Master's Project 2017

# School Neighbourhood Environment and Active Transport to Secondary Schools in Dunedin, New Zealand

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Supervisors:

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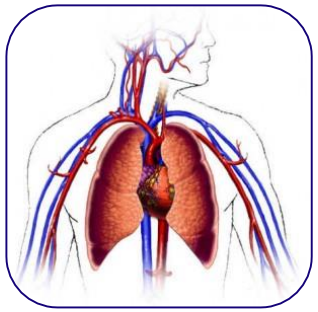
30 August 2017

# Active Transport to School (ATS): Benefits

Travel to school by modes of transport reliant on physical activity, such as walking or cycling

**Adolescent active transport**



↑ daily PA

Cycling to school associated with ↑ cardiovascular fitness

↓ depressive symptoms

Sustainable transport habits

↓ traffic congestion

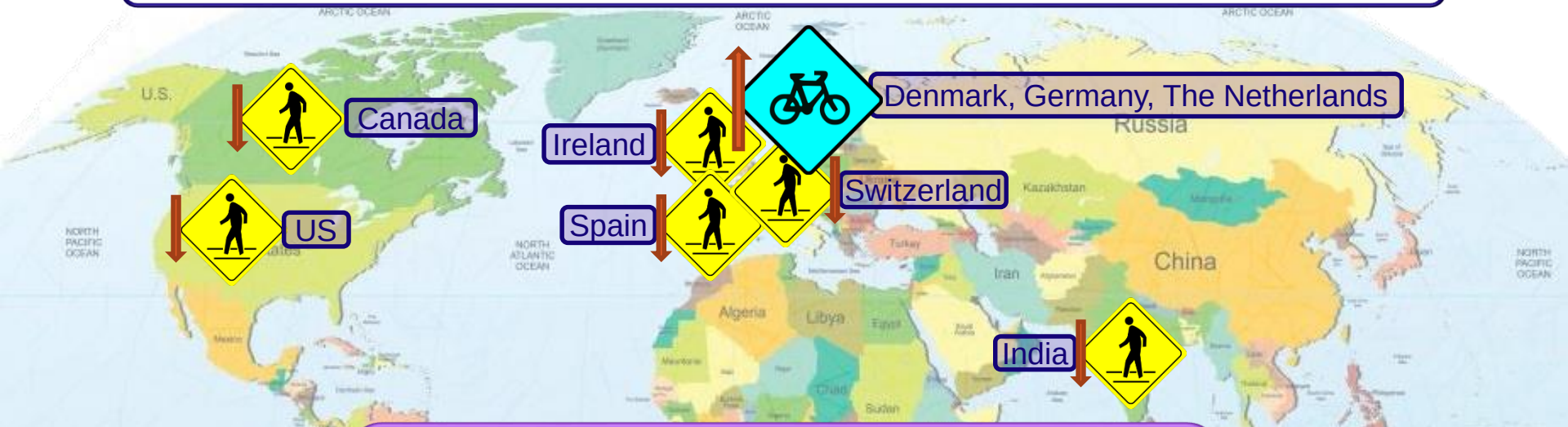
↓ vehicle emissions

Social interaction

Community strengthening

# International Rates of ATS

Large variations in rates of walking or cycling to school

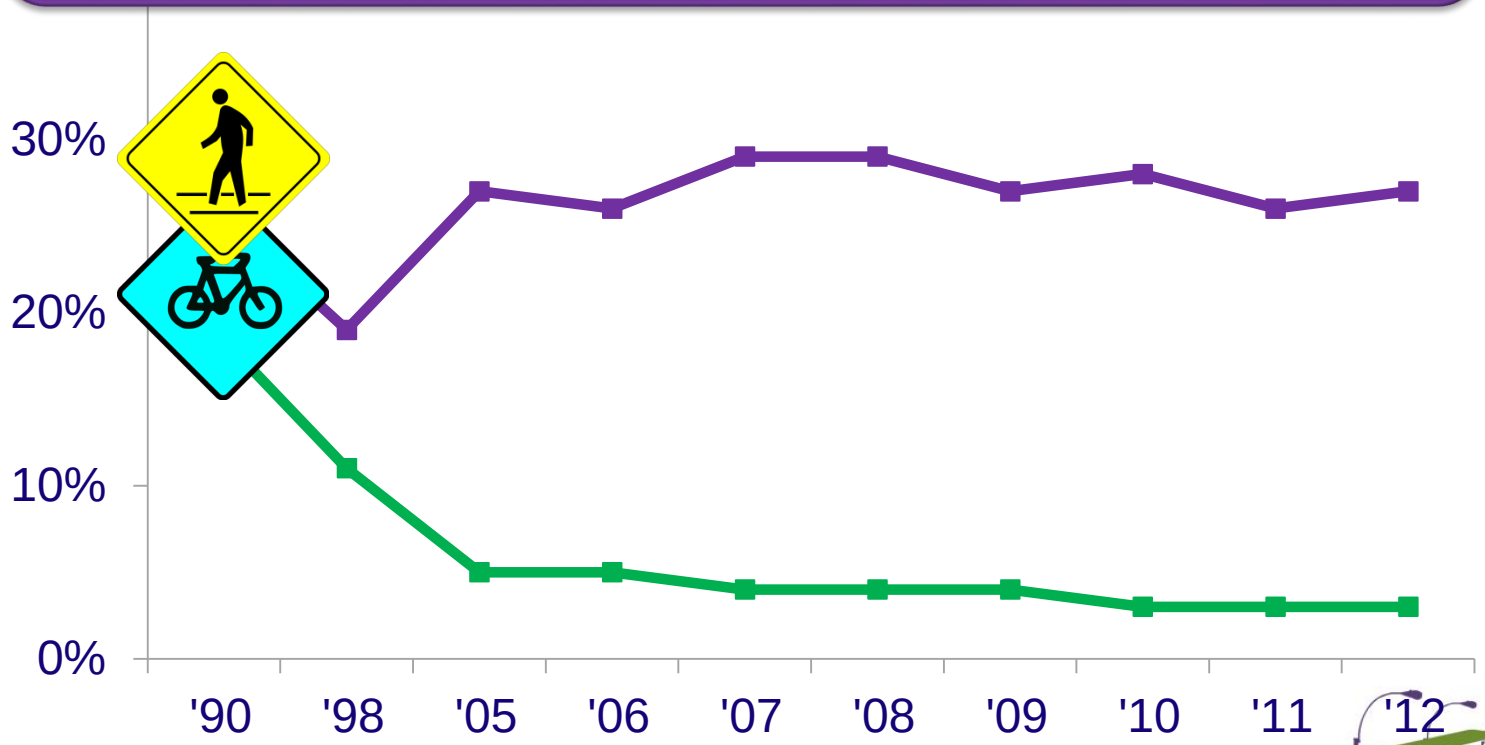



- Cycling tradition and culture
- Prioritising cycling-related infrastructure
- Traffic laws protecting rights of cyclists

Guthold et al. (2010) The Journal of Pediatrics.

# National Rates of ATS

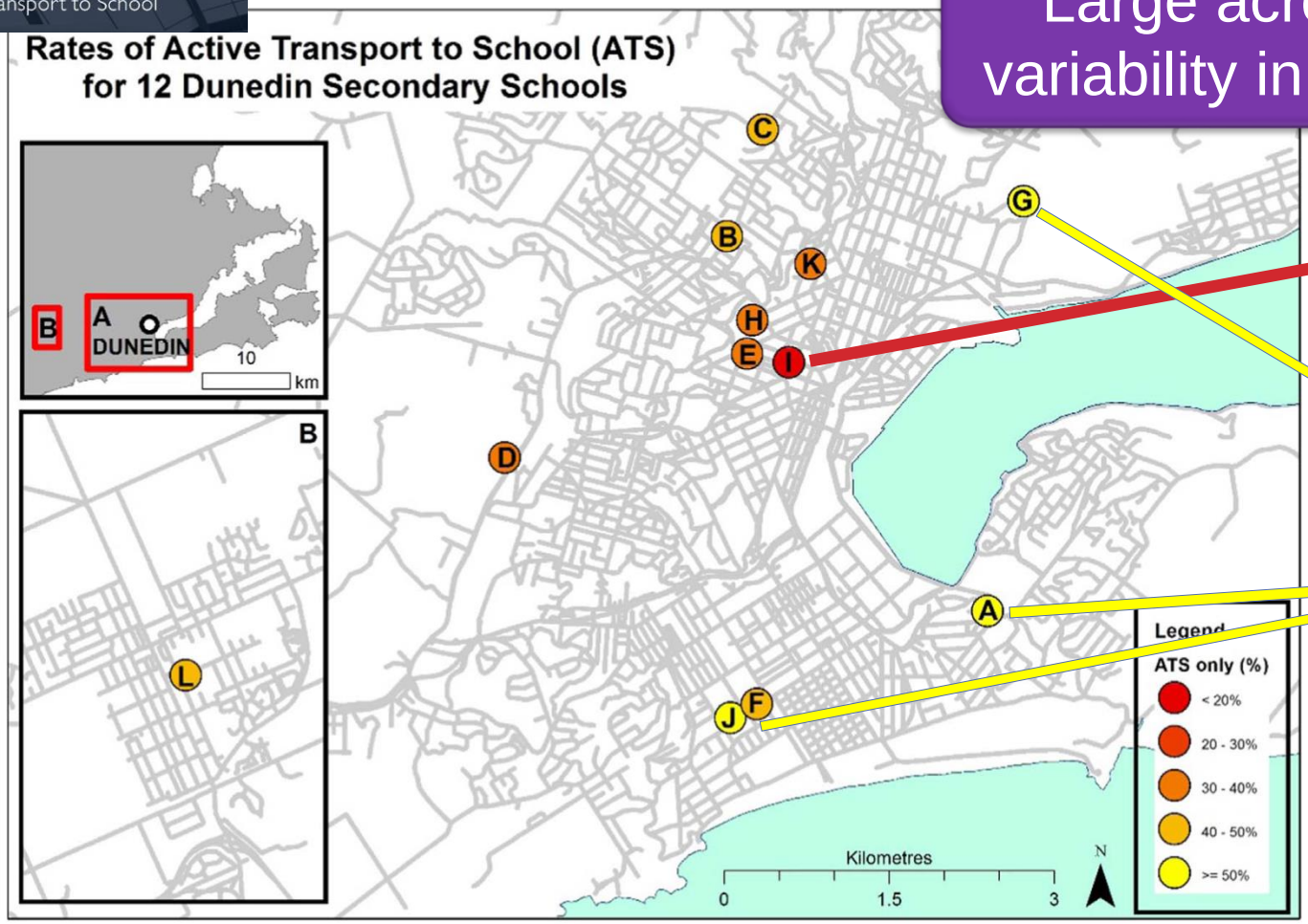
Rates of walking and cycling to school have varied substantially over the past three decades




New Zealand Household Travel Survey 1989–2014 (2015).

# Rates of ATS in Dunedin, New Zealand

BEATS Study
Built Environment and Active Transport to School



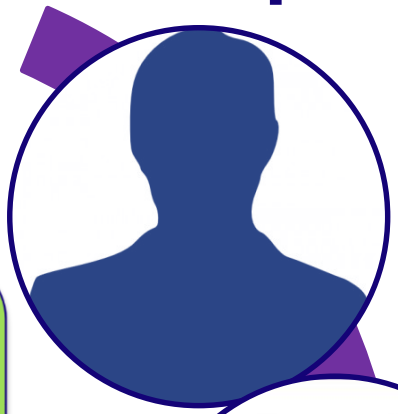

Large across-school variability in rates of ATS

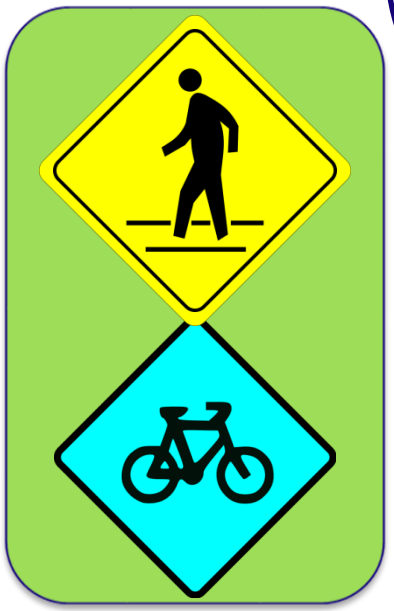
OGHS: 19.2%

Logan Park, Queens, Bayfield: >50%

Mandic et al. (2016) Journal of Transport & Health.

# Active Transport to School: Influences





## Demographic factors

- Male gender
- Low SES
- Younger age
- Minority ethnic backgrounds
- Lack of parental supervision

## Social Environment and Attitudes

- Parental concern: traffic and neighbourhood safety
- Cycling perceived as less safe
- Less parental and peer support for cycling


## Built Environment Factors

- Distance to school
- Pedestrian and cycling infrastructure
- Attractiveness of environments
- Neighbourhood walkability

# Built Environment and Active Transport

The built environment consists of the entirety of human designed and built places and facilities

## Micro-scale features

- Smaller environmental details that influence PA experiences
- Easier and cheaper to modify
- E.g. pedestrian/cycling infrastructure, road crossings, aesthetics

## Macro-scale features

- Overall community design and structure
- Supportiveness of the environment for PA
- E.g. street connectivity, residential density

# Measures of the Built Environment

Exist to identify and assess characteristics of the built environment for physical activity and active transport

**Subjective measure**

- To understand self-reported perceptions
- Survey format

**Objective measure**

- Quantify measureable environmental features
- Neighbourhood street audits or GIS analysis

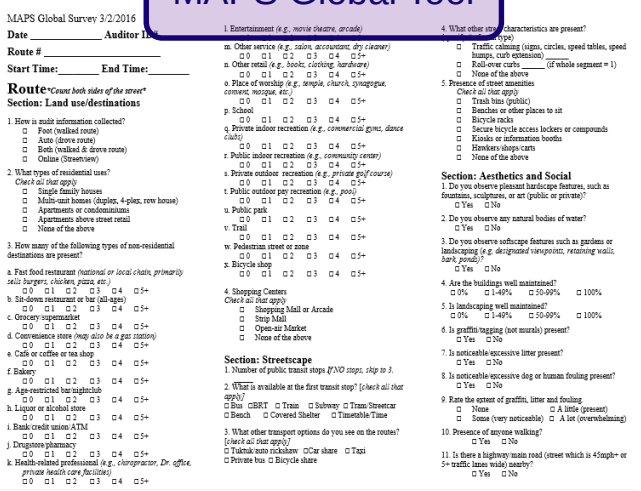
# Literature Gap


- The built environment and active transport has been well studied in adults and in primary school children
- The influence of the school neighbourhood environment on adolescent ATS remains unknown
- Future research could address this disparity and highlight the supportive or restrictive role of school neighbourhoods

# Purpose

To examine the association between the school neighbourhood built environment and the rates of ATS across all twelve secondary schools in Dunedin, New Zealand

## MAPS Global Tool



MAPS Global Survey 3/2/2016

**Date** _____ **Auditor ID#** _____

**Route #** _____

**Start Time:**_____ **End Time:**_____

**Route** *•Count both sides of the street•*

**Section: Land use/destinations**

1. How is audit information collected?
   - ☐ Foot (walked route)
   - ☐ Auto (drove route)
   - ☐ Both (walked & drove route)
   - ☐ Online (Streetview)

2. What types of residential uses? *Check all that apply*
   - ☐ Single family houses
   - ☐ Multi-unit homes (duplex, 4-plex, row house)
   - ☐ Apartments or condominiums
   - ☐ Apartments above street retail
   - ☐ None of the above

3. How many of the following types of non-residential destinations are present?

a. Fast food restaurant *(national or local chain, primarily sells burgers, chicken, pizza, etc.)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

b. Sit-down restaurant or bar (all-ages)
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

c. Grocery/supermarket
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

d. Convenience store *(may also be a gas station)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

e. Café or coffee or tea shop
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

f. Bakery
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

g. Age-restricted bar/nightclub
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

h. Liquor or alcohol store
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

i. Bank/credit union/ATM
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

j. Drugstore/pharmacy
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

k. Health-related professional *(e.g., chiropractor, Dr. office, private health care facilities)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

l. Entertainment *(e.g., movie theatre, arcade)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

m. Other service *(e.g., salon, accountant, dry cleaner)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

n. Other retail *(e.g., book, clothing, hardware)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

o. Place of worship *(e.g., temple, church, synagogue, convent, mosque, etc.)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

p. School
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

q. Private indoor recreation *(e.g., commercial gyms, dance clubs)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

r. Public indoor recreation *(e.g., community center)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

s. Private outdoor recreation *(e.g., private golf course)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

t. Public outdoor pay recreation *(e.g., pool)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

u. Public park
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

v. Trail
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

w. Pedestrian street or zone
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

x. Bicycle shop
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

4. Shopping Centers *Check all that apply*
   - ☐ Shopping Mall or Arcade
   - ☐ Strip Mall
   - ☐ Open-air Market
   - ☐ None of the above

**Section: Streetscape**

1. Number of public transit stops *If NO stops, skip to 3.*

2. What is available at the first transit stop? [*check all that apply*]
☐ Bus ☐BRT ☐ Train ☐ Subway ☐ Tram/Streetcar
☐ Bench ☐ Covered Shelter ☐ Timetable/Time

3. What other transport options do you see on the routes? [*check all that apply*]
☐ Tuktuk/auto rickshaw ☐Car share ☐ Taxi
☐ Private bus ☐ Bicycle share

4. What other street characteristics are present? *Check all that apply*
   - ☐ Traffic calming (signs, circles, speed tables, speed humps, curb extension)
   - ☐ Rail-over curbs _____ (if whole segment = 1)
   - ☐ None of the above

5. Presence of street amenities *Check all that apply*
   - ☐ Trash bins (public)
   - ☐ Benches or other places to sit
   - ☐ Bicycle racks
   - ☐ Secure bicycle access lockers or compounds
   - ☐ Kiosks or information booths
   - ☐ Hawkers/shops/carts
   - ☐ None of the above

**Section: Aesthetics and Social**

1. Do you observe pleasant hardscape features, such as fountains, sculptures, or art (public or private)?
☐ Yes ☐ No

2. Do you observe any natural bodies of water?
☐ Yes ☐ No

3. Do you observe softscape features such as gardens or landscaping (*e.g. designated viewpoints, retaining walls, bark, ponds*)?
☐ Yes ☐ No

4. Are the buildings well maintained?
☐ 0% ☐ 1-49% ☐ 50-99% ☐ 100%

5. Is landscaping well maintained?
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6. Is graffiti/tagging (not murals) present?
☐ Yes ☐ No

7. Is noticeable/excessive litter present?
☐ Yes ☐ No

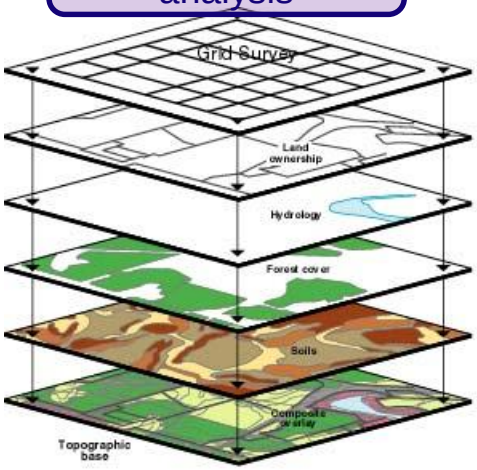
8. Is noticeable/excessive dog or human fouling present?
☐ Yes ☐ No

9. Rate the extent of graffiti, litter and fouling
   - ☐ None ☐ A little (present)
   - ☐ Some (very noticeable) ☐ A lot (overwhelming)

10. Presence of anyone walking?
☐ Yes ☐ No

11. Is there a highway/main road (street which is 45mph+ or 5+ traffic lanes wide) nearby?
☐ Yes ☐ No

## GIS-based spatial analysis



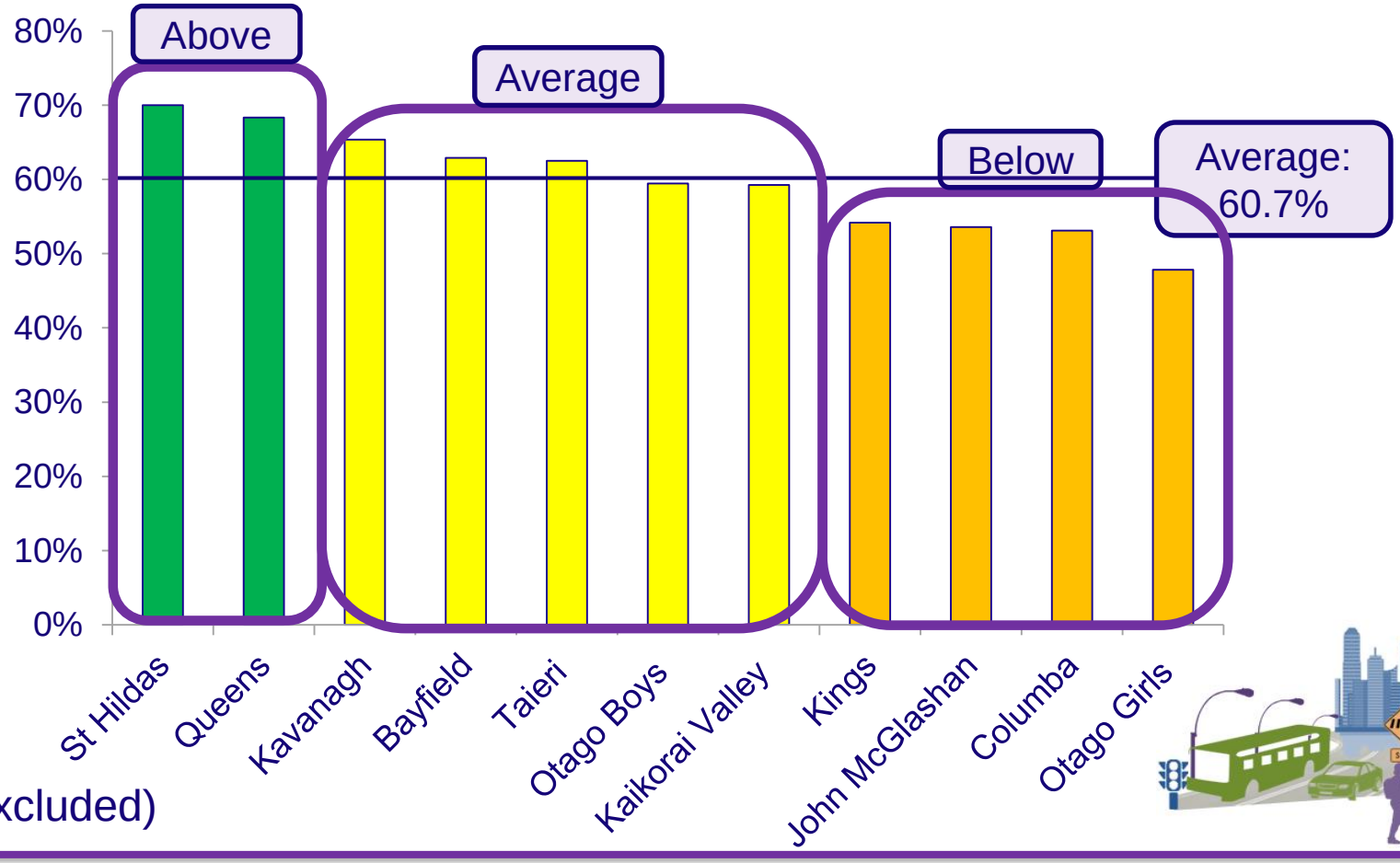

## BEATS Study

**BEATS Study**

Built Environment and Active Transport to School

# School-Specific Rates of ATS

ATS rates for adolescents living within 2.25 km of their school

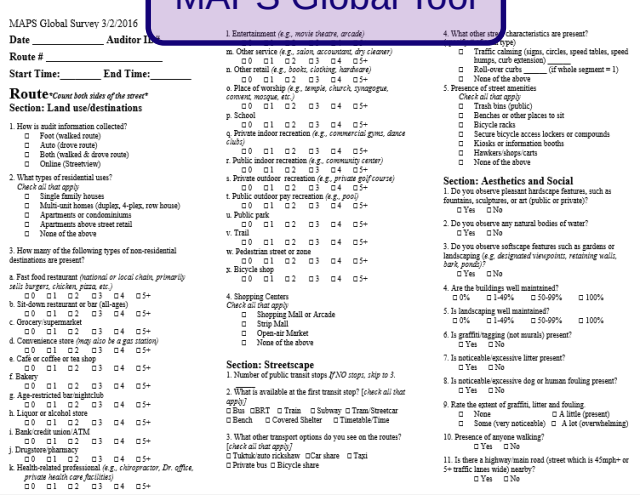



n=471
(boarders excluded)

# Research Question 1

Do characteristics of the school neighbourhood built environment obtained from MAPS Global and GIS-based spatial analysis correlate with the rates of active transport across all twelve Dunedin secondary schools?

## MAPS Global Tool



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5. Presence of street amenities
*Check all that apply*
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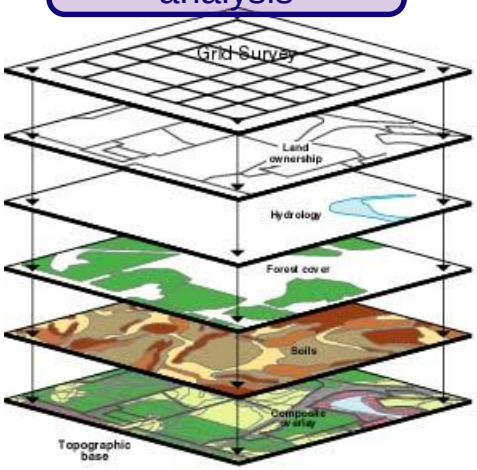


# Microscale Audit of Pedestrian Streetscapes (MAPS) Global Tool

62 Questions; Subjective measures; Micro-scale features of Route, Segment, Crossing and Cul-de-sac

## Route *Count both sides of the street*

### Section: Land use/destinations

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l. Entertainment *(e.g., movie theatre, arcade)*
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☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

4. Shopping Centers
*Check all that apply*
- ☐ Shopping Mall or Arcade
- ☐ Strip Mall

4. What other street characteristics are present? (specify # of each type)
- ☐ Traffic calming (signs, circles, speed tables, speed humps, curb extension) _____
- ☐ Roll-over curbs _____ (if whole segment = 1)
- ☐ None of the above

5. Presence of street amenities
*Check all that apply*
- ☐ Trash bins (public)
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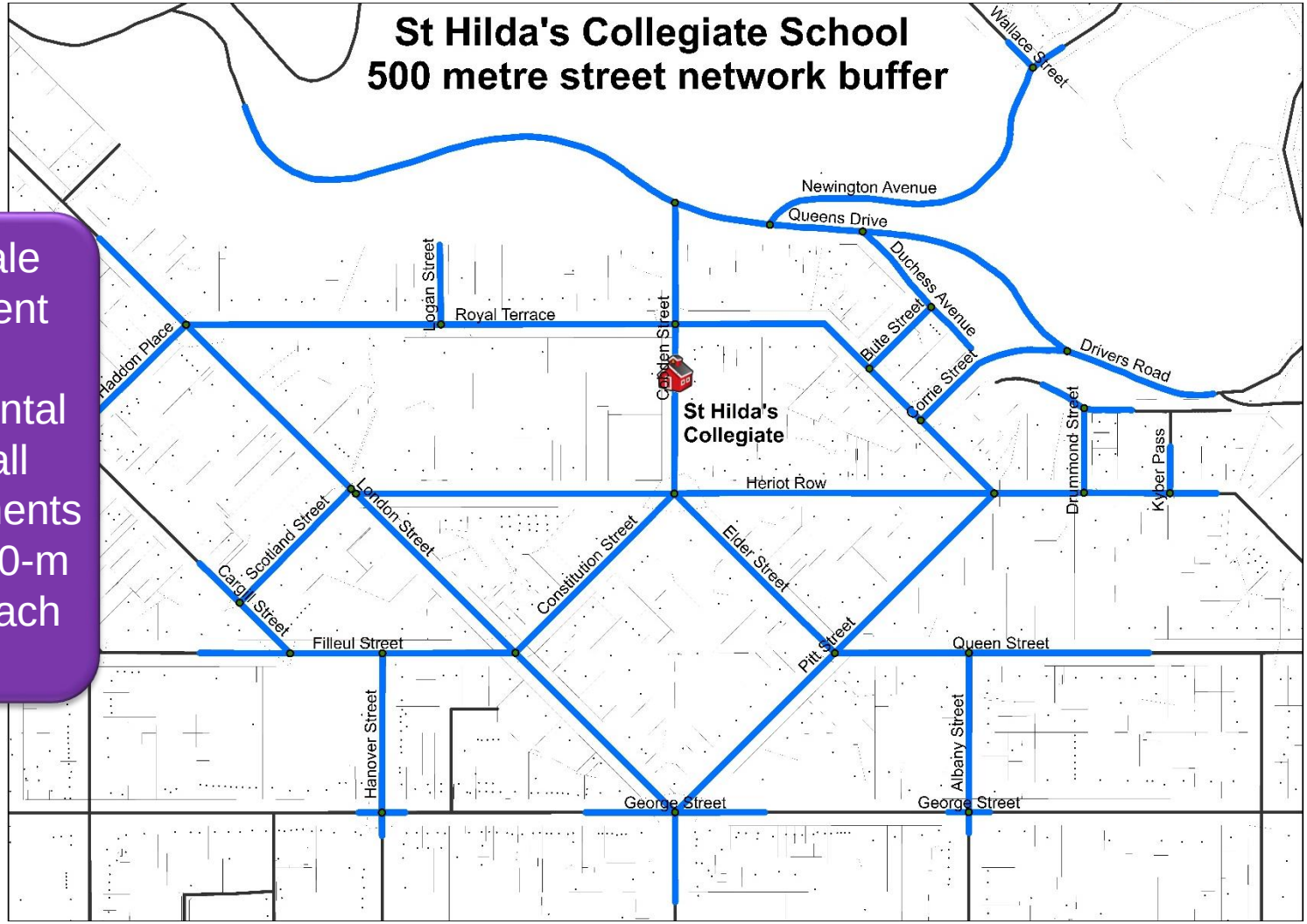
http://sallis.ucsd.edu/measure_maps.html

# Individual School Buffer-Zones



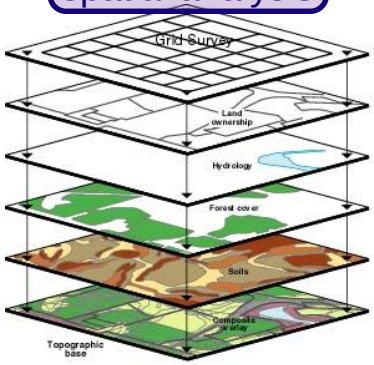

Micro-scale environment

Environmental audit of all street segments within a 500-m buffer of each school

n=67 segments

# Objective Measures of Built Environment

GIS-based spatial analysis




- Macro-scale environment
- Geographic unit of analysis: individual school neighbourhood environments
- Four separate street-network buffer-zones: **500 m, 1 km, 1.5 km and 2.25 km**

- Land use mix
- Residential density
- Intersection density

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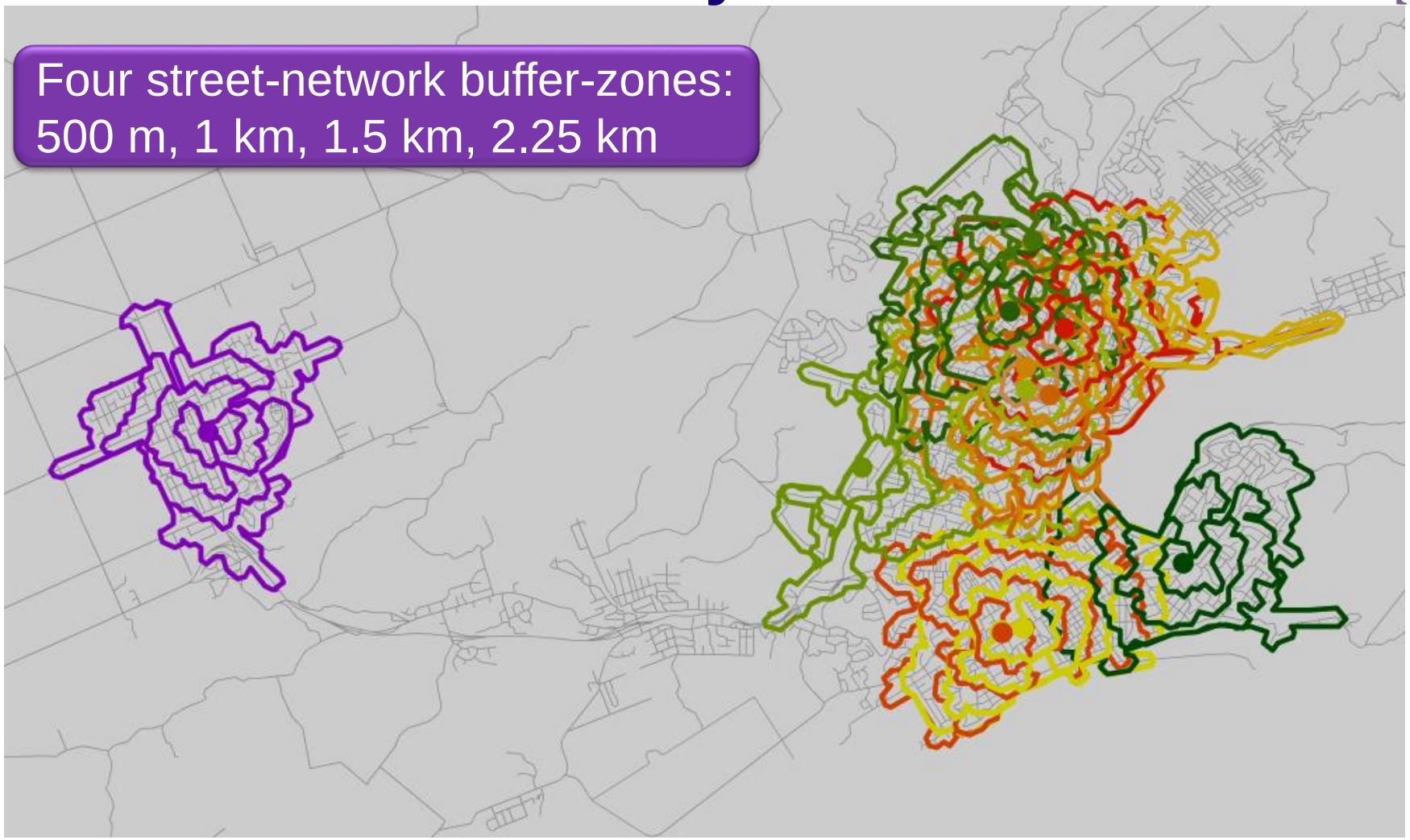
- Topography

→ Walkability index score

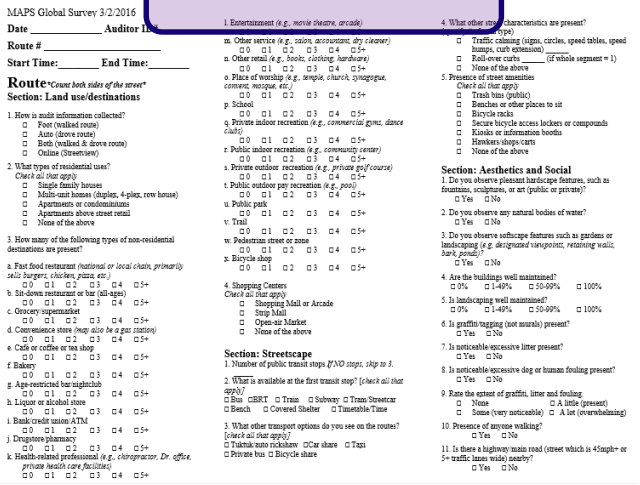
# Buffer-Zones of Twelve Dunedin Secondary Schools



# Research Question 2

Among adolescents who live within walking distance to school (≤2.25 km), do perceptions of the route to school correlate with school neighbourhood environment features (from MAPS Global and GIS-based spatial analysis)?

## MAPS Global Tool



MAPS Global Survey 3/2/2016

**Date** _____ **Auditor ID** _____

**Route #** _____

**Start Time:**_____ **End Time:**_____

**Route**-*Count both sides of the street**

**Section: Land use/destinations**

1. How is audit information collected?
   - ☐ Foot (walked route)
   - ☐ Auto (drove route)
   - ☐ Both (walked & drove route)
   - ☐ Online (Streetview)

2. What types of residential uses?
   *Check all that apply*
   - ☐ Single family houses
   - ☐ Multi-unit homes (duplex, 4-plex, row house)
   - ☐ Apartments or condominiums
   - ☐ Apartments above street retail
   - ☐ None of the above

3. How many of the following types of non-residential destinations are present?

a. Fast food restaurant *(national or local chain, primarily sells burgers, chicken, pizza, etc.)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
b. Sit-down restaurant or bar (all-ages)
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
c. Grocery/supermarket
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
d. Convenience store *(may also be a gas station)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
e. Café or coffee or tea shop
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
f. Bakery
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
g. Age-restricted bar/nightclub
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
h. Liquor or alcohol store
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
i. Bank/credit union/ATM
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
j. Drugstore/pharmacy
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
k. Health-related professional *(e.g., chiropractor, Dr. office, private health care facilities)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
l. Entertainment *(e.g., movie theatre, arcade)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
m. Other service *(e.g., salon, accountant, dry cleaner)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
n. Other retail *(e.g., books, clothing, hardware)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
o. Place of worship *(e.g., temple, church, synagogue, convent, mosque, etc.)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
p. School
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
q. Private indoor recreation *(e.g., commercial gyms, dance clubs)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
r. Public indoor recreation *(e.g., community center)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
s. Private outdoor recreation *(e.g., private golf course)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
t. Public outdoor pay recreation *(e.g., pool)*
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
u. Public park
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
v. Trail
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
w. Pedestrian street or zone
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
x. Bicycle shop
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

4. Shopping Centers
*Check all that apply*
- ☐ Shopping Mall or Arcade
- ☐ Strip Mall
- ☐ Open-air Market
- ☐ None of the above

**Section: Streetscape**

1. Number of public transit stops *If NO stops, skip to 3.*

2. What is available at the first transit stop? [*check all that apply*]
☐ Bus ☐BRT ☐ Train ☐ Subway ☐ Tram/Streetcar
☐ Bench ☐ Covered Shelter ☐ Timetable/Time

3. What other transport options do you see on the routes? [*check all that apply*]
☐ Tuktuk/auto rickshaw ☐Car share ☐ Taxi
☐ Private bus ☐ Bicycle share

4. What other street characteristics are present?
*Check all that apply*
- ☐ Traffic calming (signs, circles, speed tables, speed humps, curb extension)
- ☐ Rail-over curbs _____ (if whole segment = 1)
- ☐ None of the above

5. Presence of street amenities
*Check all that apply*
- ☐ Trash bins (public)
- ☐ Benches or other places to sit
- ☐ Bicycle racks
- ☐ Secure bicycle access lockers or compounds
- ☐ Kiosks or information booths
- ☐ Hawkers/shops/carts
- ☐ None of the above

**Section: Aesthetics and Social**

1. Do you observe pleasant hardscape features, such as fountains, sculptures, or art (public or private)?
☐ Yes ☐ No

2. Do you observe any natural bodies of water?
☐ Yes ☐ No

3. Do you observe softscape features such as gardens or landscaping (*e.g. designated viewpoints, retaining walls, bark, ponds*)?
☐ Yes ☐ No

4. Are the buildings well maintained?
☐ 0% ☐ 1-49% ☐ 50-99% ☐ 100%

5. Is landscaping well maintained?
☐ 0% ☐ 1-49% ☐ 50-99% ☐ 100%

6. Is graffiti/tagging (not murals) present?
☐ Yes ☐ No

7. Is noticeable/excessive litter present?
☐ Yes ☐ No

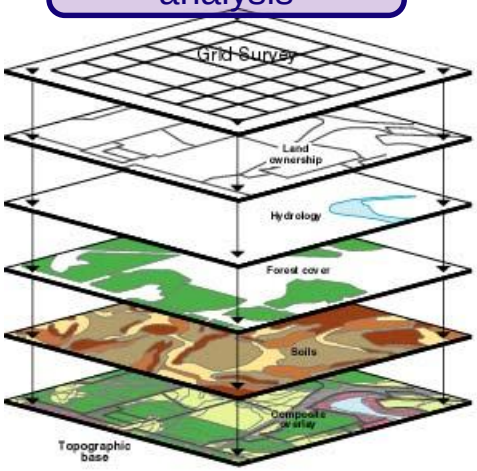
8. Is noticeable/excessive dog or human fouling present?
☐ Yes ☐ No

9. Rate the extent of graffiti, litter and fouling
- ☐ None ☐ A little (present)
- ☐ Some (very noticeable) ☐ A lot (overwhelming)

10. Presence of anyone walking?
☐ Yes ☐ No

11. Is there a highway/main road (street which is 45mph+ or 5+ traffic lanes wide) nearby?
☐ Yes ☐ No

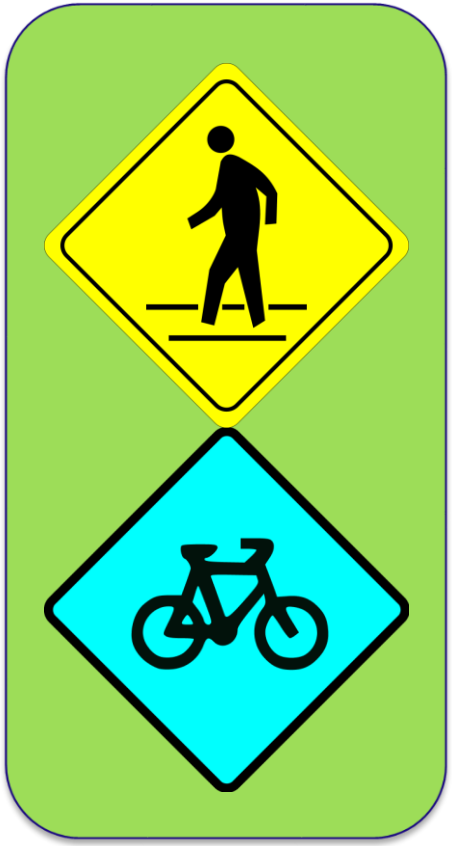
## GIS-based spatial analysis




## BEATS Study

**BEATS Study**
Built Environment and Active Transport to School

# Perceptions of the Route to School



Six questions in the BEATS Student Survey:

- Hills along the route to school
- Lighting along the way
- Presence of traffic
- Dangerous crossings
- Stray dogs
- If the route to school was boring

# Data Analysis

**Micro-scale features**
MAPS Global Tool

**Macro-scale features**
GIS spatial analysis

Adolescents' perception of route to school

- Analysed between groups with above average, average and below average rates of ATS using ANOVA
- Categorical variables: Chi square-test
- Continuous data: mean±standard deviation or frequency

# Significance and Implications

- Micro- and macro-scale neighbourhood features can have substantial influences on ATS
- Understanding the environmental characteristics which are associated with higher rates of ATS in Dunedin adolescents
- May contribute to the design or modification of school neighbourhood environments and interventions to enhance rates of ATS

# Thank you!

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