

A Conceptual Framework for Modelling Safe Walking and Cycling Routes to Secondary Schools

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Safe Routes to School

Safe Routes to School is a programme to encourage adolescents to walk and cycle safely to and from school.

Source: (McDonald et al., 2014)



Active Transport to School

Rates of adolescents' active transport to school:

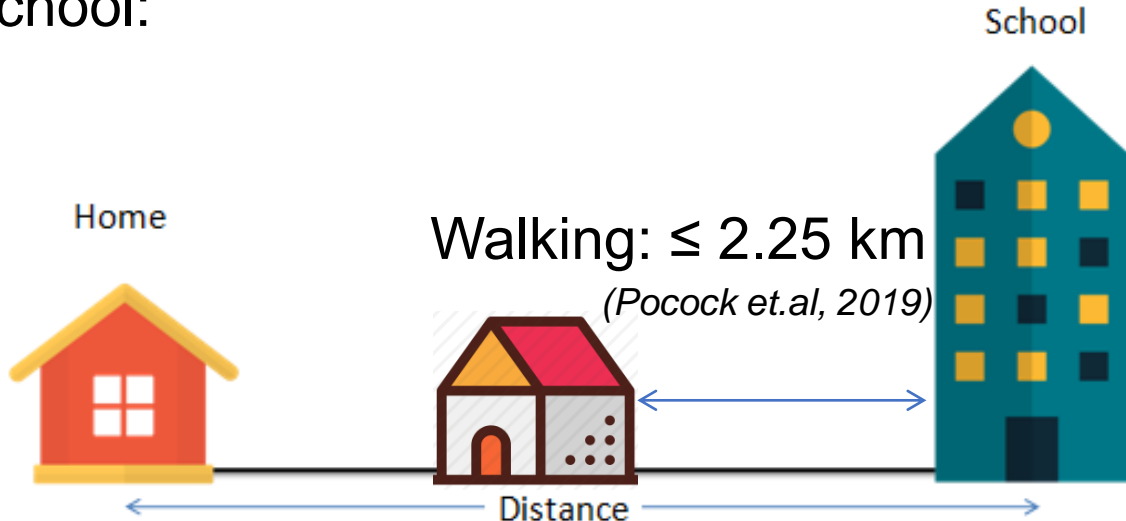
- New Zealand: 31%

Source: (Melody et al., 2018)



Distance of Active Transport to School

Threshold distance for adolescents' active transport to school:

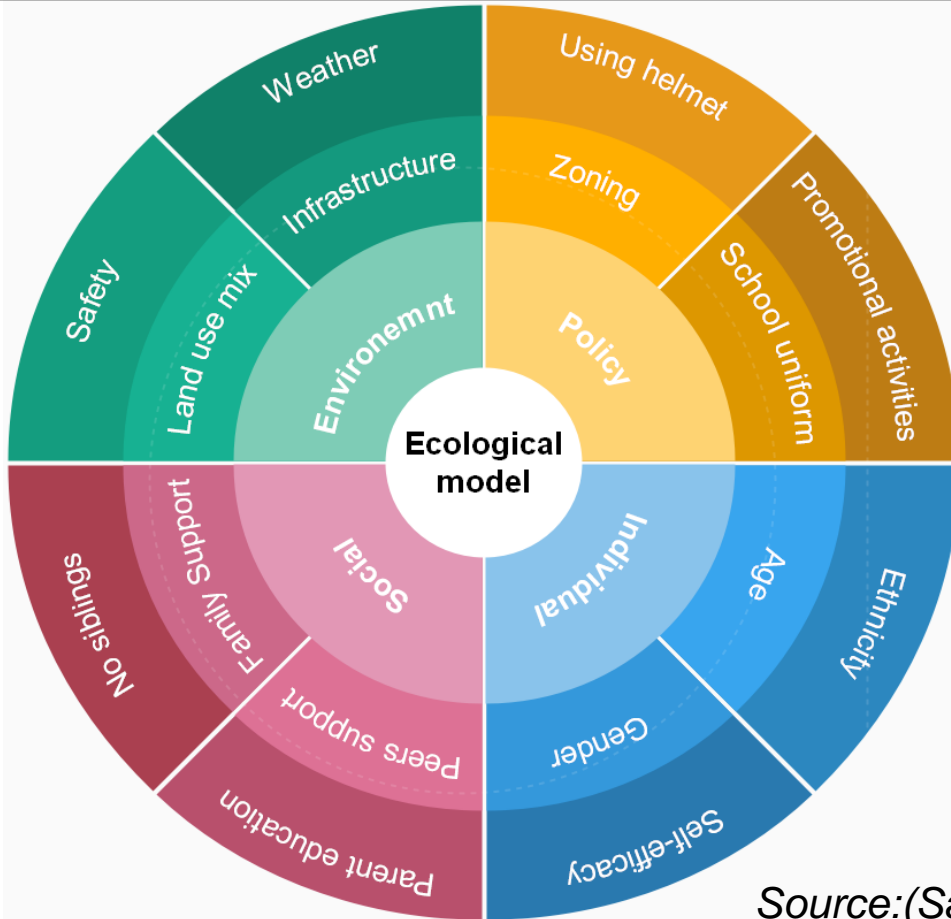


Cycling: ≤ 4.00 km
(Mandic et.al, 2017)

Existing Frameworks

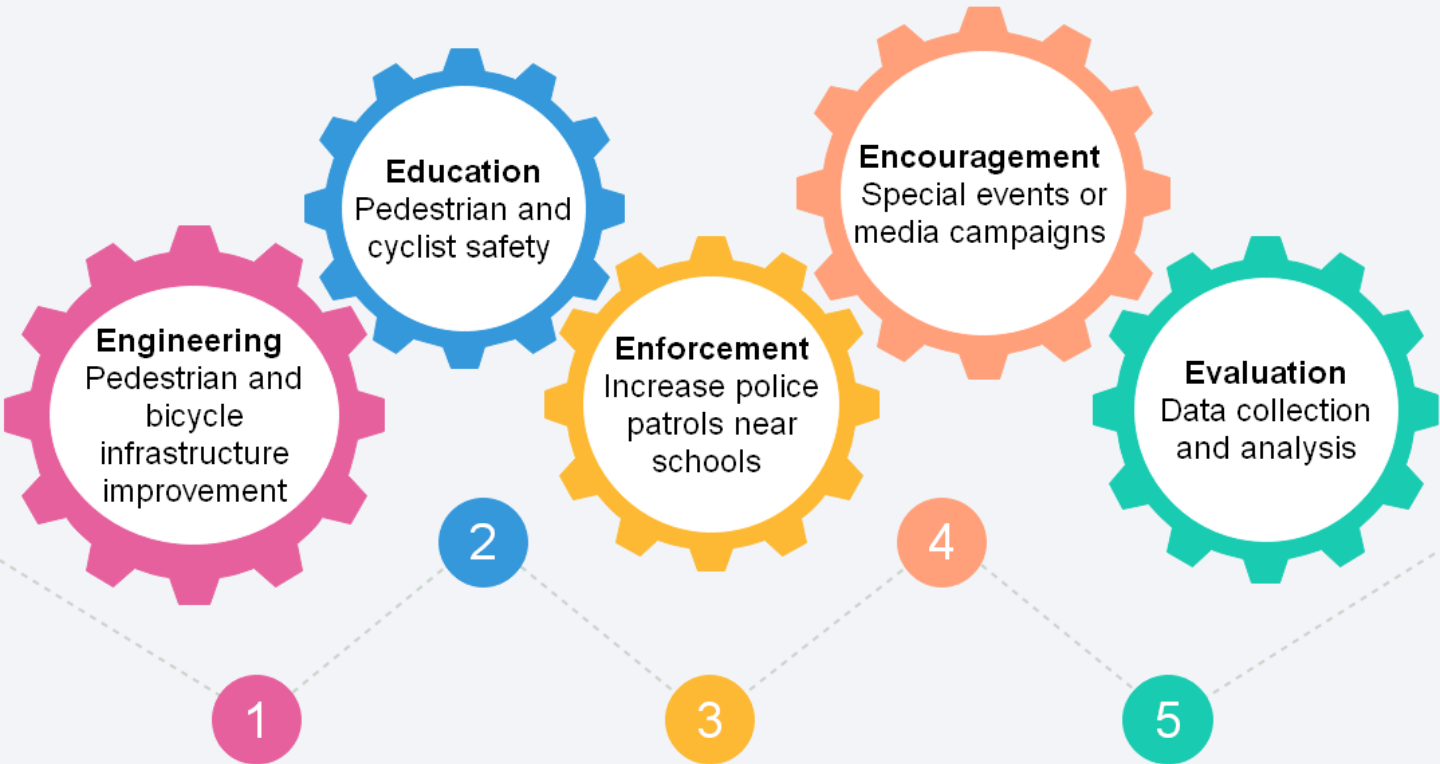
1. Ecological model;
2. Five Es framework of transport planning; and
3. Travel mode choice framework for school travel.

Ecological Model



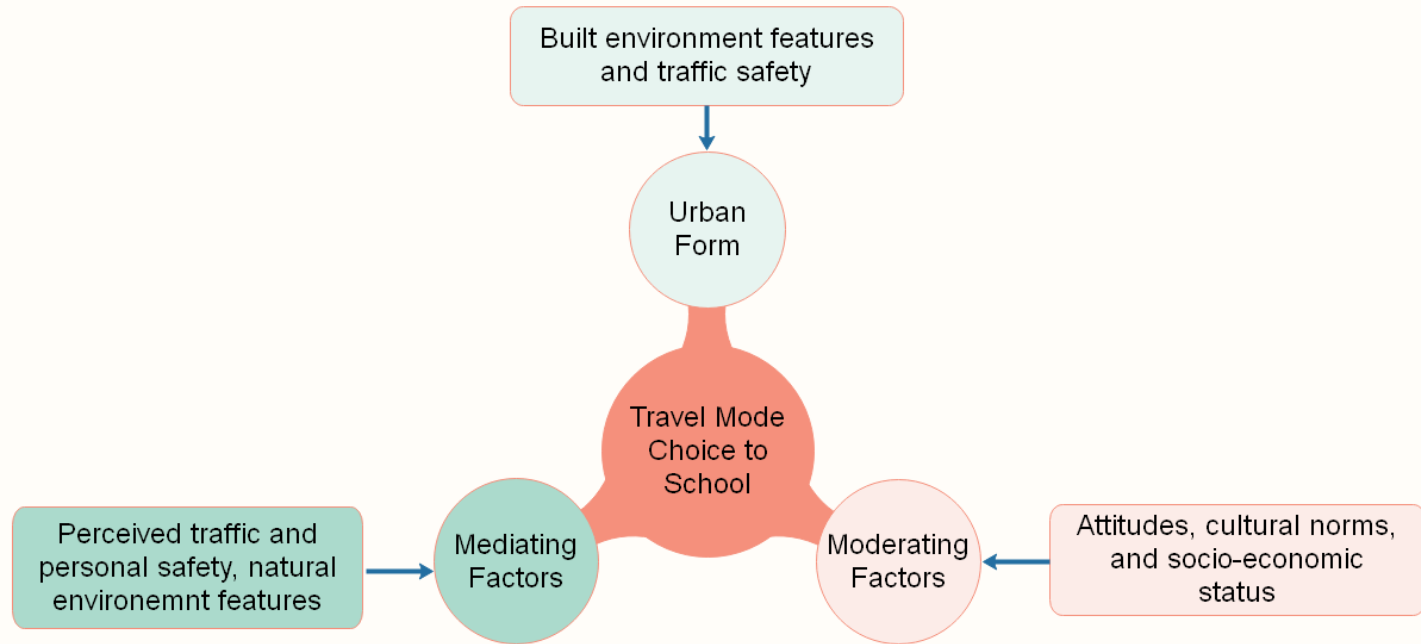
Source: (Sallis et al., 2006)

Five Es Framework



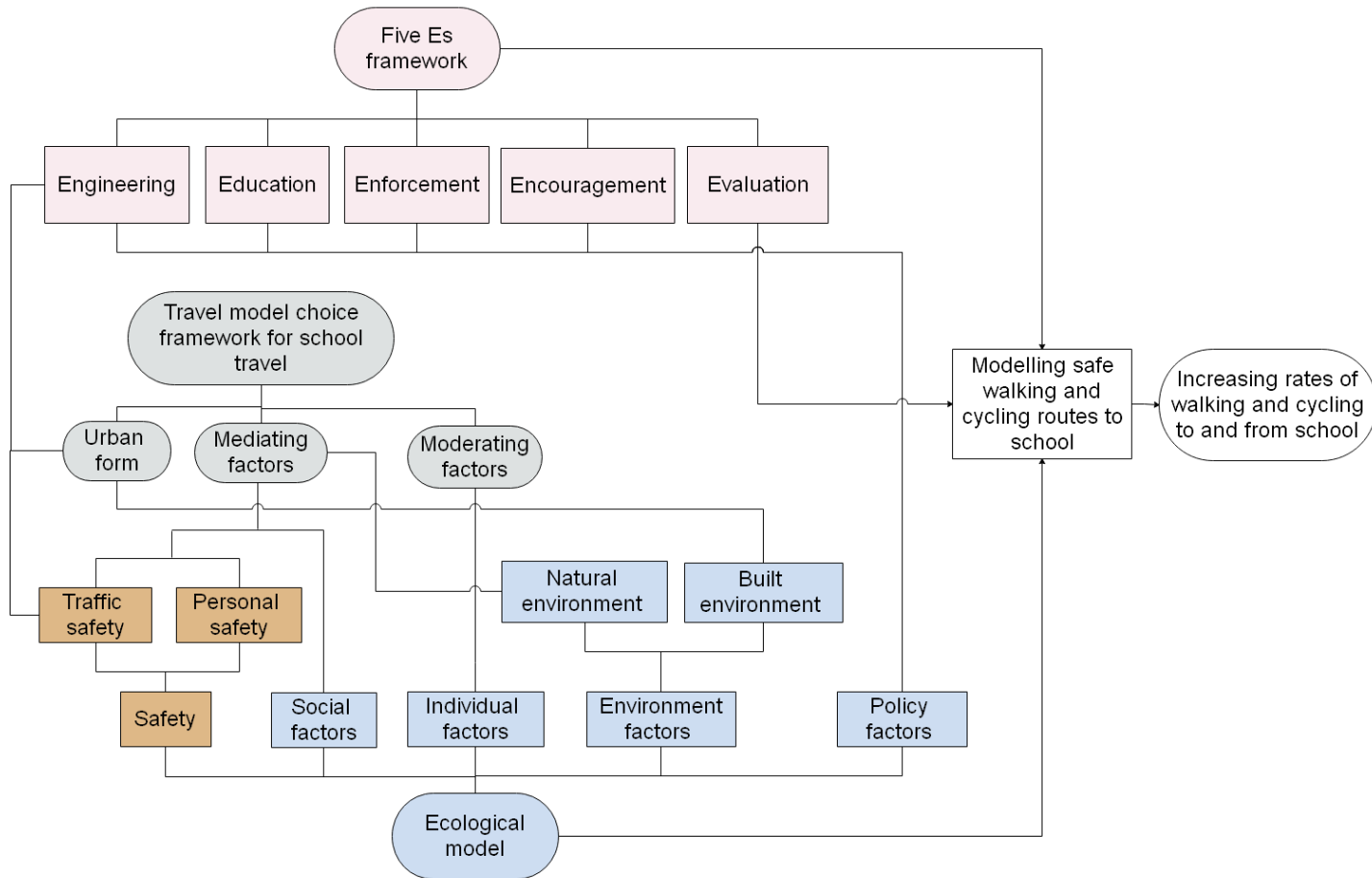
Source: (United States Department of Transportation, 2005)

Travel Model Choice Framework to School

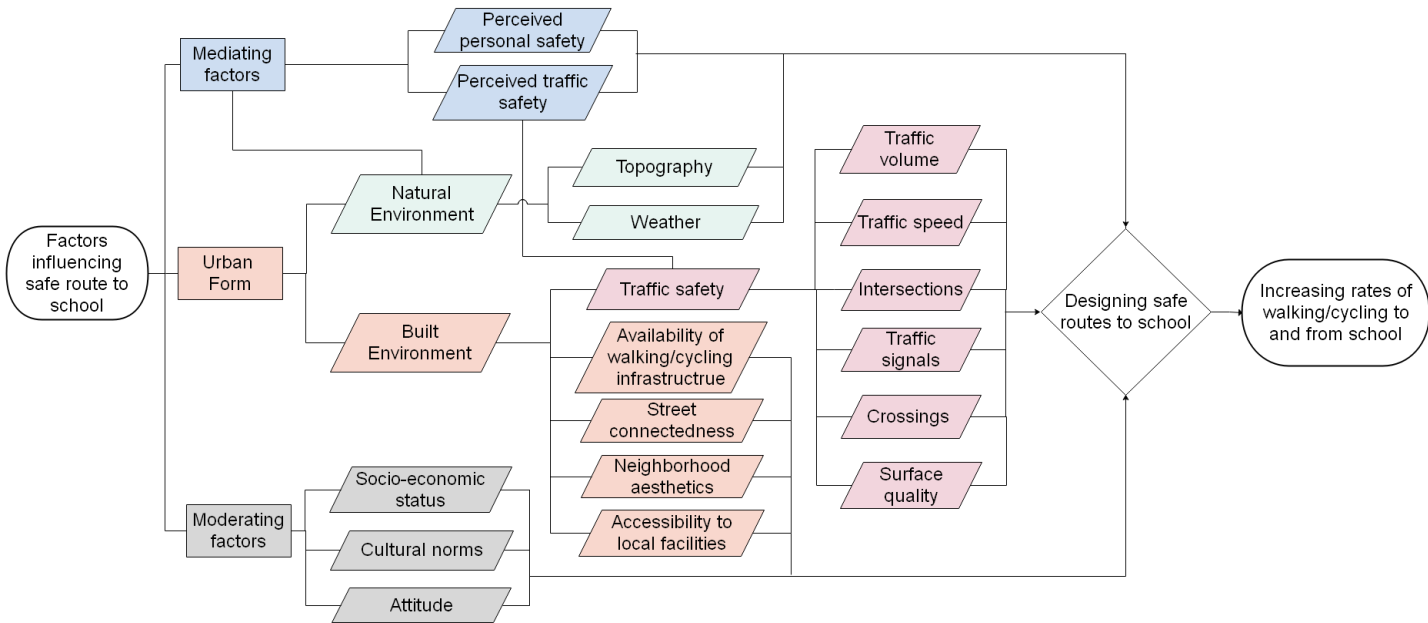


Source: (McMillan, 2005)

Framework for Modelling Safe Routes to School

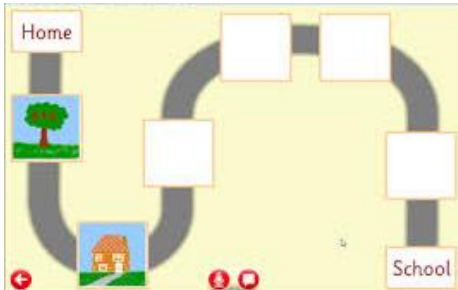


Factors Affecting Safe Routes to School



Built Environment

Direct route to school



Walking and cycling infrastructure



Street connectivity



Built Environment

Neighborhood
aesthetics



Accessibility to local
facilities



Traffic Safety

Traffic volume and speed



Traffic lights



Safe road crossings



Traffic Safety

Dangerous
intersection



Evenness of walking
and cycling lanes.

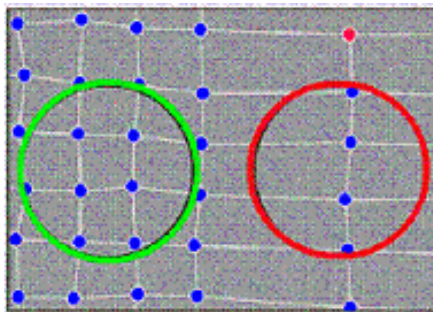


Geographic Information Systems (GIS)

- Distance from Home to School

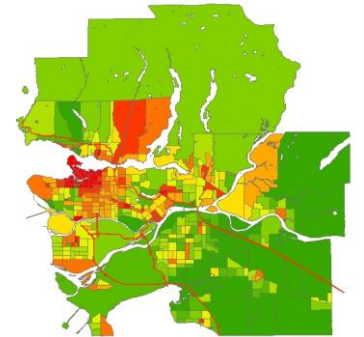
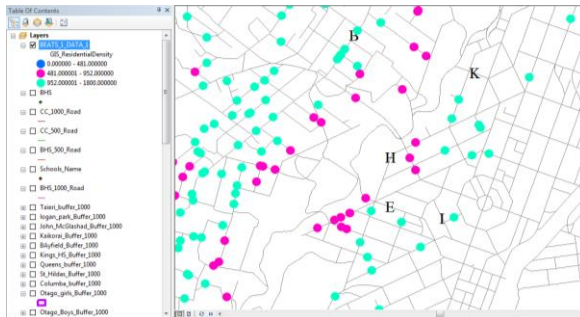


- Intersection Density



Geographic Information Systems (GIS)

- Residential Density

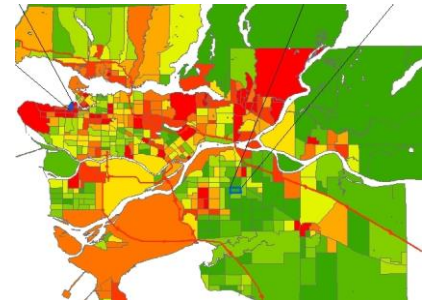


- Land Use Mix

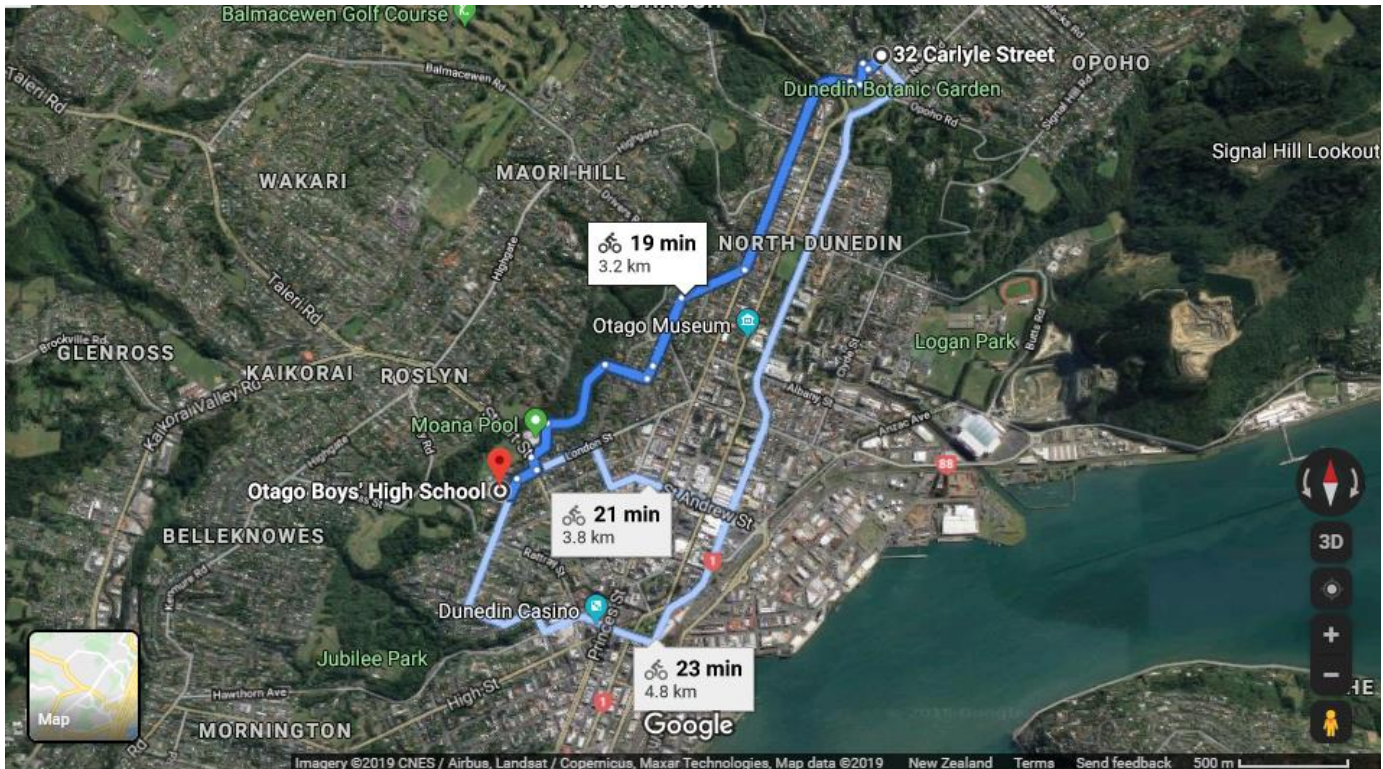
Mean land use entropy:

Range: 0 to 1

0 = homogeneous, 1 = heterogeneous



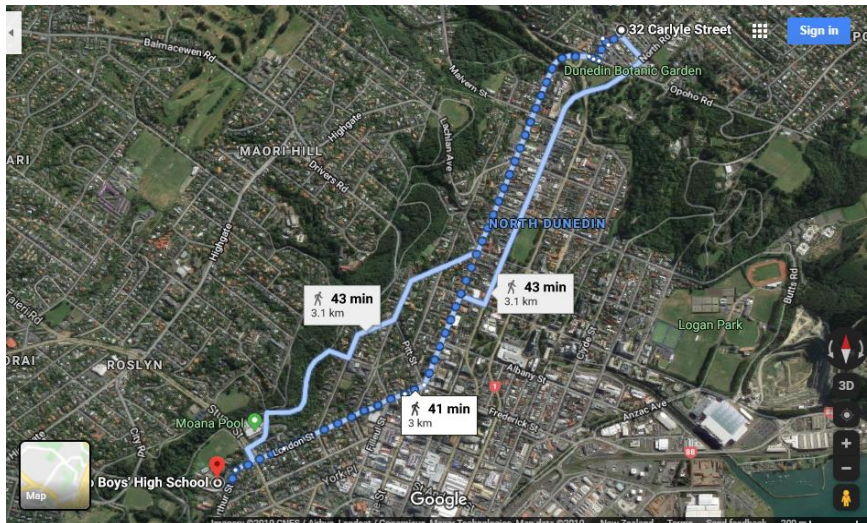
Mapping Routes to Schools



Environmental Scan

Route: Home to school.

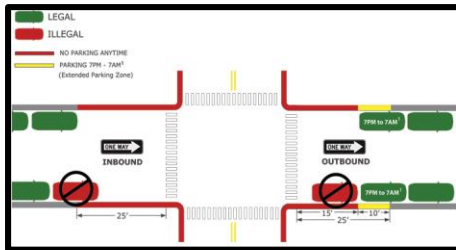
- Residential and non-residential land use;
- Street characteristics; and
- Aesthetics



Environmental Scan

Segment characteristics:

Parking



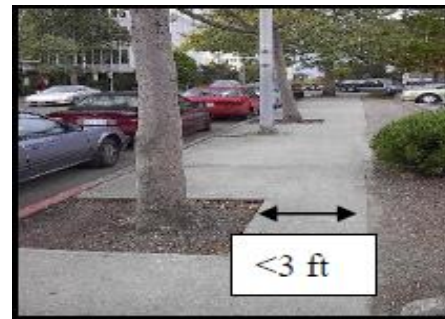
Traffic lanes



Sidewalks



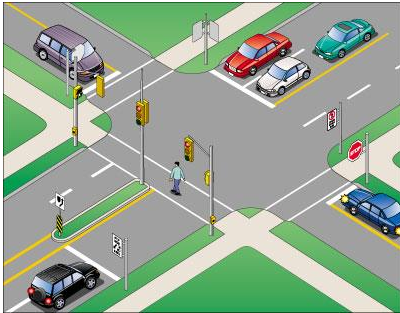
Obstructions



Environmental Scan

Crossing:

Intersection control



Overpass or underpass



Signalization



Environmental Scan

Cul-de-sac or Dead End:



Tool: MAPS (Micro-scale Audit of Pedestrian Streetscapes) Global tool.

Strength and Weakness of Framework

Strength:

Integration of the three existing frameworks related to active transport to school in adolescents.

Weakness:

Reliance on of academic literature from developed countries published in English.

Next Steps

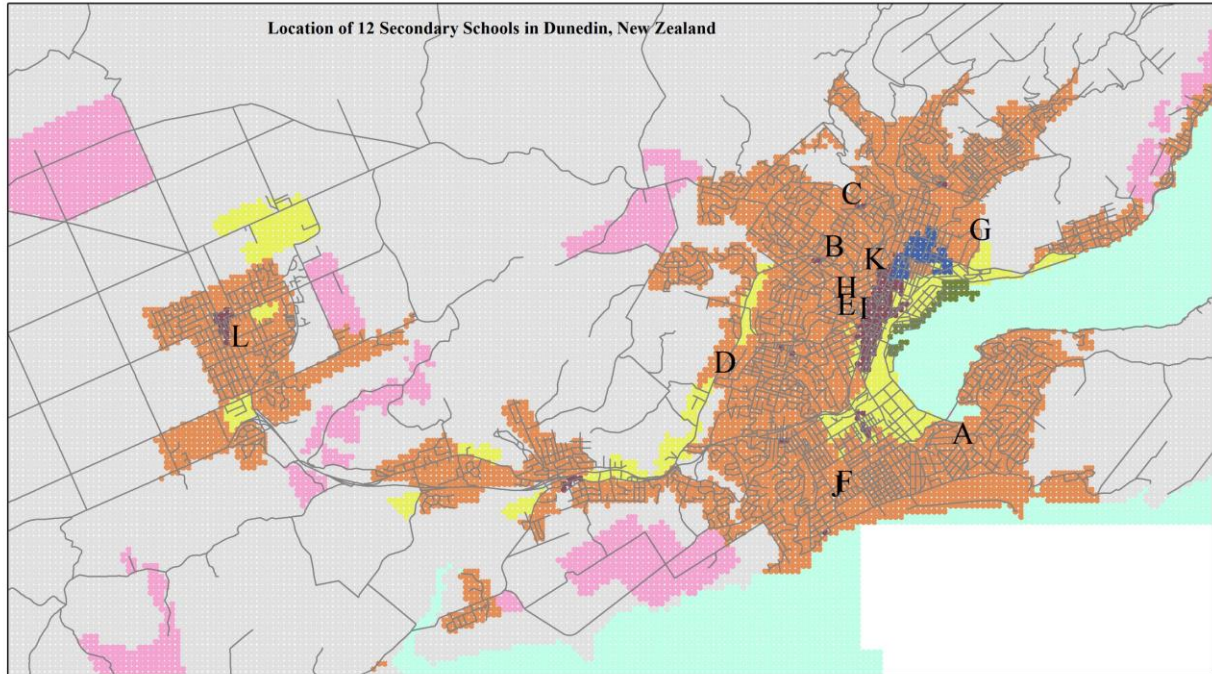
The framework needs to be tested in different geographical settings where walking and cycling to secondary schools is perceived as unsafe.

Dunedin, A Case Study

1. Examine adolescents' perceptions and objective measures of built environment of the school neighborhood;
2. Model adolescents' safe walking and cycling routes for all 12 Dunedin secondary schools; and
3. Incorporate feedback received from students, teachers, and the school principals to finalize safe routes to school.

Location of Dunedin Schools

Location of 12 Secondary Schools in Dunedin, New Zealand



Legend

Schools Name

A
B
C
D
E
F
G
H
I
J
K
L

Road

— Dunedin City Council Road

Land Use

● Campus
● Commercial
● Industrial
● Land
● Ocean
● Port
● Residential
● Rural
● Rural Residential



1 0.5 0 1 2 3 4 Kilometers



Why Dunedin is an Interesting Case?

- Problem of road safety.
- Lower rate of cycling compared to walking among adolescents (2.1% vs. 50.8%).
- Compare to walking, cycling:
 - is less safe,
 - is less encouraged by parents, and
 - has fewer cycle path.

Source: (Mandic et al., 2017)

Recruitment of Schools and Participants

Number of Schools:

- 12 Dunedin secondary schools.

Number of adolescents:

- Student Survey, $n = 1,600$.
- Mapping, $n = 200$.

GIS and environmental scan data

Feedback on Modelled Safe Routes to School

Feedback on modelled safe routes to school will be received from:

- Students;
- School principals;
- Dunedin City Council; and
- Other Stakeholders.

Research Contributions

- Provide a framework for modelling safe routes to schools.
- Provide traffic safety and built environment information to schools and Dunedin City Council to create safe routes to schools.
- Help to design safe drop-off and pick-up points along those safe routes.

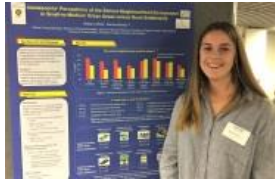
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NEW ZEALAND



Any Question, Please?



Thank you for Listening
