The characteristics of **schools** and early **childhood centres** exposed to high levels of **traffic noise**

Allan Schori

Victoria University of Wellington, Environmental Health Intelligence Massey University

Master of Geographic Information Science

VICTORIA UNIVERSITY OF WELLINGTON
TE HERENGA WAKA

Contents

Background
Research questions
Data and methods
Result
Conclusions

Issue

Siting schools and early childhood centres close to busy, noisy roads

- Drivers:

  Growing population, discontent from locals, consents

Residents appeal decision to convert former Auckland church to large daycare centre
Zizi Sparks - 08:39, Mar 15 2017

Neighbours oppose childcare centre
Imogen Neale - 10:16, Jan 08 2018

Neighbours upset second daycare coming to their street on Auckland's North Shore
Zizi Sparks - 15:39, Aug 15 2017

Daycare plans protested
Zizi Sparks - 14:35, May 05 2016

Impact of busy roads

Increased:

Risk of **physical injury**

Exposure to **air pollutants**

Exposure to **noise pollution**
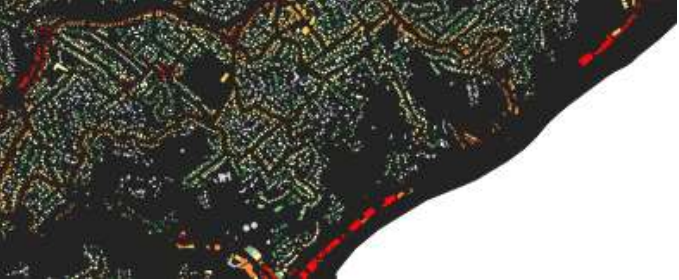
Impact of busy roads

Increased:

Risk of **physical injury**

Exposure to **air pollutants**

Exposure to **noise pollution**

Health effects of noise pollution

Cardiovascular disease
Heart disease, hypertension, stroke

Mental health
Anxiety, depression, hyperactivity in children

Sleep quality
Multiple awakenings, increased blood pressure

Metabolic
Obesity, diabetes (T2)

Hearing loss
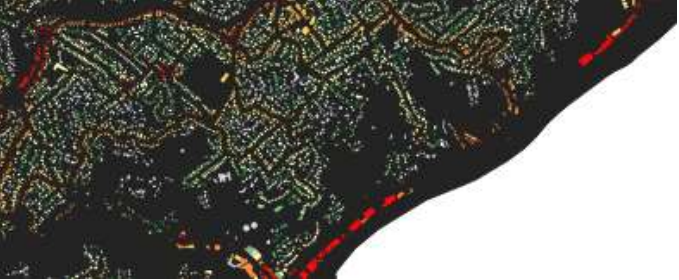Hearing impairment and Tinnitus

Annoyance
Subjective

Cognitive impairment
Reading & oral comprehension

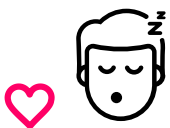# Health effects of noise pollution

Cardiovascular disease
Heart disease, hypertension, stroke

Mental health
Anxiety, depression, hyperactivity in children

Sleep quality
Multiple awakenings, increased blood pressure

Metabolic
Obesity, diabetes (T2)

Hearing loss
Hearing impairment and Tinnitus

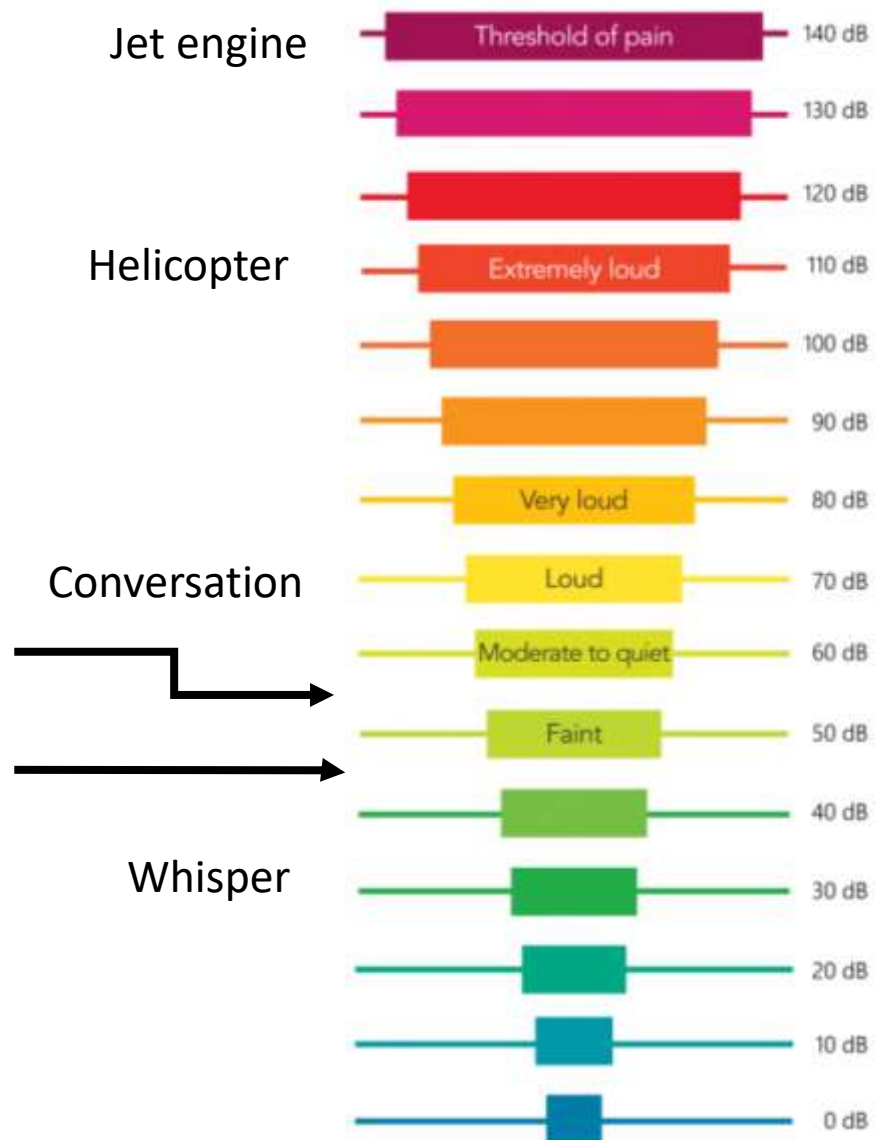**Annoyance**
Subjective

Cognitive impairment
Reading & oral comprehension

WHO noise guidelines

Jet engine

Threshold of pain	140 dB
	130 dB
	120 dB

Helicopter

Extremely loud	110 dB
	100 dB
	90 dB
Very loud	80 dB

Conversation

Loud	70 dB
Moderate to quiet	60 dB

Above 53dB for daytime

Faint	50 dB
	40 dB

Above 45dB for night-time

Whisper

	30 dB
	20 dB
	10 dB
	0 dB

8

Research questions

- How clustered are schools and early childhood centres with elevated traffic noise levels?
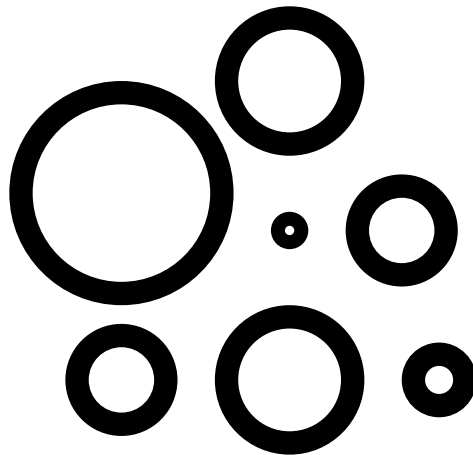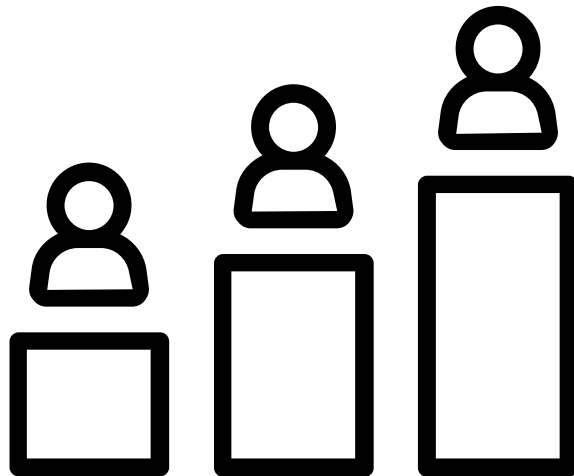
Research questions

- How do noise levels at schools and early childhood centers compare to other locations in Wellington?
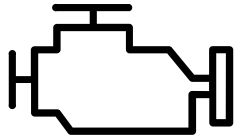
Research questions

- How do socio-economic characteristics interact with noise levels at schools and early childhood centers?
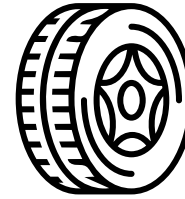
What is traffic noise?

Propulsion noise
Engine noise, fans

- Speed OSM
- Road slope DEM
- Vehicle class (truck, car) Pneumatic road tube (NZTA)
- Vehicle count Pneumatic road tube (NZTA)

Rolling noise
Interaction between tyre and road

- Speed OSM
- Road surface reference road surface
- Temperature Kelburn weather station mean temperature
- Vehicle count Pneumatic road tube (NZTA)

How these things relate to noise

- Common Noise Assessment Methods in Europe

European Commission

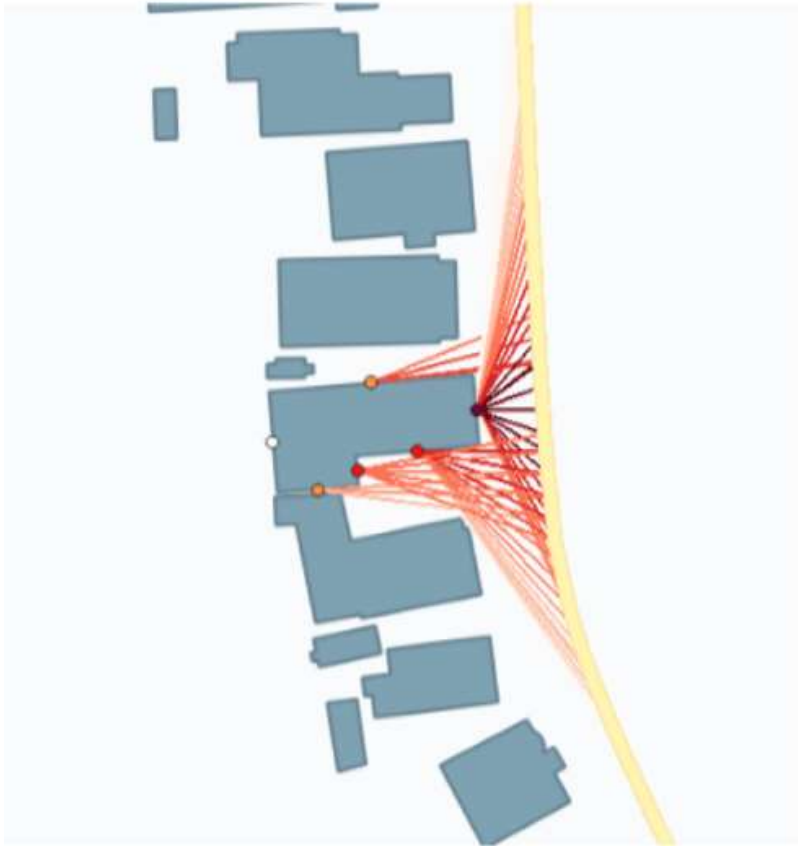Common Noise Assessment Methods in Europe (CNOSSOS-EU)

Application in a GIS

- Noise levels calculated at 10m points along the road centrelines

- Noise propagation paths drawn, extending 50m from each road point
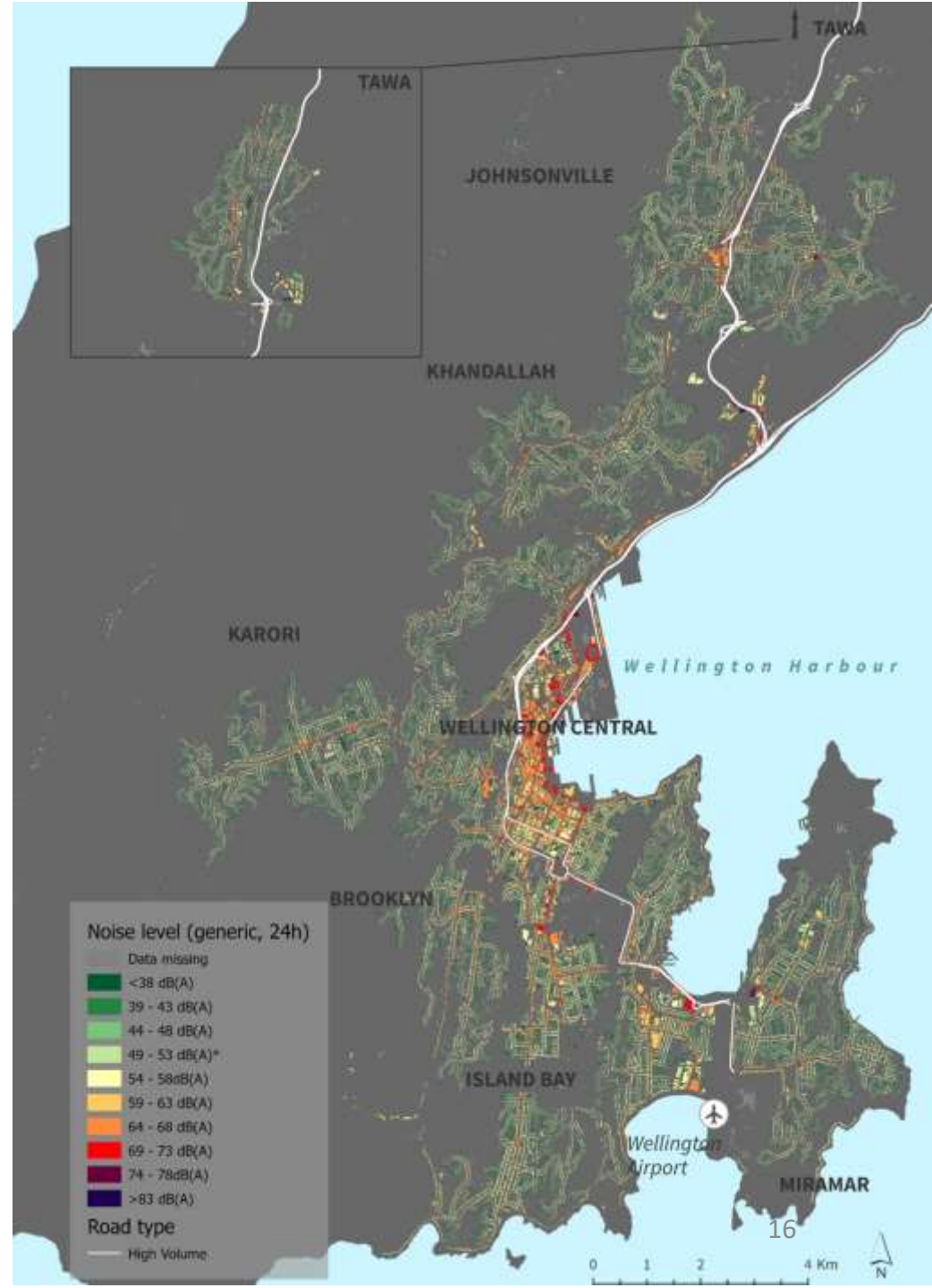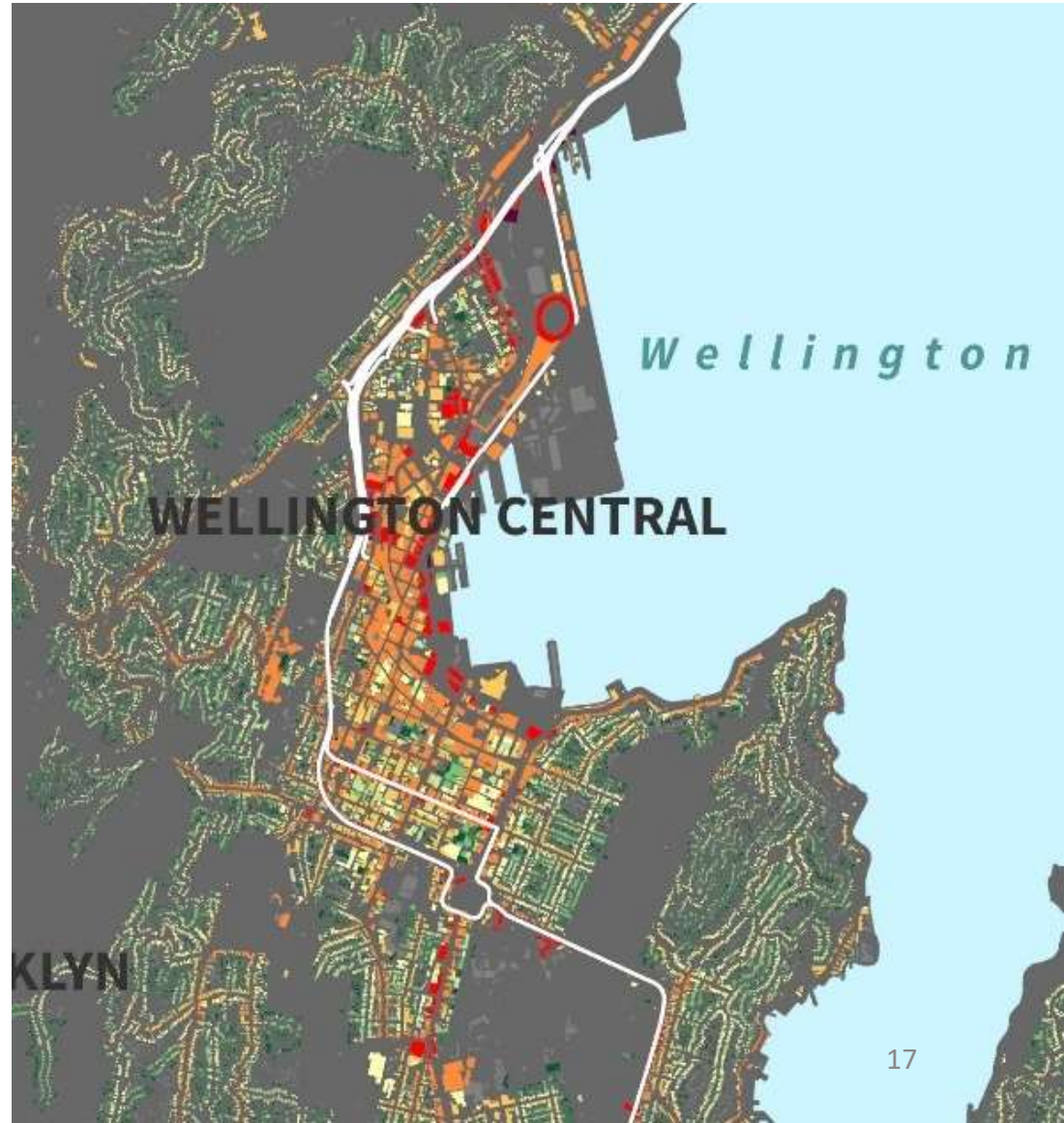
QGIS

Propagation paths

Direct

Diffracted

Noise levels

Noise level (generic, 24h)
- Data missing
- <38 dB(A)
- 39 - 43 dB(A)
- 44 - 48 dB(A)
- 49 - 53 dB(A)*
- 54 - 58dB(A)
- 59 - 63 dB(A)
- 64 - 68 dB(A)
- 69 - 73 dB(A)
- 74 - 78dB(A)
- >83 dB(A)

Road type
— High Volume

Clustered patterns of noise

- High noise level around Central Wellington
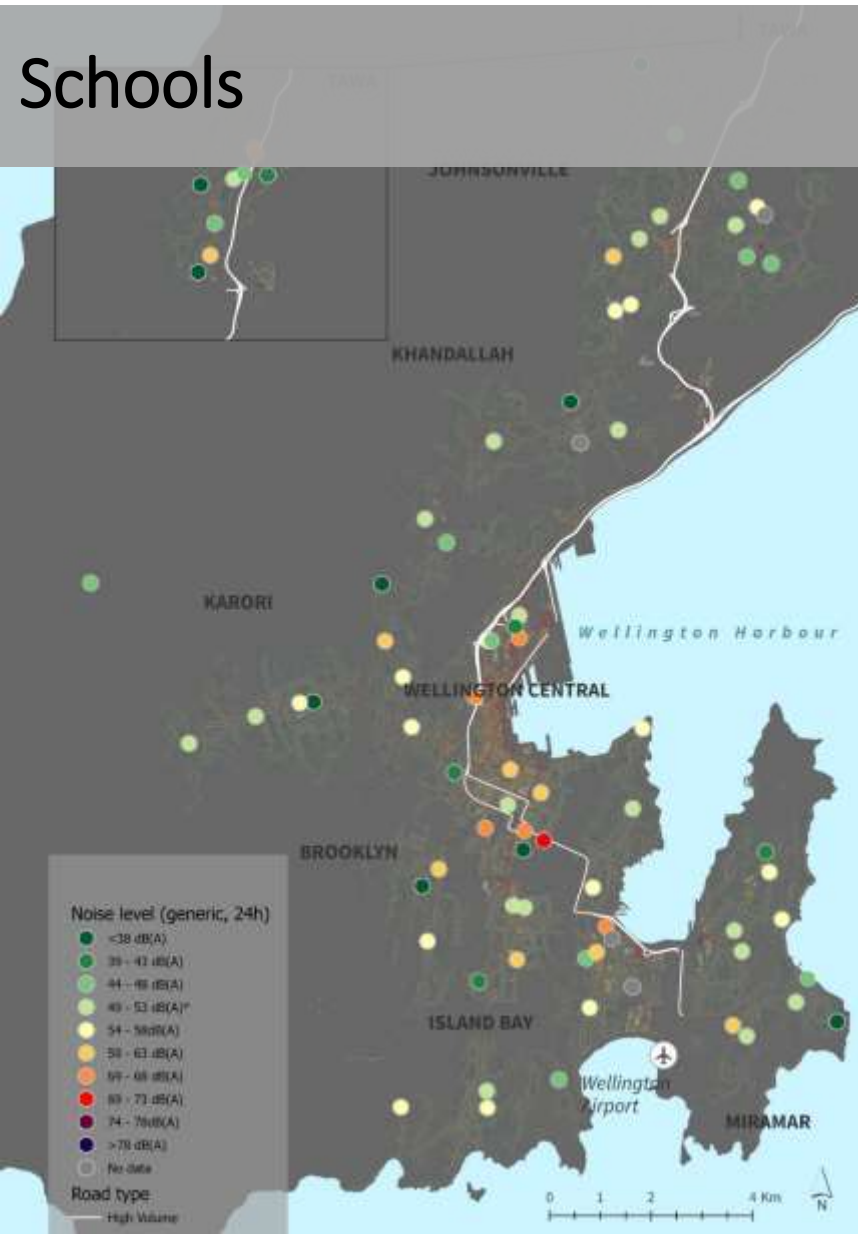
Clustered patterns of noise

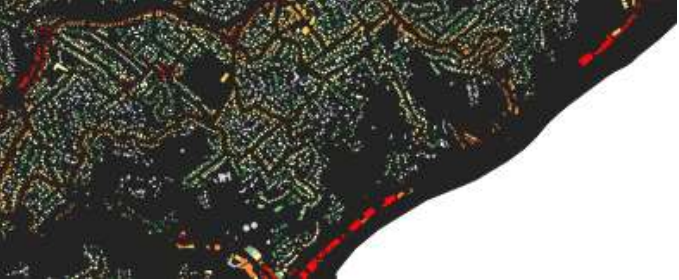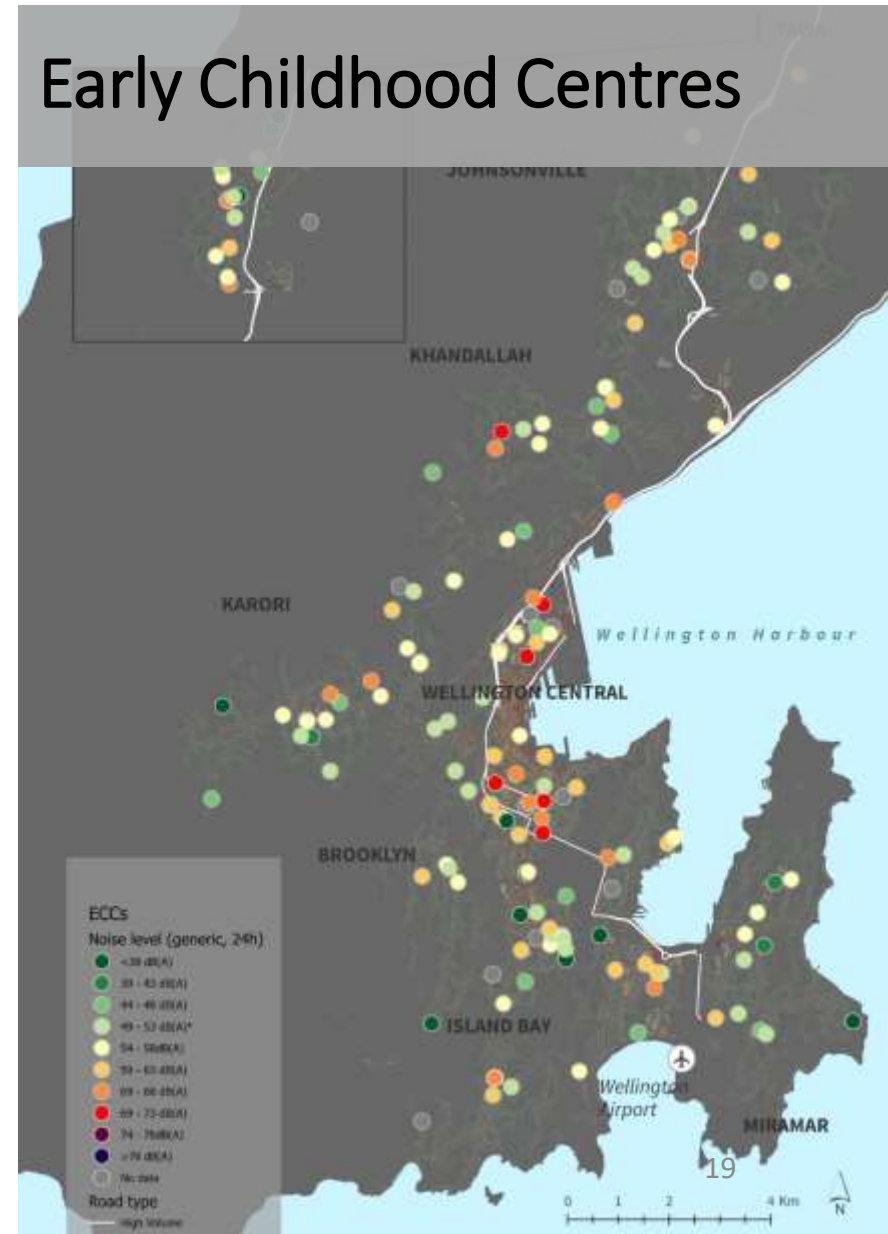- High noise levels follow highways and main routes through suburbs
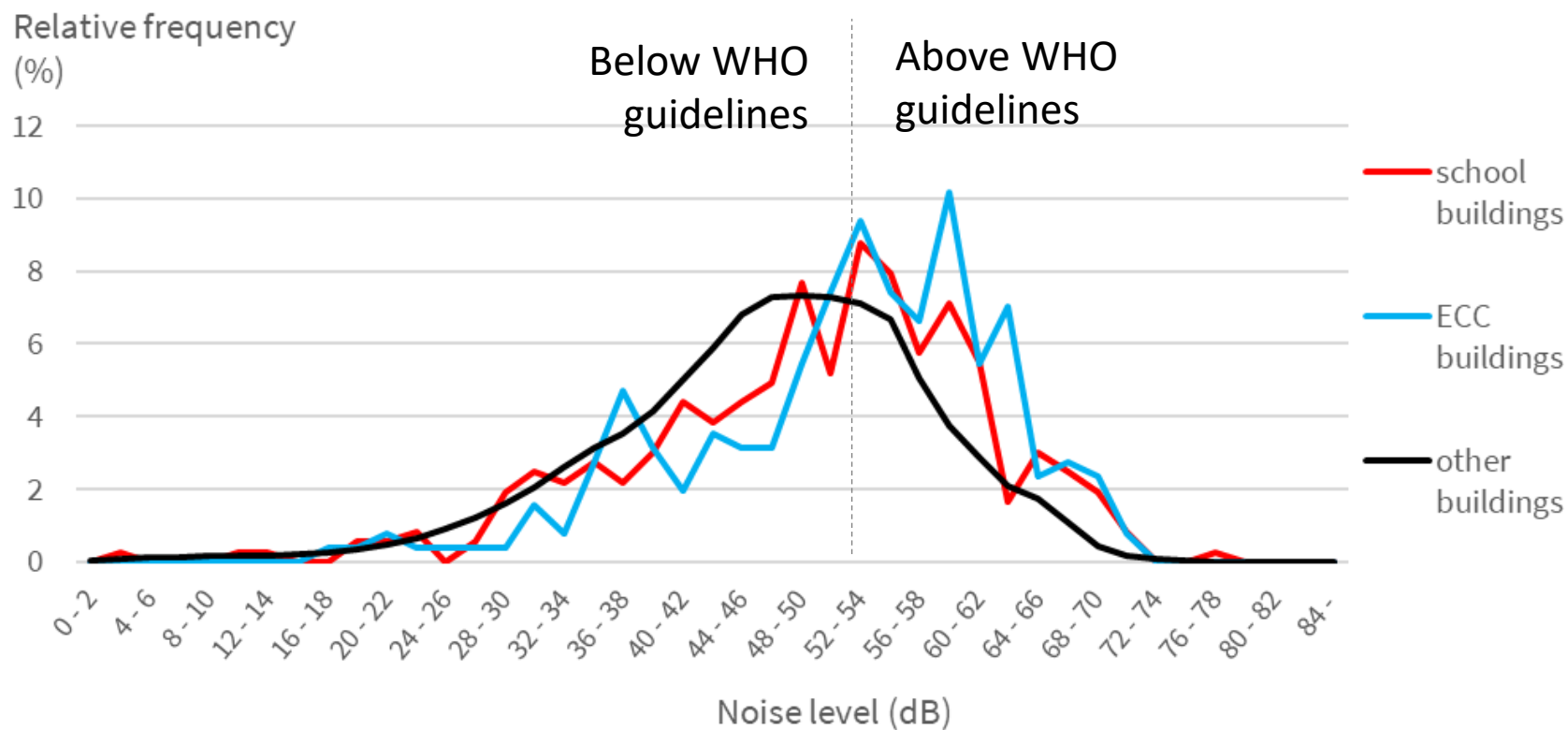
Clustered patterns of noise
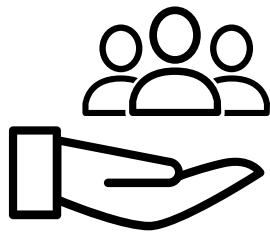

Schools

Early Childhood Centres

Comparison with other building uses

Relative frequency (%) vs Noise level (dB)

Below WHO guidelines / Above WHO guidelines

Legend:
- school buildings (red)
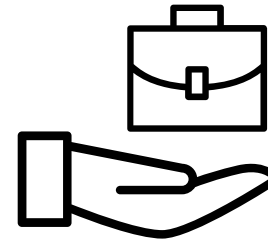- ECC buildings (blue)
- other buildings (black)

Interaction with socio-economic factors:

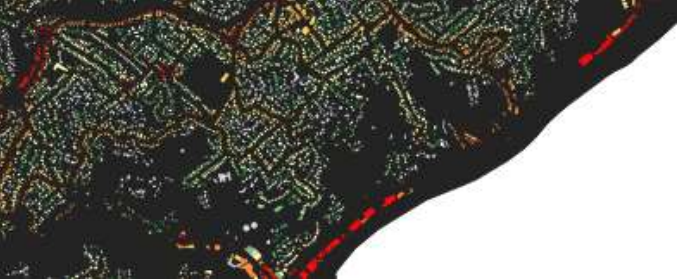## ECC ownership type

52.3 dB
Community based

57.0 dB
Privately owned

(WHO thresholds: 53dB day, 45dB night)

- Different priorities for different ownership models

- Convenience hypothesis

Interaction with socio-economic factors:

International-domestic students

51.7dB
Domestic students
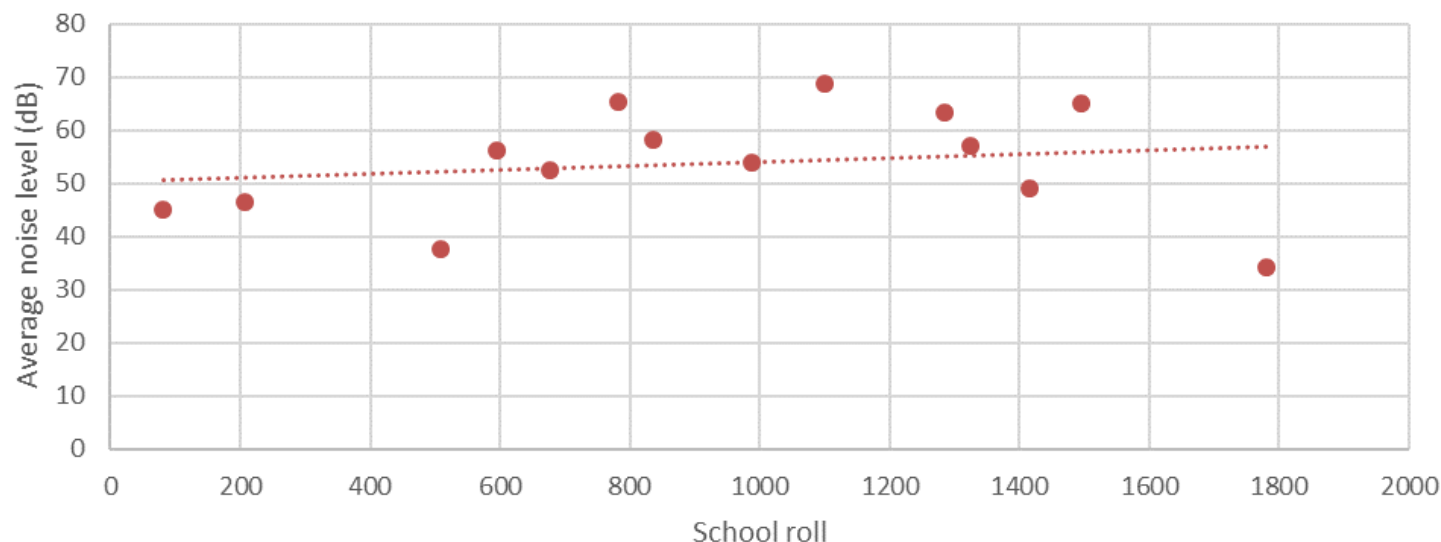
54.2dB
International students

(WHO threshold: 53dB)

- Fits with patterns of recent migrants selecting central areas

- Non-native English speakers sensitive to noise in classrooms
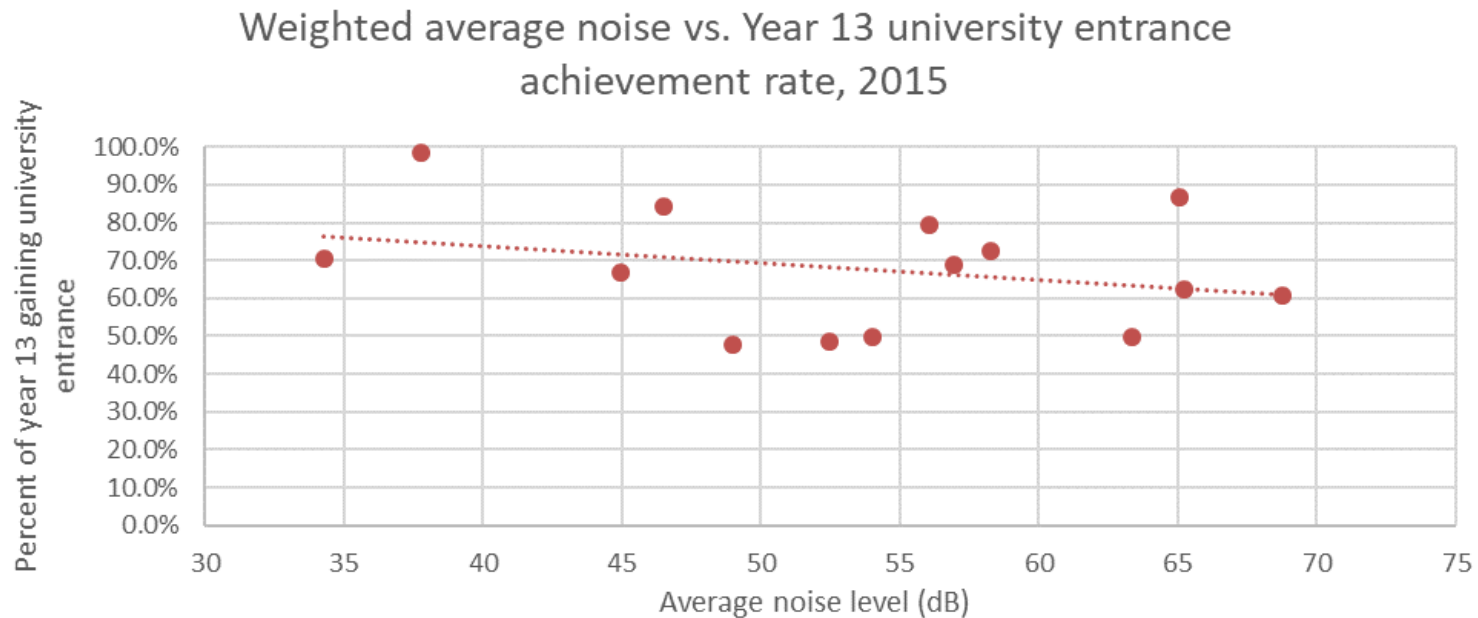
School roll size

Weighted average noise vs. School roll (high schools)

- Weak relationship between roll and noise level
- Schools are destinations. 15% of Wellington are either employed by schools or enrolled at school

Student achievement

Weighted average noise vs. Year 13 university entrance achievement rate, 2015

- University entrance rates decrease as noise levels increase

Other results

- Significant, but small differences in ethnicity:
  - Māori highest for ECCs
  - Pacific highest in schools

- No difference between facility types (primary vs secondary, playcenter vs kindergarten)

- No difference in deprivation

Conclusions

- High noise levels are typically clustered in the central city, and near highways and main routes

- Elevated noise levels around schools and ECC are a widespread issue

- Certain groups more affected:
  o International students
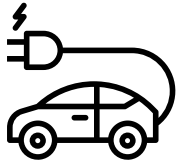 o Privately run ECCs
  o Large roll sizes

What can be done?

Change road surface
Rubberized, porous surfaces

Switch to electric vehicles
Reduce propulsion noise, though no effect on rolling noise

Fewer cars on the road
Encouraging public and **active transport**

Speed restrictions
Around sensitive areas

Noise barriers
Absorb/reflect noise away

Questions?

Allan Schori, Mairead de Roiste, Barry Borman, Mirjam Schindler

Contact: allan.schori@vuw.ac.nz

Thanks to:

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

ehinz Environmental Health Intelligence New Zealand

VICTORIA UNIVERSITY OF WELLINGTON
TE HERENGA WAKA