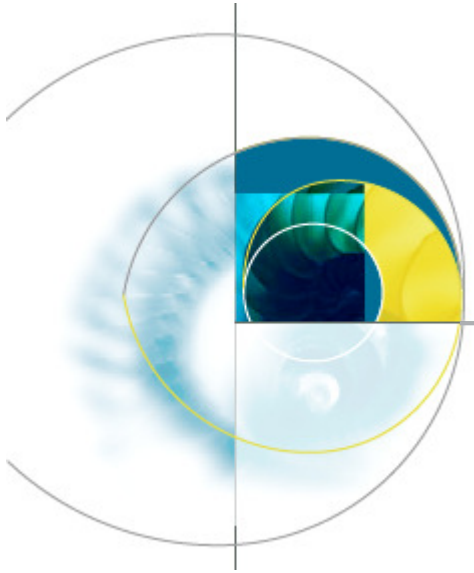

Applying Systems Dynamics Modelling to HIA

Case study from
Canterbury Regional Land Transport HIA

Adrian Field and David Rees
Synergia Ltd

17 November 2010

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This presentation

- Background to Synergia
- Systems thinking approaches
- System dynamics modelling
- Application of modelling with CRLTS HIA
- Key findings
- Limitations and reflections

- Acknowledgements
  - Environment Canterbury
  - Community and Public Health
  - Christchurch City Council
  - Ministry of Health

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About us

- Research, evaluation and strategic design company
- Expertise across health, local government, physical activity and social sectors
- Engaged by ECAN and Community & Public Health to support Canterbury RLTS HIA
- Application of systems thinking across our assignments

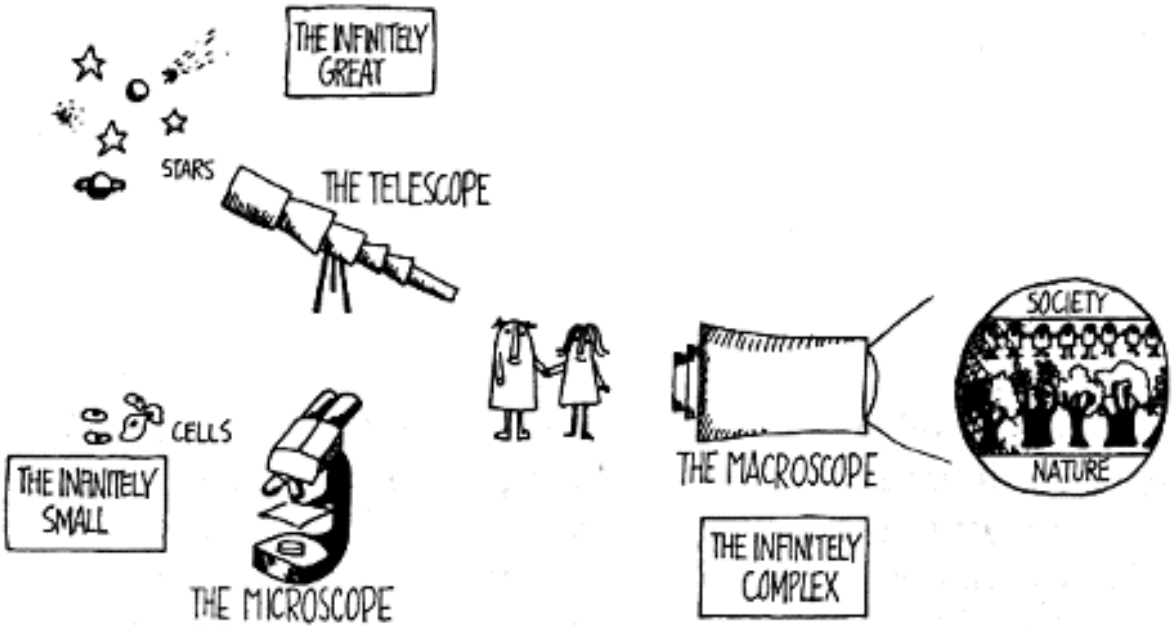
Systems thinking

- Develops insights into the nature of a system and how it behaves
- Designs solutions to meet complex challenges
- Actively seeks input of people with different perspectives, cultures and goals
- Considers both the causes and consequences
- Considers the interplay (feedback) between different issues across the system
- Seeking to quantify impacts based on plausible futures

Modelling health outcomes through CRLTS HIA

- ECAN commissioned Synergia Ltd to undertake a system dynamics simulation model of transport and health to support the Canterbury transport HIAs
- Model explores links between transport choices and health outcomes
- Quantifying some of the key linkages, and the size and timing of potential health impacts
- Draws on Canterbury transport data, NZ Health Survey data, and builds on analyses of HaPINZ, NZ transport and WHO data
- Acknowledgements:
  - HIA Review group – input into model design and development
  - Dr Graeme Lindsay and Dr Alexandra Macmillan – review of approaches and research on health and environmental impacts
  - ECAN, CCC and CPH – Provision of key data

What are we trying to do when we model?



"The macroscope filters details and amplifies that which links things together. It is not used to make things larger or smaller but to observe what is at once too great, too slow, and too complex for our eyes."

The Macroscope: A New World Scientific System
Joel de Rosnay, 1979

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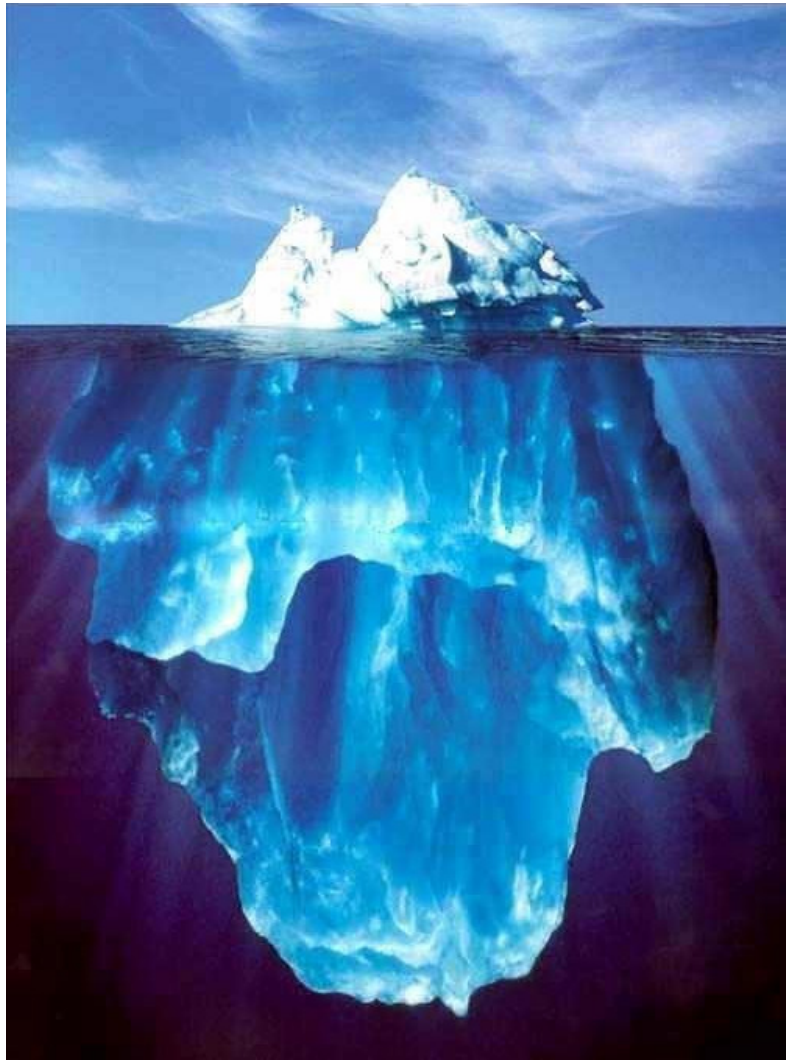
….to see what is not immediately obvious

Increasing Leverage



EVENTS

PATTERNS

STRUCTURE

MENTAL MODELS

VALUES

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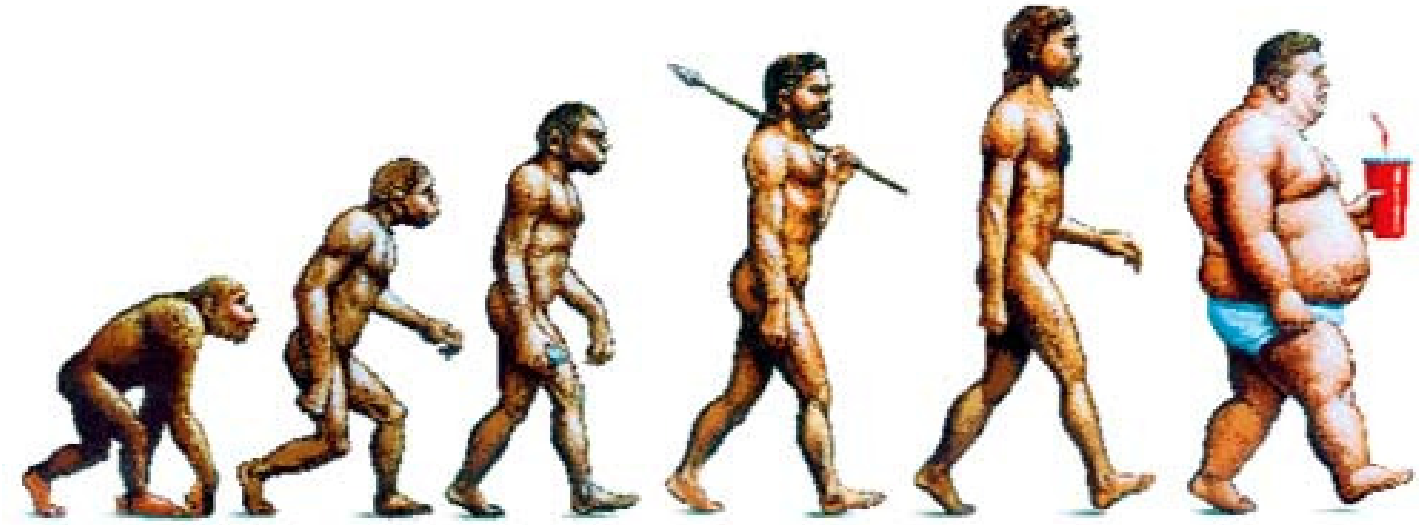
….and what may happen through time



The Economist
December 2006

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Back when we lived in caves, our mental simulations served us well. The rules were simple. See bear, whack bear, eat bear…maybe even share bear. Bear meat wasn't laced with additives, heavy metals, and/or pesticides. We didn't have to trade off time spent hunting, with our day job and the kids' soccer practice. Lawyers weren't yet invented. Life was straightforward. Our mental models were simple….

Barry Richmond
An Introduction to Systems Thinking
2001

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Then came “progress.” We created tools, used them to decimate most of the bear, started wearing bear coats and growing our own food, someone invented MTV…and the rest, as they say is history? Life got complex. It became difficult to do anything without inadvertently causing a bunch of other things to happen – most of which we remained oblivious to. Everything became a “competition.” We began competing for resources, people, time and mind-share. All the free lunches were eaten.

Barry Richmond
An Introduction to Systems Thinking
2001

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Seeing problems embedded in the context of other problems

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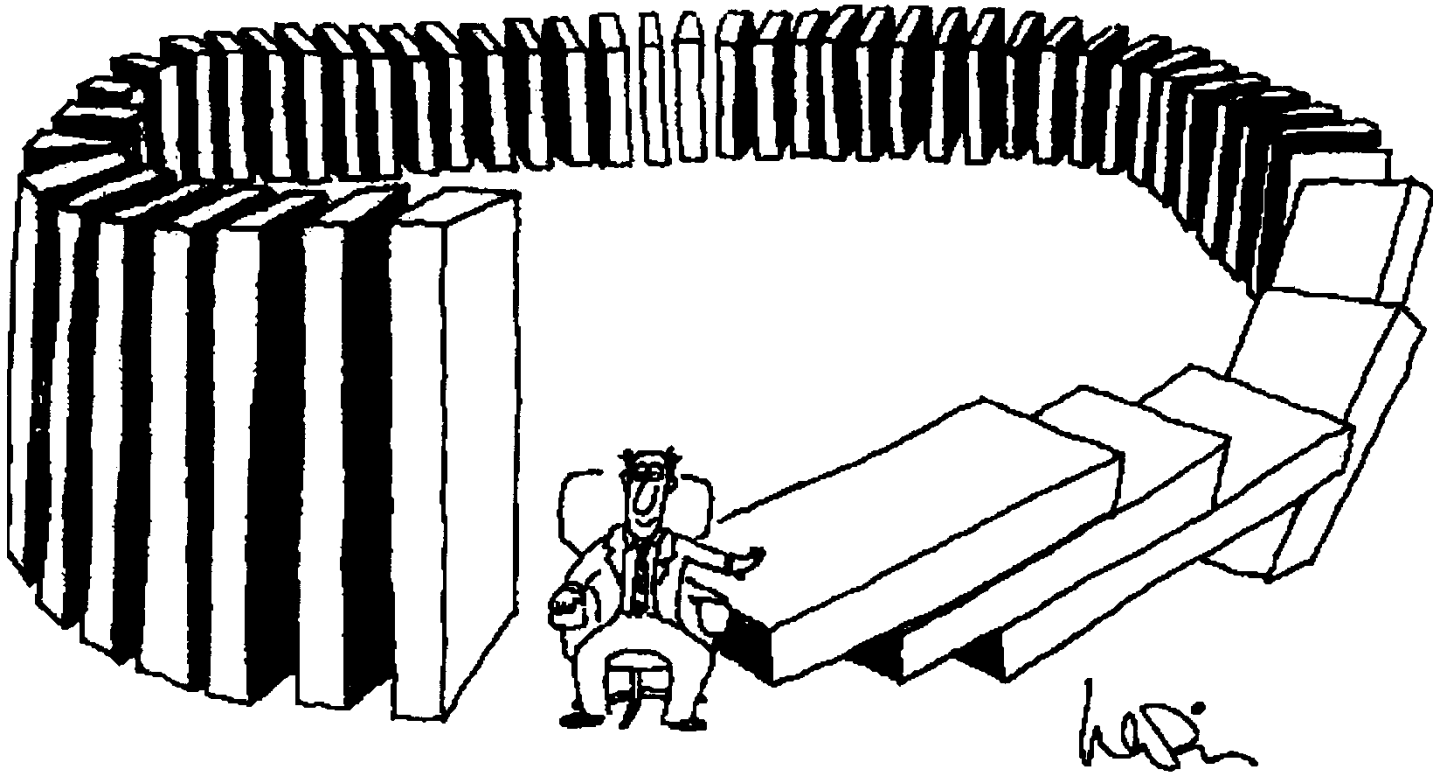

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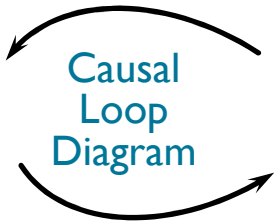
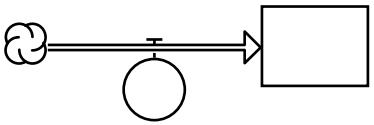
Models

Static → Dynamic

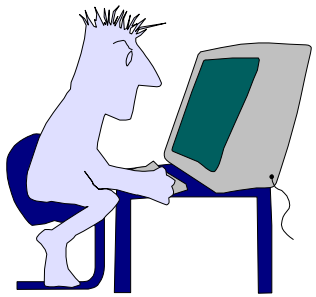
Mental Models



Visual Models



Stock & Flow Diagram



Dynamic Computer Simulation

Simulation Models

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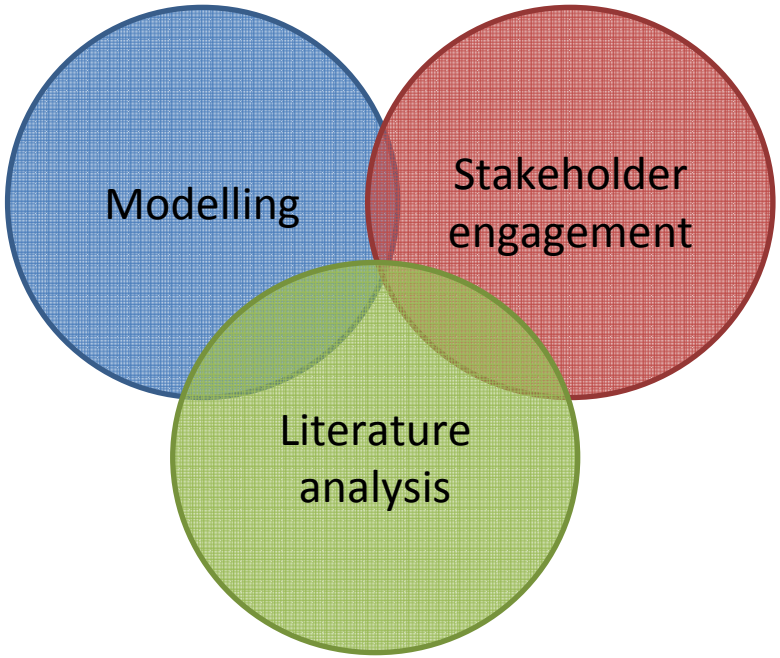
Applying modelling in Canterbury RLTS HIA



- RLTS HIA stakeholder engagement (urban and rural workshops)
- Literature analysis
- Synthesis of all findings in final report
- Inform development of strategic options for CRLTS

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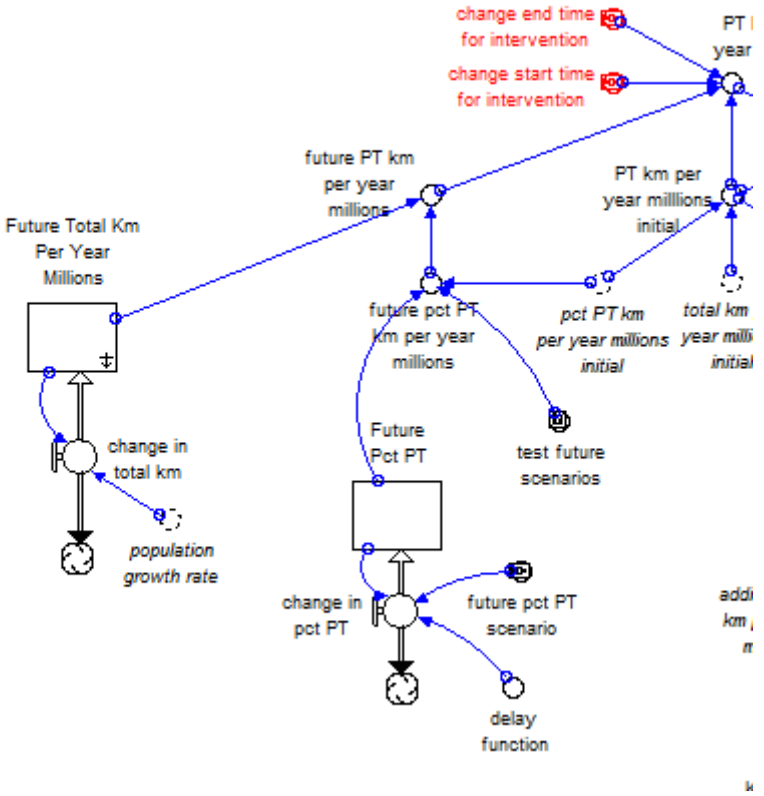
Modelling approach

- System dynamics modelling is an approach to improve understanding of how a system performs over time
- Draws together best evidence with expert insight
- Explicit picture of the system and a causal model to identify what outcomes can emerge
- Collaborative process of identifying causes, researching connections and critiquing findings



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Notes about the model

- Model based on vehicle km travelled and analysis of impacts of transport choice – different from scenarios to be explored in this workshop
- Model can be used to look at the relative shifts within scenarios and the potential health outcomes
- Four scenarios run over a 15 year timeframe

Scenarios – transport mode choice based on km travelled

Baseline Scenario 1
"No change"
Greater Christchurch

Public transport	5.4
Cycling	1.8
Cars	88.9
Walking	3.9

Scenario 2
"Car culture"
Greater Christchurch

Public transport	4.0
Cycling	1.5
Cars	91.5
Walking	3.0

Scenario 3
"Decline of the car"
Greater Christchurch

Public transport	15.0
Cycling	7.0
Cars	70.0
Walking	8.0

Scenario 4
"Continuing current trends"
Greater Christchurch

Public transport	5.5
Cycling	2.3
Cars	89.1
Walking	3.1

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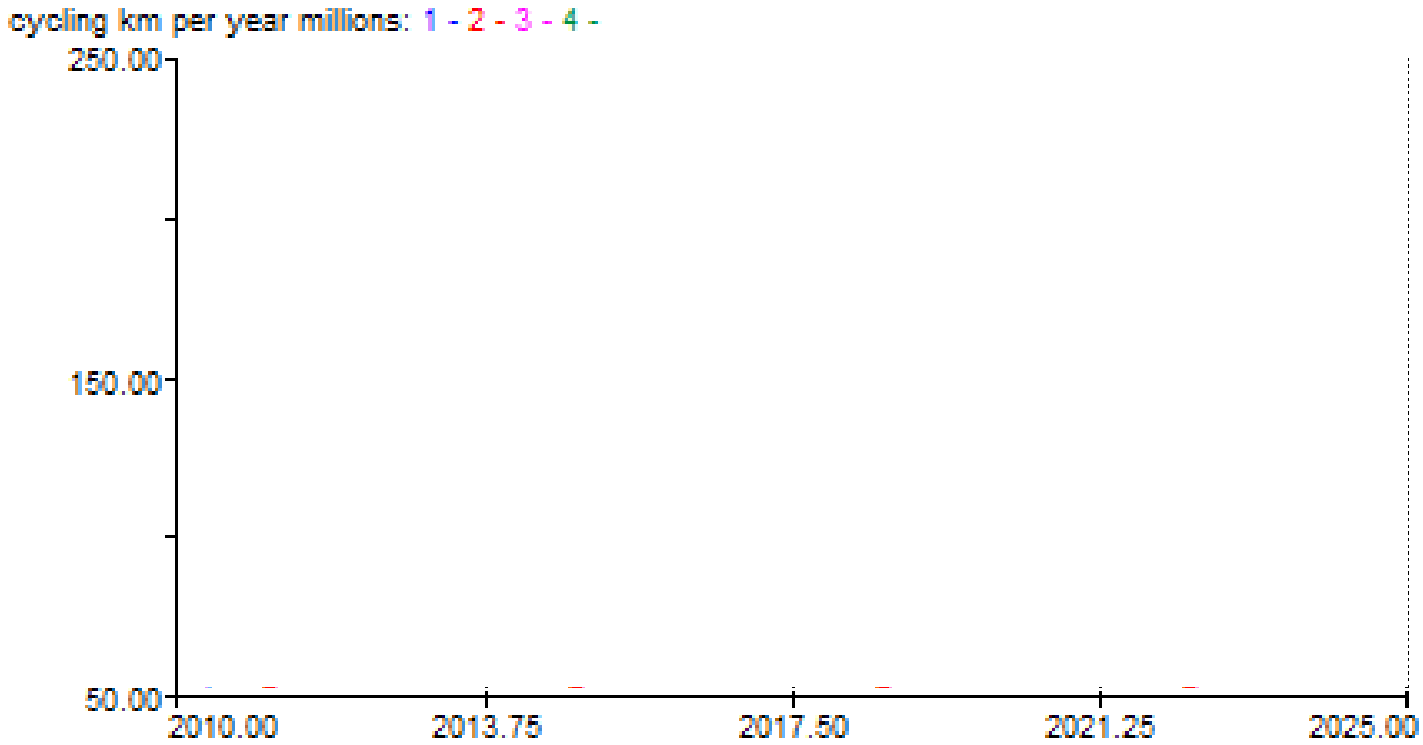
Potential cycling impacts (km per year)



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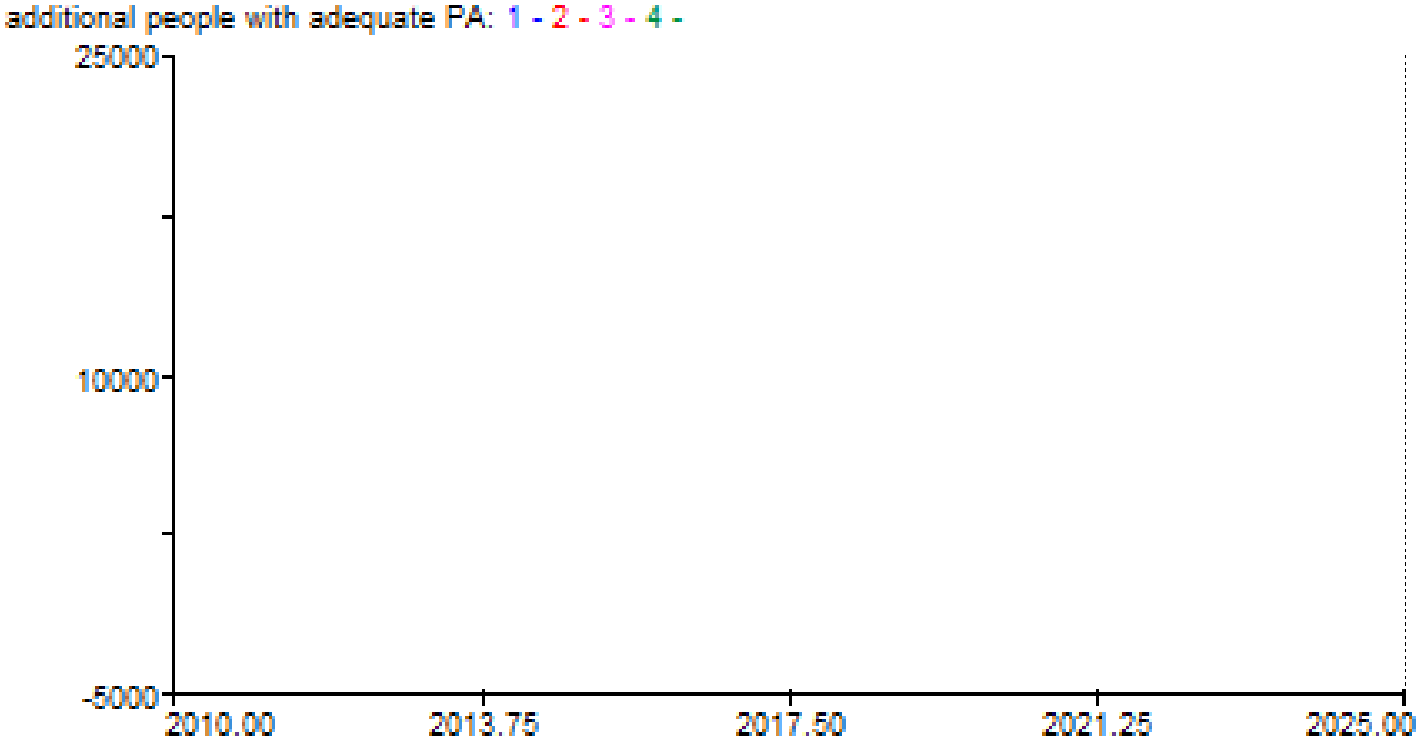
Potential physical activity impacts
(% with adequate levels of physical activity)



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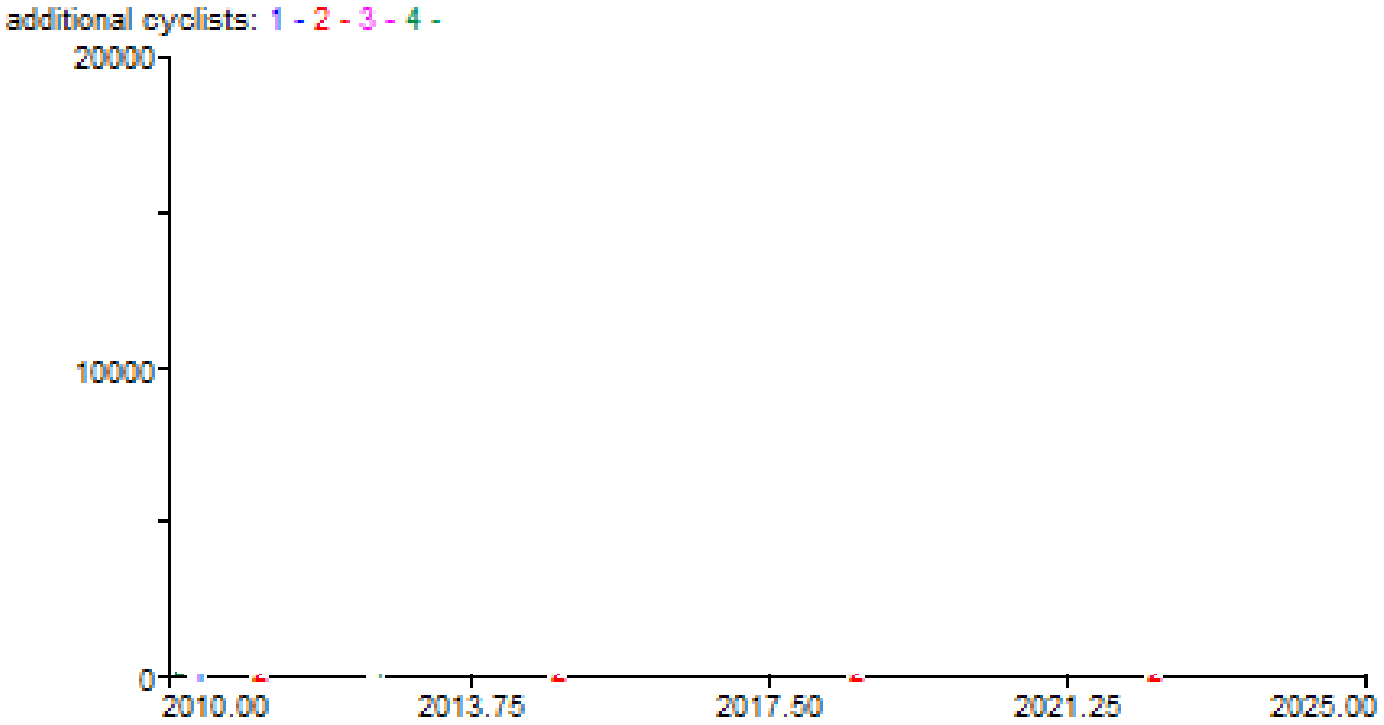
Potential mode choice impacts (additional cyclists)



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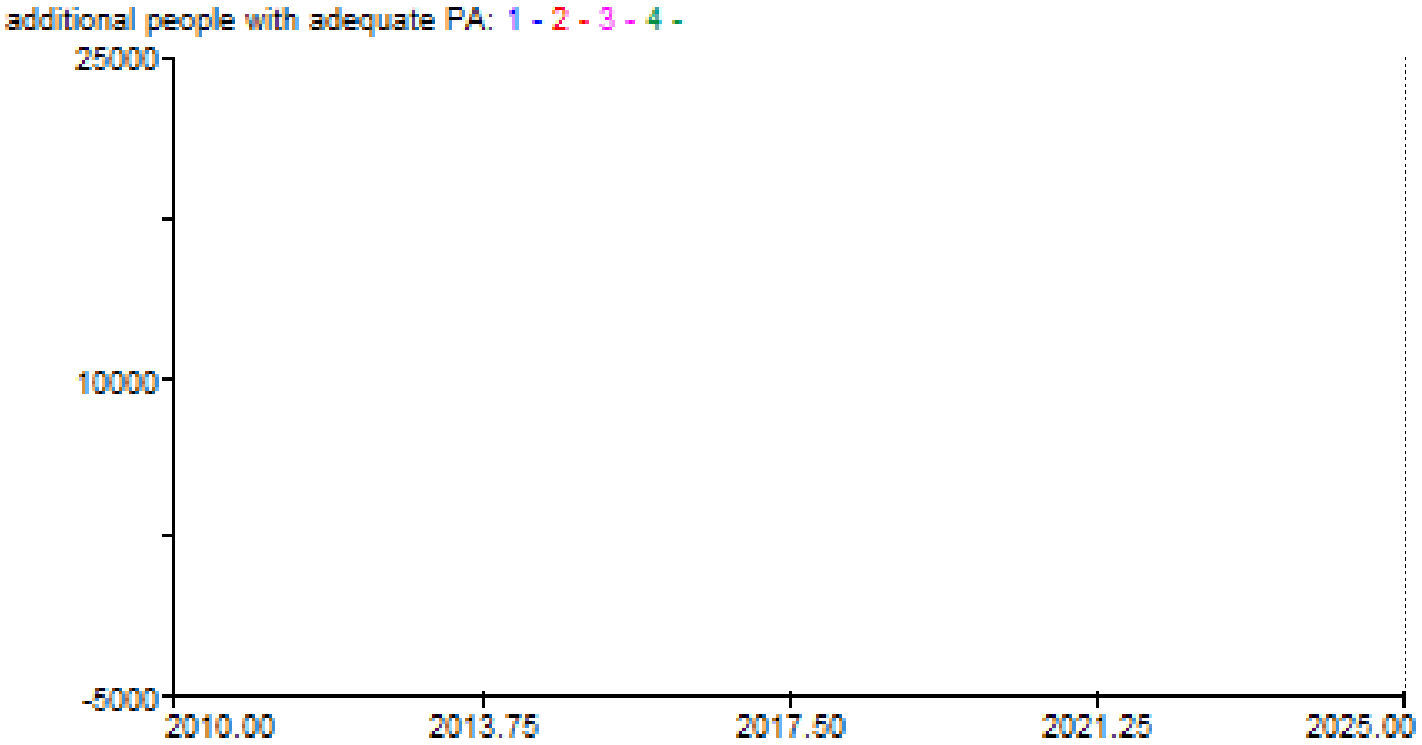
Potential mode choice impacts (additional public transport users)



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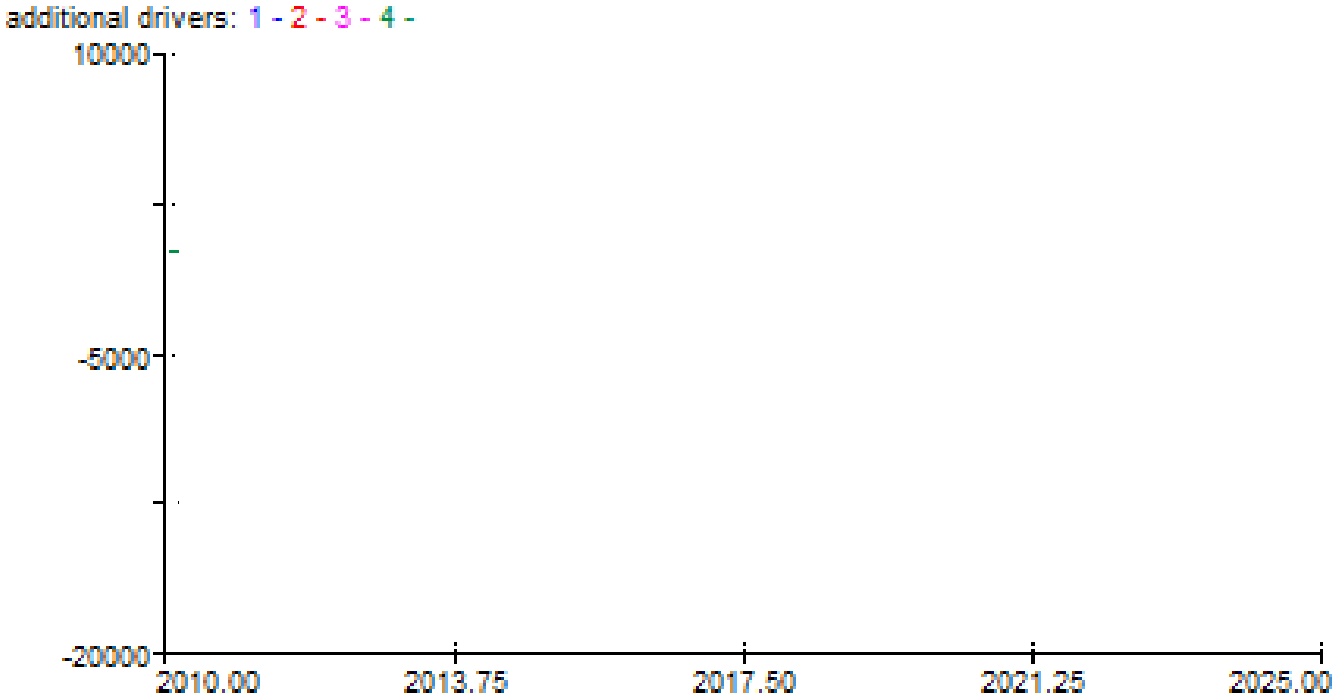
Potential mode choice impacts (additional drivers)



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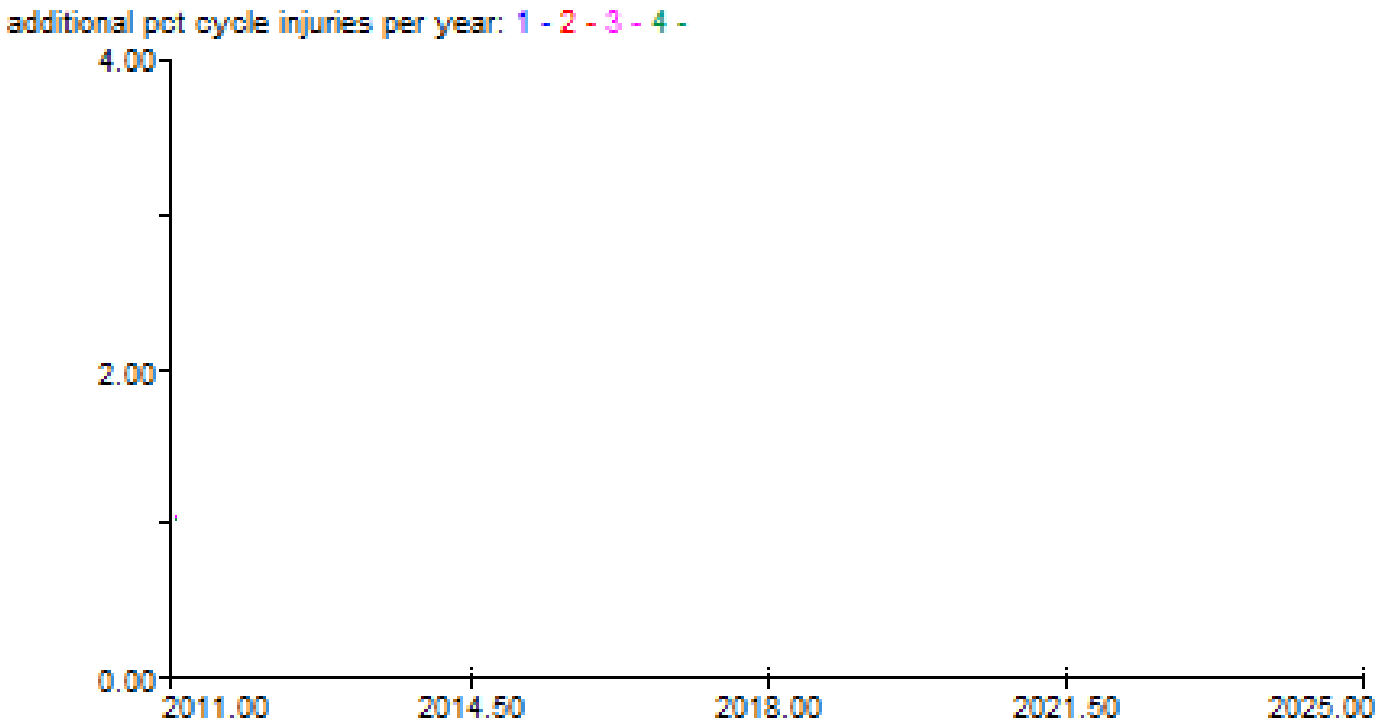
Potential cycling impacts
(% of cyclist injuries per year)



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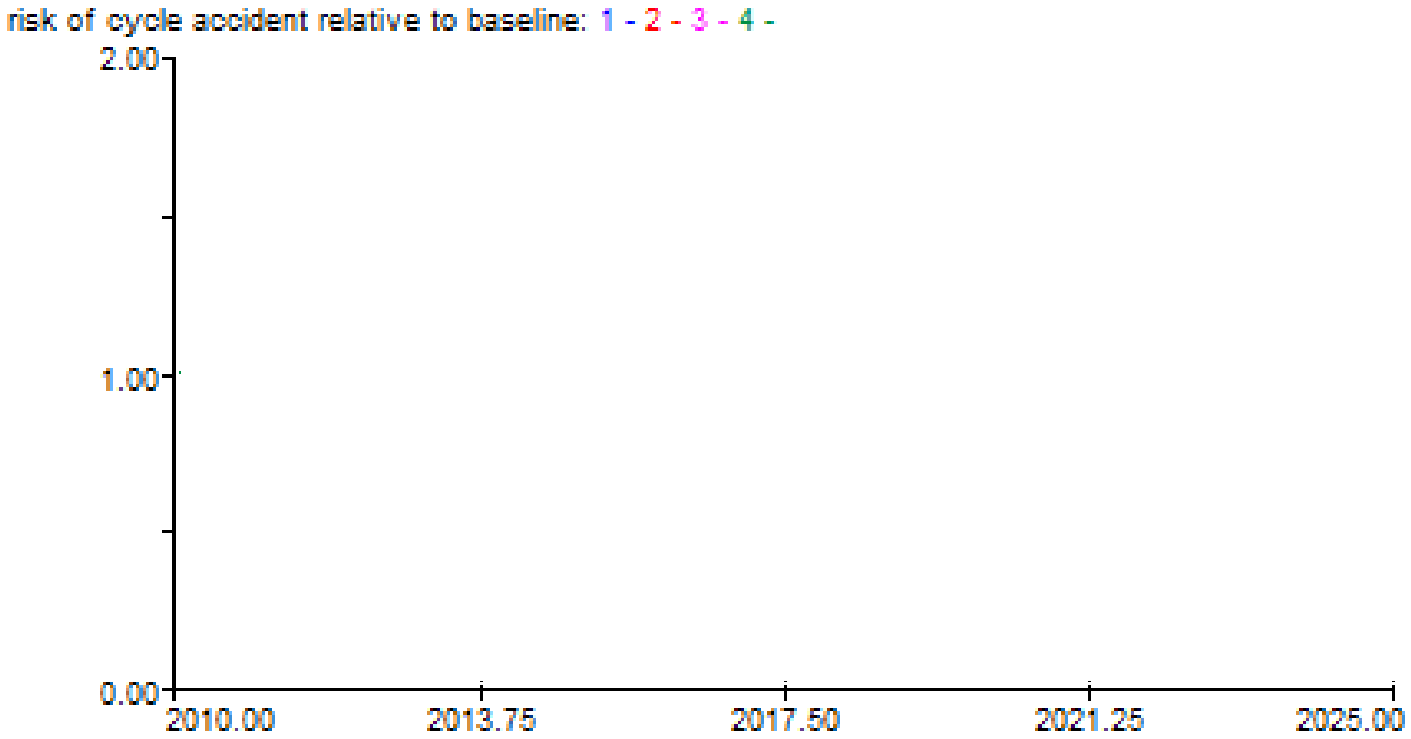
Potential cycling impacts (relative injury risk)



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Limitations

- Practical
  - All models are wrong – some are useful
- Technical
  - Model calibrations have high degrees of uncertainty due to the fact that there is much that is unknown.
    - For example, in shifting more people to cycling – how many are already achieving appropriate physical activity levels and therefore what is that actual benefit to the population?
    - Some outputs were functions of others (e.g. car use and PM10 emissions)
- Engagement:
  - Provided a validation tool for HIA discussions; could have been used more to prompt debate and discuss alternative futures

Reflections

- Shows potential scale of impact of transport changes
- Able to factor in different mix of transport modes and for different populations
  - Canterbury, Rural, Greater Christchurch, older people, low SES
- Compared with ‘gut-feel’ it is a significant step forward in exploring ‘what-if’ scenarios
- All assumptions explicit and debateable
- Brought together the mental models, data and knowledge on transport issues
- Validated many of the directions brought forward in the qualitative engagement
- Additional layer of ‘contestable advice’

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