E-bike safety, speed, gender and regulation

Presentation to Asia-Pacific Cycle Congress
October 2017

John Lieswyn, ViaStrada
Simon Kennett, NZTA

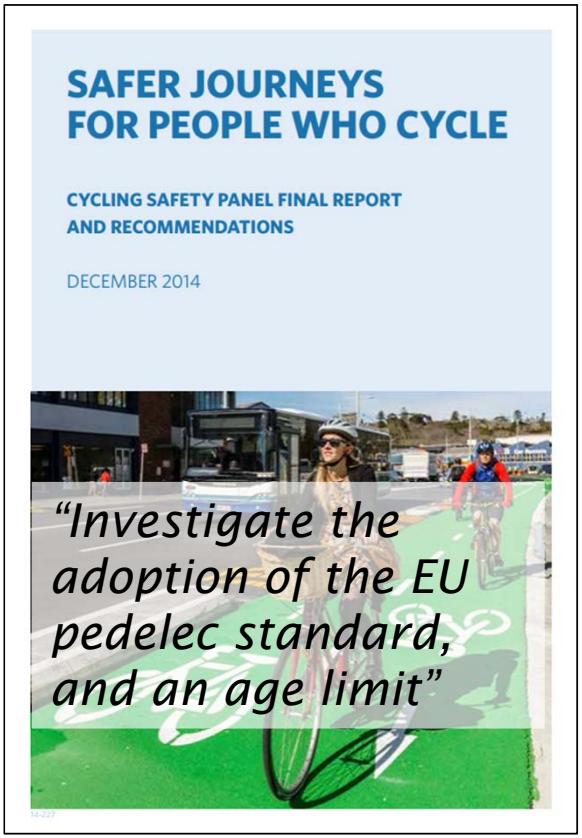
VIASTRADA
TRAFFIC ENGINEERING AND PLANNING

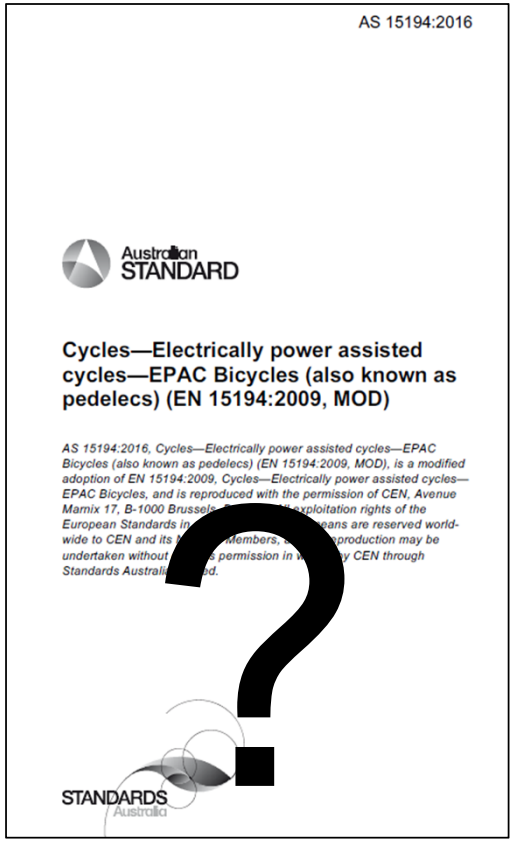
NZ TRANSPORT AGENCY
WAKA KOTAHI

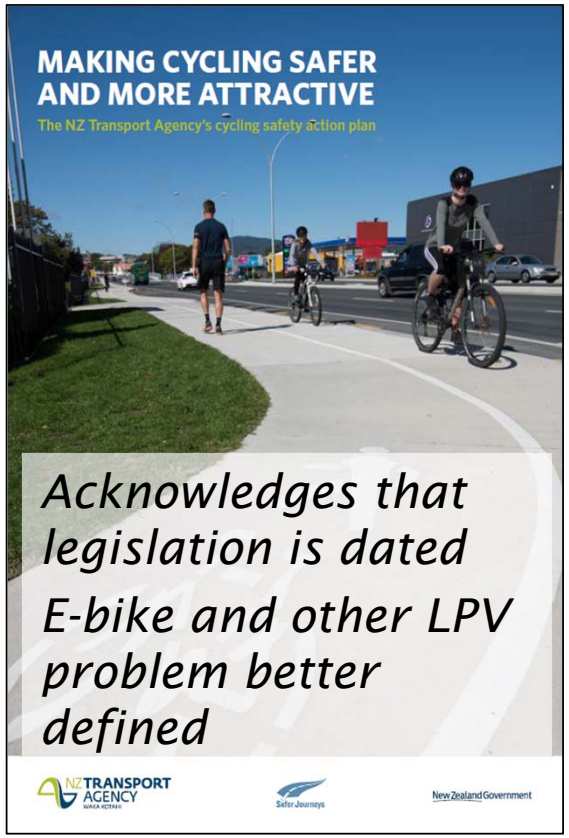
Presentation outline

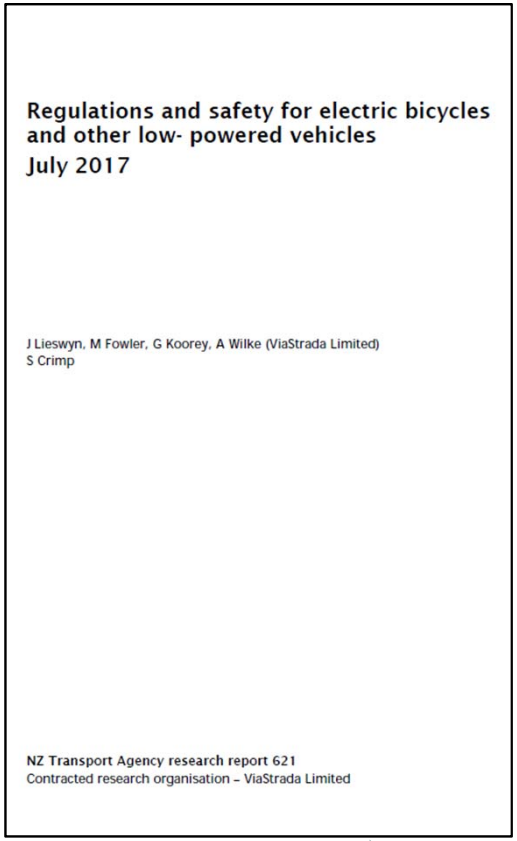
1. Background
2. Why regulate, types of e-bikes
3. Safety and speed
4. Regulatory approaches
5. Next steps

Background









2014 2016 2017

https://www.nzta.govt.nz/assets/Uploads/Progress-on-making-cycling-safer-and-more-attractive.pdf

A note to the audience

This presentation is based on research report *RR 621 Regulations and safety for electric vehicles and other low-powered vehicles*.

While the NZ Transport Agency provided investment, the research was undertaken independently, and the resulting findings should **not be regarded as being the opinion, responsibility or policy** of the Transport Agency or indeed of any NZ Government agency.

The Transport Agency is established under the Land Transport Management Act 2003. The objective of the Transport Agency is to undertake its functions in a way that contributes to an efficient, effective and safe land transport system in the public interest. The Transport Agency funds innovative and relevant research that contributes to this objective.

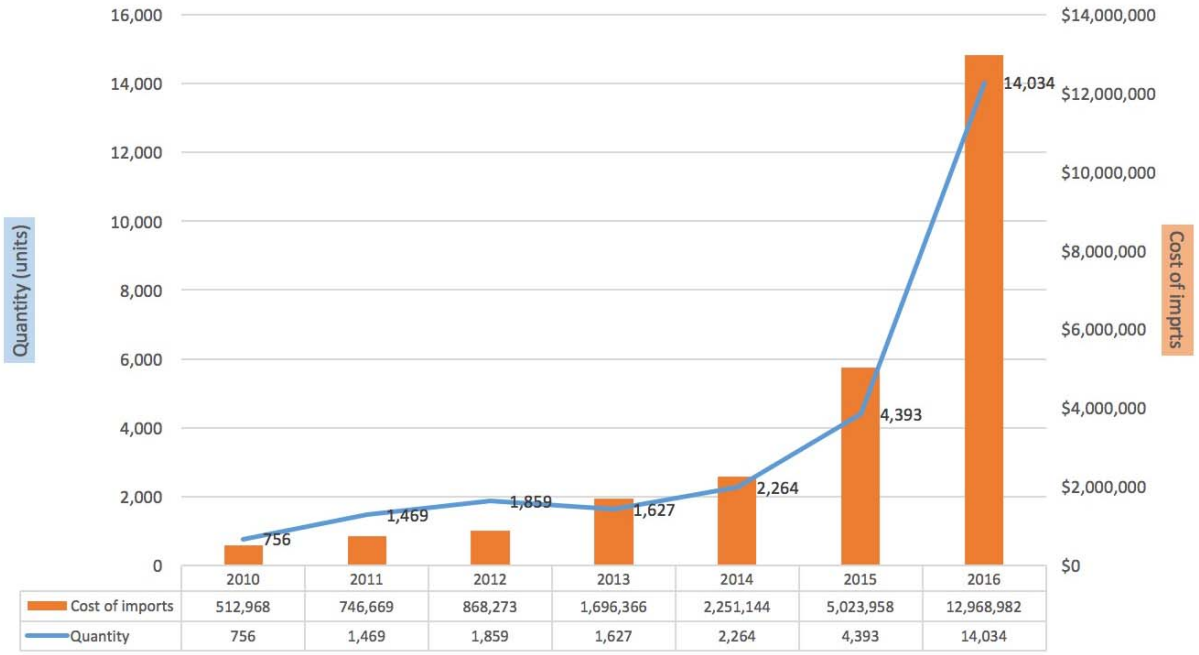
People using this research should apply and rely on their own skill and judgement and, if necessary, they should seek appropriate legal or other expertise regarding its use.

NZ TRANSPORT AGENCY
WAKA KOTAHI

Research motivation

Innovation outrunning legislation

Fast growth



	2010	2011	2012	2013	2014	2015	2016
Cost of imports	512,968	746,669	868,273	1,696,366	2,251,144	5,023,958	12,968,982
Quantity	756	1,469	1,859	1,627	2,264	4,393	14,034

VIASTRADA

Research questions and report structure

Report organisation	Topic or *research question* addressed
1. Introduction	Why regulate?
2. Types of LPVs	What is an LPV?
3. Survey summary	What does the public and industry think?
4. Market analysis	How significant is the issue?
5. Safety analysis	How serious is the issue?
6. User limitations	Should there be any age restrictions?
7. Technological features affecting safety	How will technology help?
8. Existing legislation around the world	What are other countries doing?
9. Potential regulatory options	What are the pros and cons?
10. Non-regulatory options	How else can we: • Address safety concerns • Support mode shift goals and “safety in numbers” • Support innovation?

WHY REGULATE | TYPES OF E-BIKES

Why: clarify existing rules

wheeled recreational device—

a) means a vehicle that is a wheeled conveyance (other than a cycle that has a wheel diameter exceeding 355 mm) and that is propelled by human power or gravity; and

b) includes a conveyance to which are attached 1 or more auxiliary propulsion motors that have a combined maximum power output not exceeding 300 W

?

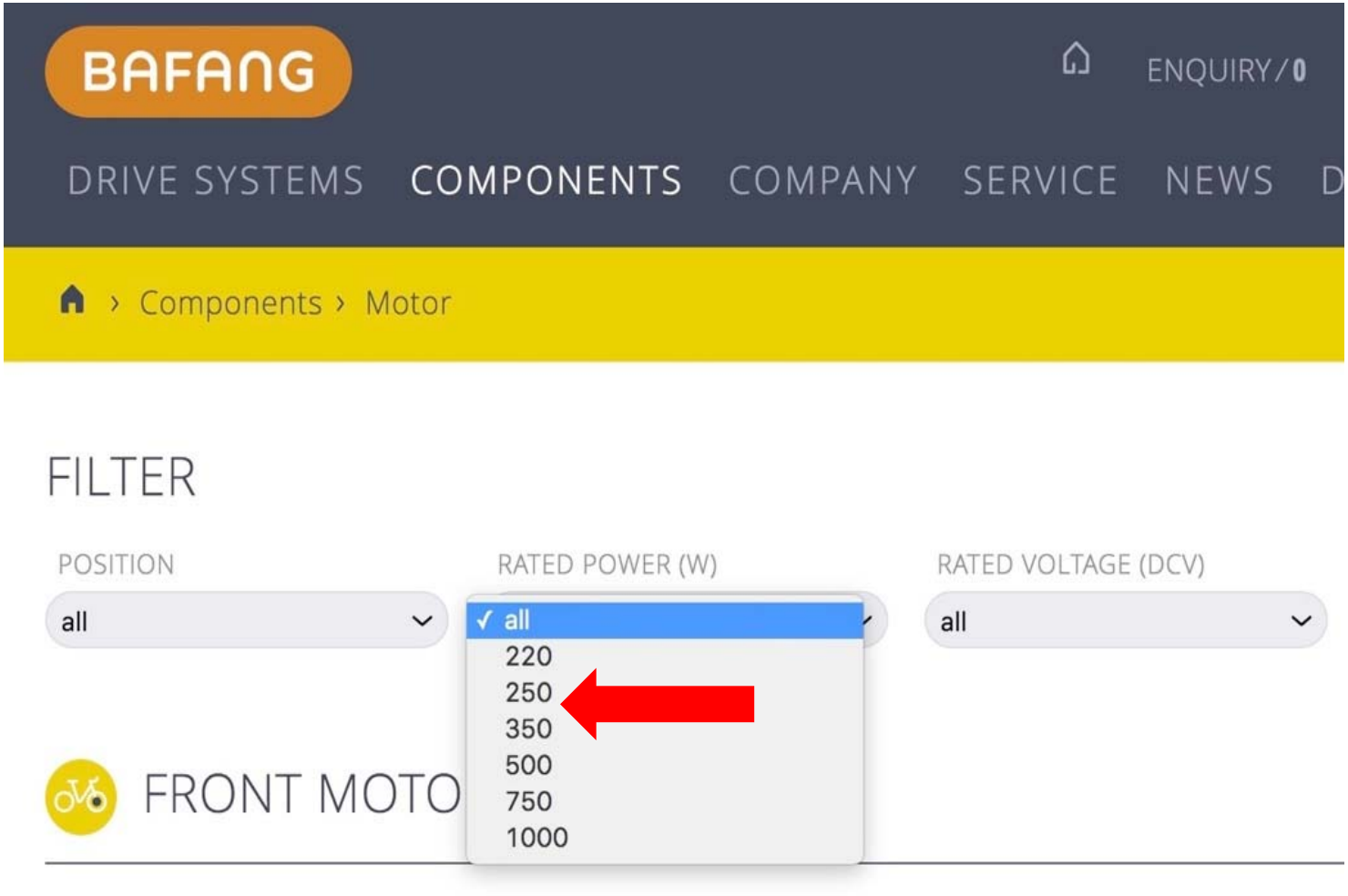
The following are examples of vehicles that meet the definition of motor vehicle but have difficulties meeting the safety standards and other requirements. This means they cannot be operated on the road.

- Motorised skate boards, scooters, and roller skates
- Segways and similar
- Powered Self Balancing Unicycles
- Cycles fitted with petrol motors
- Low powered scooters/mopeds
- Cycles designed primarily to be propelled by an engine not the muscular energy of the rider

VIASTRADA NZ TRANSPORT AGENCY WAKA KOTAHI

Why: conform to, support industry

- 300W rated motor doesn't exist



http://www.szbaf.com/en/components/motor.html

Safe system approach

Vehicle safety

Road and path design

User behaviours

E-bike types in NZ (per current regulations)

“Power-assisted pedal cycle”
designed primarily to be propelled by the muscular energy of the rider

Pedelec

Throttle
‘twist & go’

“Power-assisted pedal cycle”
Ambiguous. Not really ergonomic to pedal.

“Power-assisted pedal cycle”
But at 70 km/h, should it be?

“Pedal-assisted power cycle”
term in case law only. Scooter-style electric bike (SSEB). Max 20-25 km/h. Looks like a motor scooter.

“Power-assisted pedal cycle”
Cargo trike

VIASTRADA

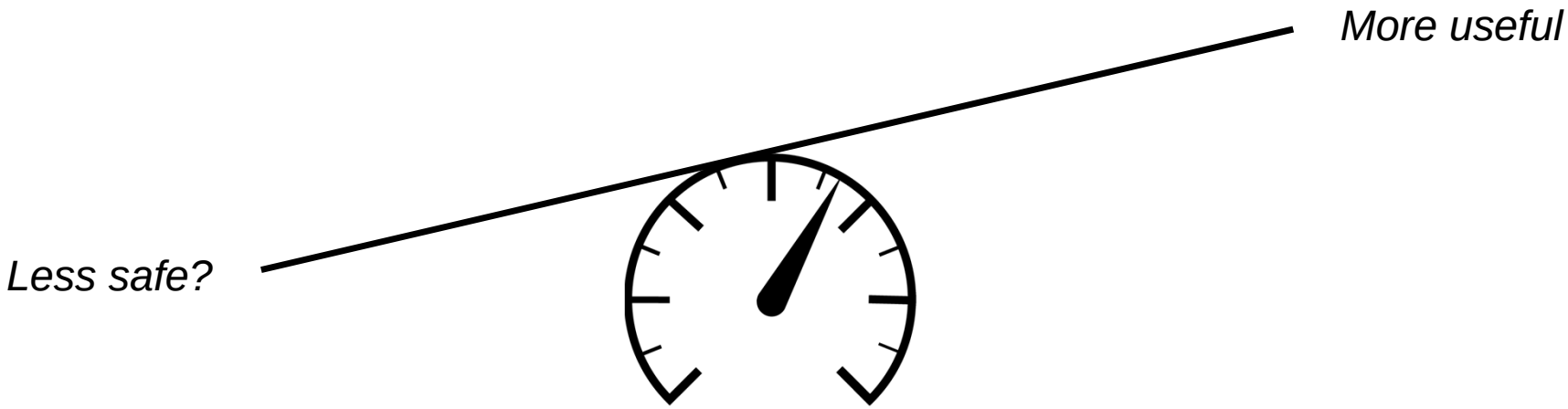
NZ TRANSPORT AGENCY
WAKA KOTAHI

SAFETY AND SPEED

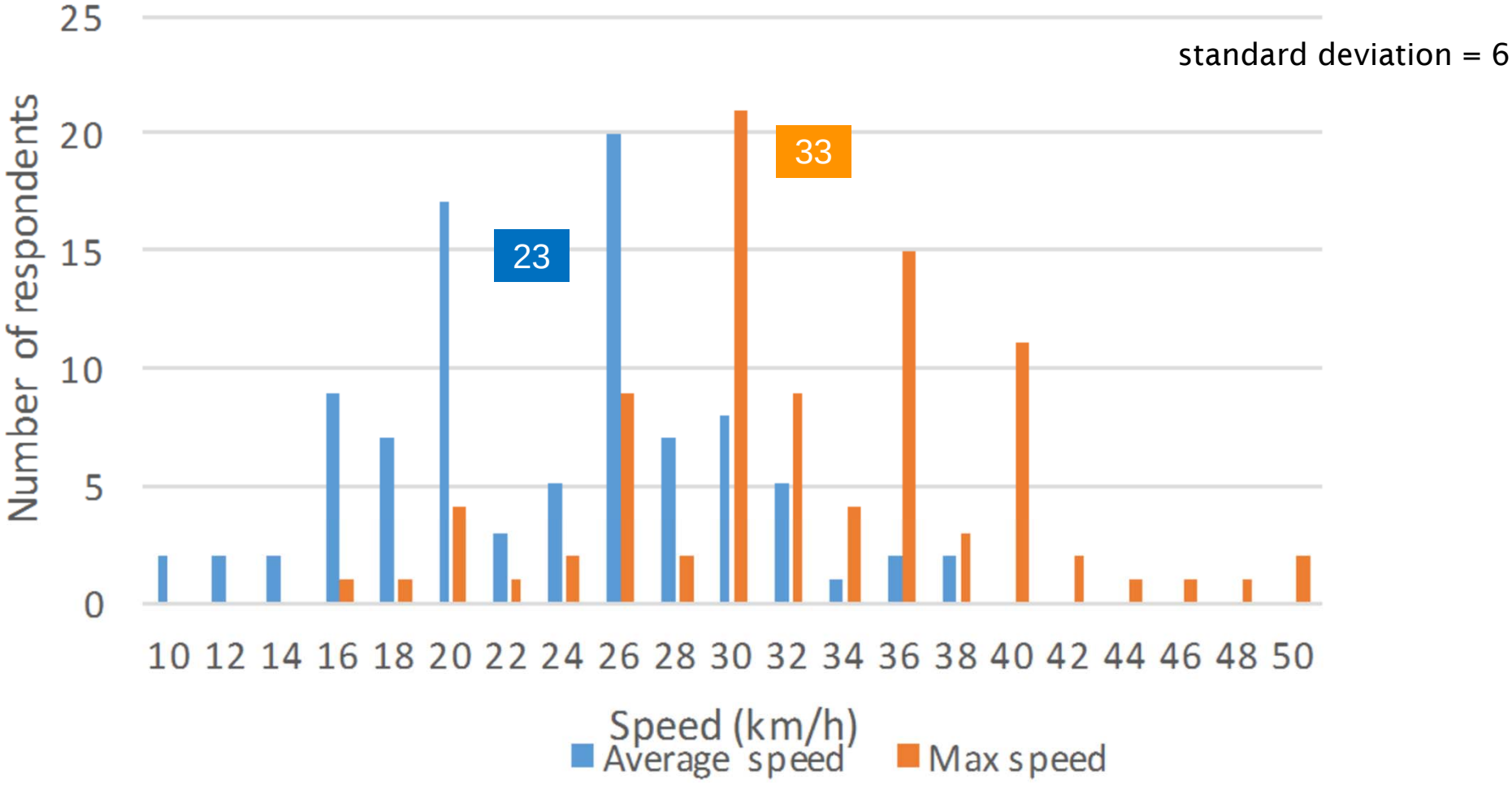
Speed is most common safety concern

- E-bikes, compared with ordinary bikes:
  - Heavier
  - Can accelerate faster
  - Higher average speed

  → Greater momentum on collision
  → Requires greater cognitive ability
  → Helps users to avoid conflict, take the lane



E-bike max / avg speeds from our survey



VIASTRADA

Unpowered	E-25	E-32	E-45	Diff.	Study	Country	Context
18.4					Boufus et al (2017)	AU	Paths
-	16.9	-	-	3.3	Dozza et al (2016)	SWE	Various
13.6	-	-	-		Dozza et al (2013)	SWE	Various
15.3	17.4			2.1	German Insurance Association (2014)	GER	Roads
			23.2	7.9			
16.1	-	-	-	-	Schleinitz et al (2015)	GER	Paths
	19.0	-	-	2.9			
	-	-	24.9	8.8			
19.8	22.5			2.7	Sander and Marker (2015)	GER	Roads
13.7	15.8			2.1	Sperlich et al (2012)	GER	Roads
21.6	-	-	-	-	Parkin and Rotheram (2010)	UK	Roads
17.7	19.3			2.6	Vlakveld (2014)	HOL	Roads
14.9	16.6			1.7			
10.5		13.3	-	2.9	Langford et al (2015)	US	Paths
12.6		11		-1.6			
10.3	16.5			6.2	Gojanovic et al (2011a)	FIN	Road
23.6		**30**		**6.4**	**Lieswyn (unpublished)**	**NZ**	**Various**

Unpowered riders on shared paths

- 5,421 riders at 12 Sydney sites
- “Riders adjust their speeds to…pedestrians and path conditions”

Median	**16 km/h**	**Mean**	**18.4 km/h**	**> 30 km/h**	**7.8%**

FACTORS LEADING TO SPEED +/- MEDIAN SPEED	**Odds ratio**
Pedestrians > 100 / hour	.15
Female	.4
Commuter path	1.1
Width	1.3
Centreline present	1.4
Visual segregation	3.9

VIASTRADA NZ TRANSPORT AGENCY WAKA KOTAHI

Boufous, Hatfield, Grzebieta (in press) *Environmental factors on cycling speed on shared paths*

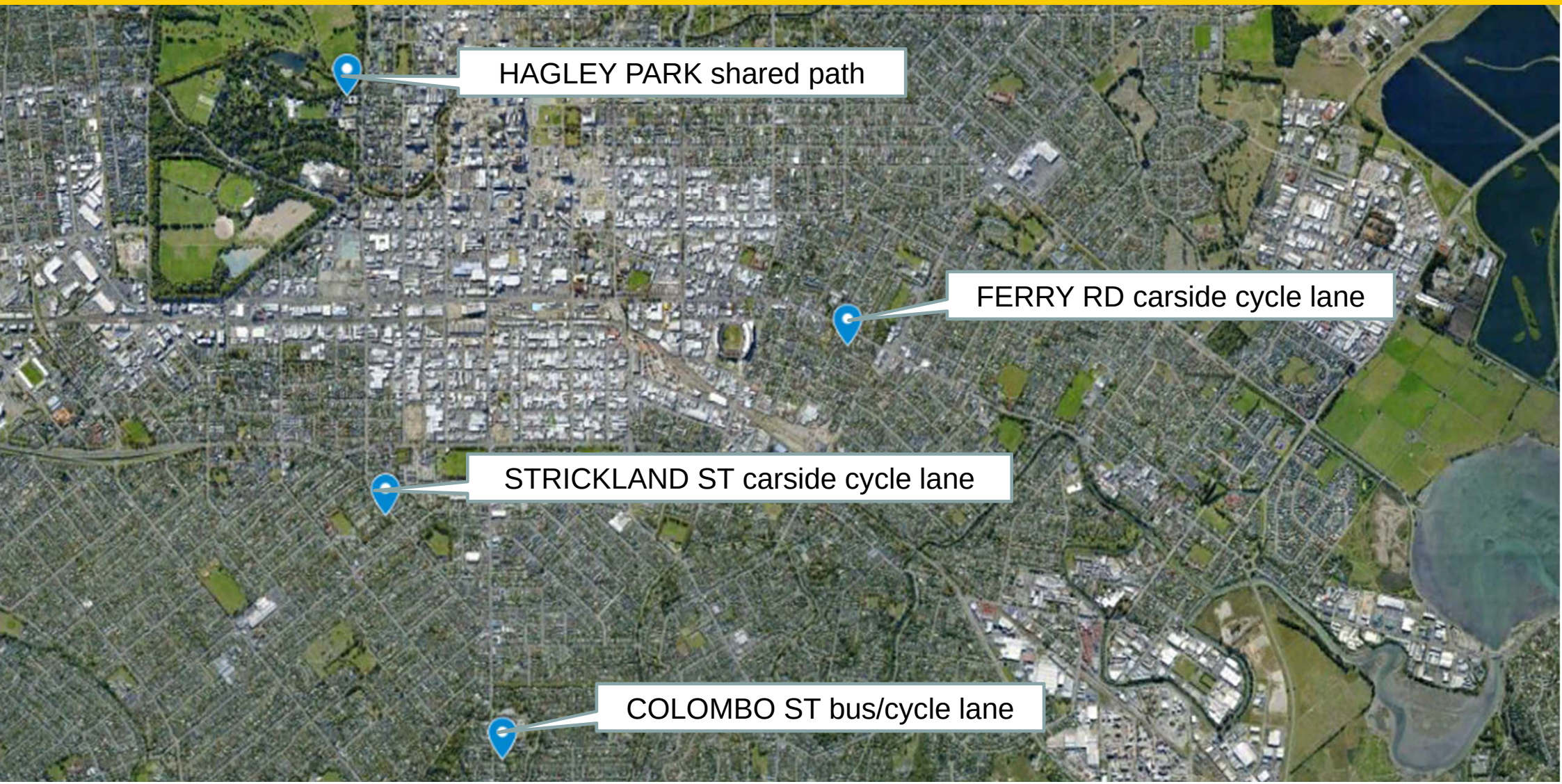
Methods

- Pro Laser III radar gun
  - Speed accuracy +/-1 km/h for subject targets
  - Range 1800m, accuracy 0.15m
  - Acquisition time 0.3s
  - Beam width 1m @ 300m
- Free speed observations – separate reading if:
  - Lateral ± 1m, considered apparent steering inputs
  - Longitudinal ± 3 bike lengths, considered apparent deceleration
- E-bikes identification
  - Initial judgement aided by presence of steady headlight
  - Confirmed by visual scan for motor

VIASTRADA

NZ TRANSPORT AGENCY
WAKA KOTAHI

Christchurch sites



Wellington site

Results by gender

Type	Female		Male		Diff.	All riders		Precision at 95% CI
	Avg.	Obs.	Avg.	Obs.	Avg.	Avg.	Obs.	
E-bike	27.4	9	30.9	15	3.5	29.6	24	2.4 km/h
Unassisted	21.4	167	25.3	502	3.9	24.4	669	0.5 km/h
Total	21.7	176	25.5	517	3.8	24.5	693	
Female % (e-bike)		38%						
Female % (unassisted)		25%						
E-bike diff.						5.3		

1. Women are a larger proportion of e-bike (38%) than unassisted riders (25%)
2. The difference in average speed between genders **may** be less for e-bikes than for unassisted riders
3. E-bike riders travel **about** 5 km/h faster (29.6 km/h) than unassisted riders (24.4 km/h)

Results by facility type

Type	Bus / bike lane		Cycle lane carside		Shared path	
Location	Average	Obs.	Average	Obs.	Average	Obs.
E-bike	**25.0**	1	**32.5**	6	**28.9**	17
Colombo	25.0	1				
Ferry			32.8	4		
Hagley					28.8	8
Strickland			32.0	2		
Hutt Rd					29.0	9
Unassisted	**25.4**	93	**24.6**	249	**23.9**	327
Colombo	25.4	93				
Ferry			25.6	92		
Hagley					21.7	215
Strickland			24.0	157		
Hutt Rd					28.2	112
Total	25.4	94	24.8	255	24.1	344
E-bike diff.	n/s		**7.9**		**5.0**	

REGULATORY APPROACHES

Regulation in EU

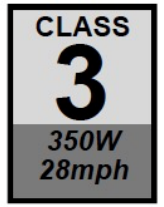
- Effective 01 January 2017

	Category	Description	Power	Motor cut-out	Type approval
AS 15194	Pedelec	Motor only functions on condition the cyclist pedals.	<= 250 W	<= 25 km/h	Not applicable
	Powered cycle	Designed to pedal; auxilliary motor with primary aim to aid pedalling. May have a throttle. Can include vehicles with 2, 3 or 4 wheels.	<= 1000 W	<= 25 km/h	L1e-A
	Moped	Includes SSEBs, electric mopeds and S-Pedelecs.	<= 4000 W	<= 45 km/h	L1e-B

Regulation in USA

Class	Description	Throttle	Power	Motor cut-out	Age
Class 1	Low-speed **pedal**-assisted electric bicycle	No	Max 750W	Max 20 mph (32 km/h)	n/a
Class 2	Low-speed **throttle**-assisted electric bicycle	Yes			
Class 3	**Speed** pedal-assisted electric bicycle Helmet, speedometer, **prohibited on shared paths or protected cycleways unless authorised locally**	No		<= 45 km/h	>= 16

- Tampering with speed control prohibited
- Registration, license, insurance not required
- Permanent label
- Mopeds, SSEBs separately regulated



VIASTRADA NZ TRANSPORT AGENCY WAKA KOTAHI

Quick look at criterion 2: speed

Regime	Pros	Cons
Limit motor assist cut-out speed	• Proxy for safety • Differentiates from mopeds	• Existing bikes? • Widen gap in modes
25 km/h	• Consistent with AU • Safer in event of crash	• Not as equitable with cars • Less selection
32 km/h	• Consistent w/ US, NZ fleet • Helps ‘take the lane’ • Majority support >25 km/h	• Not a 5 km/h increment (35?) • Less safe in a crash • Worse shared path conflicts?

Quick look at criterion 2: speed

Regime	Pros	Cons
Limit motor assist cut-out speed	• Proxy for safety • Differentiates from mopeds	• Existing bikes? • Widen gap in modes
25 km/h	• Consistent with AU • Safer in event of crash	• Not as equitable with cars • Less selection
32 km/h	• Consistent w/ US, NZ fleet • Helps ‘take the lane’ • Majority support >25 km/h	• Not a 5 km/h increment (35?) • Less safe in a crash • Worse shared path conflicts?

Quick look at criterion 2: speed

Regime	Pros	Cons
Limit motor assist cut-out speed	• Proxy for safety • Differentiates from mopeds	• Existing bikes? • Widen gap in modes
25 km/h	• Consistent with AU • Safer in event of crash	• Not as equitable with cars • Less selection
32 km/h	• Consistent w/ US, NZ fleet • Helps ‘take the lane’ • Majority support >25 km/h	• Not a 5 km/h increment (35?) • Less safe in a crash • Worse shared path conflicts?

SITUATION TODAY AND NEXT STEPS

Situation today

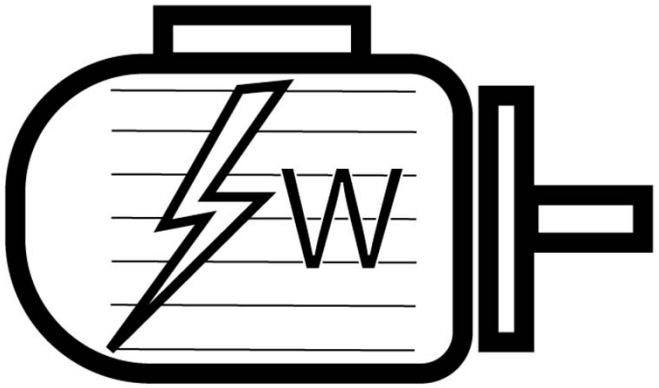
Sale >300W not illegal

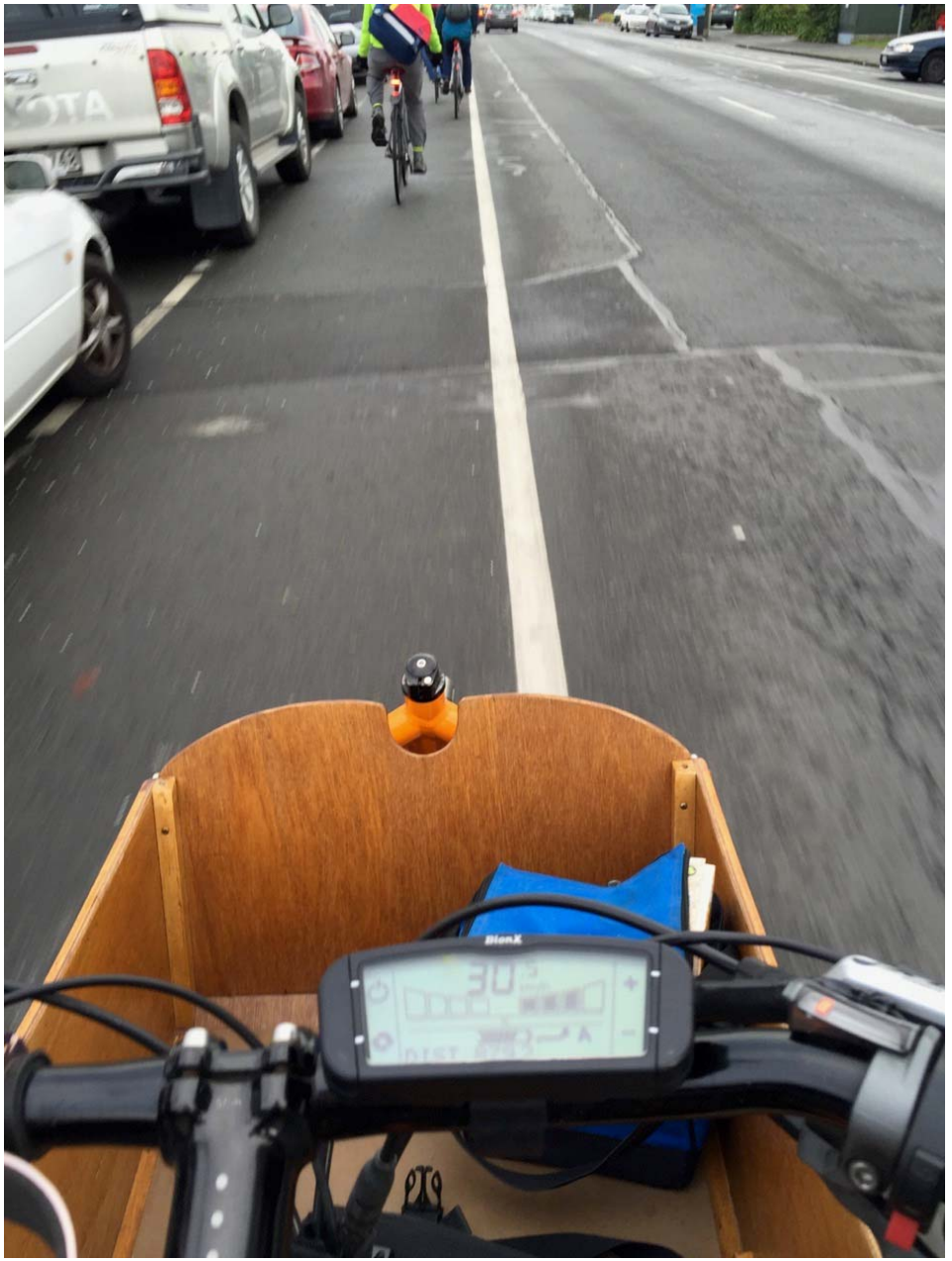
Use of >300W on road is illegal

Industry competitive concerns


USE
RAMP


CONTROL


W



Thank you

John Lieswyn
john@viastrada.nz
Simon Kennett
Simon.kennett@nzta.govt.nz