illlustrations/summary-of-cycle-counting-technologies.jpg

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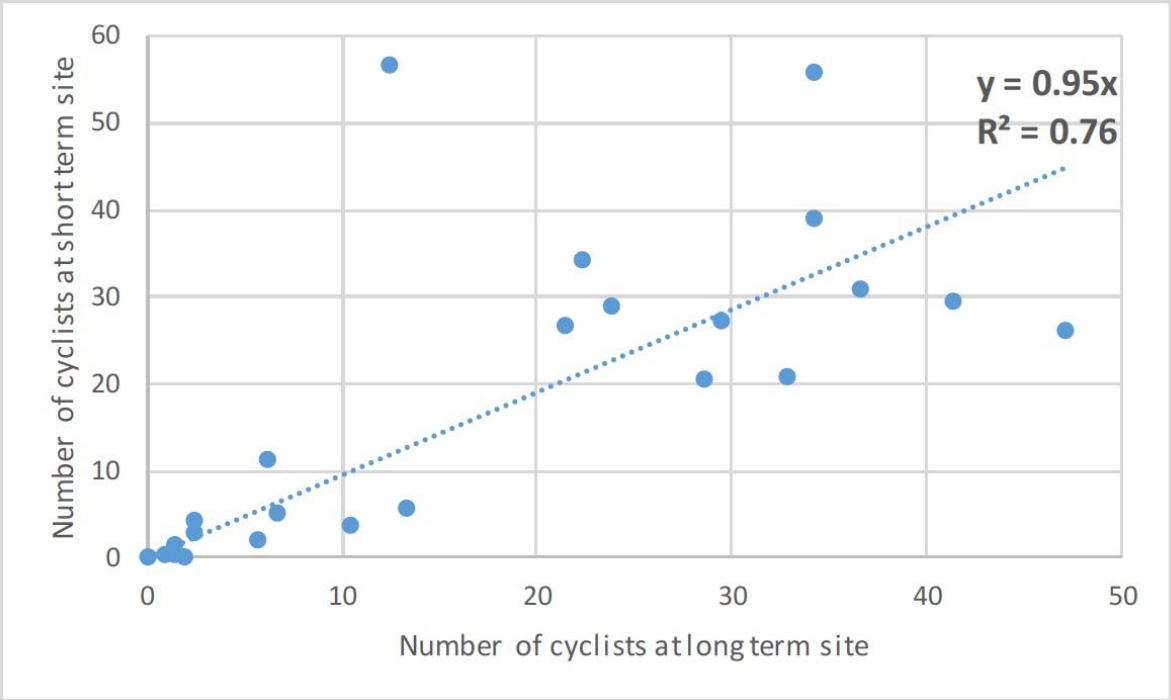
Check the R^2 before scaling!

- Less than .7 – not suitable match or sample too small



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Data management and analysis takeaways

1. Train staff to improve consistency of manual counts
2. Accuracy improves with careful matching of technologies to sites
3. Justify and document count sites
4. Rotating counters increases data quantity and quality
5. Check, clean, smooth!
6. Use caution when scaling and reporting on short term counts
7. Run statistical tests on your data to determine level of confidence