MOVING TO SOCIOTECHNICAL ASSET MANAGEMENT OF AN INTERCONNECTED NETWORK OF BRIDGES

ROYCE GREAVES – CPENG INTPE MIPENZ NDIAM

Mackinac Bridge, Michigan, USA

2016 TRB Asset Management Conference – Minneapolis MN July 10 to Jun 12 2016

OVERVIEW

Kicking Horse Canyon Park Bridge, Canada

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Overview

- Introduction
- Definitions
- Context and Case Study
- Benefits
- Summary
- Acknowledgements
- Questions

INTRODUCTION

Auckland Highway Alliance, New Zealand

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Who is Opus?

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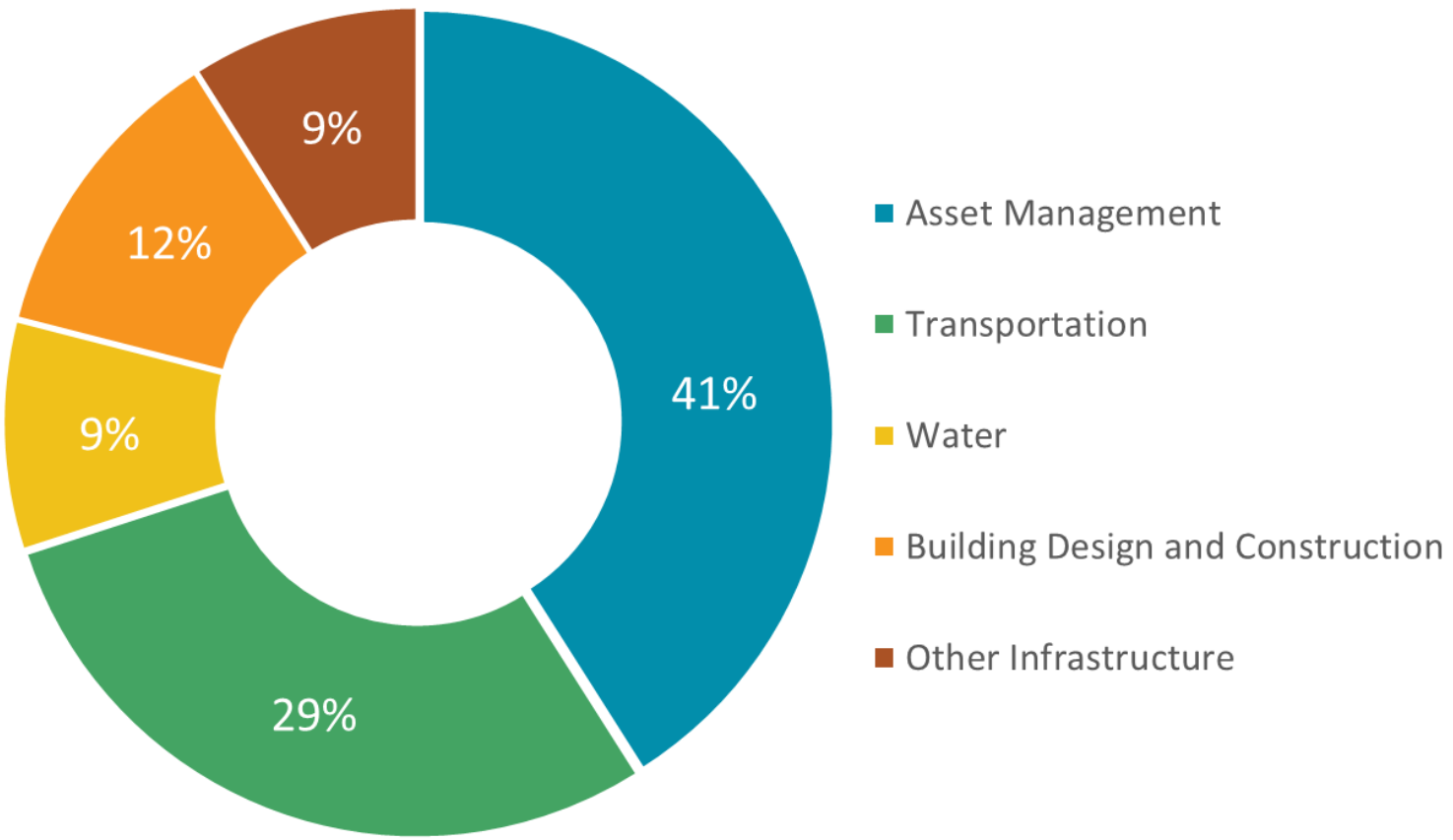
Who is Opus?


41%
29%
9%
12%
9%
Asset Management
Transportation
Water
Building Design and Construction
Other Infrastructure

Who am I?

14 Jan 2015

19 Jan 2015

DEFINITIONS

Panmure Station, Auckland, New Zealand

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What is Socio Technical AM?

- Recognition that Asset Management is as much technical process as it is social process
- 6 year history (in AM)
- Part of ISO 55000 – International AM Standard

How do we apply that to bridges?

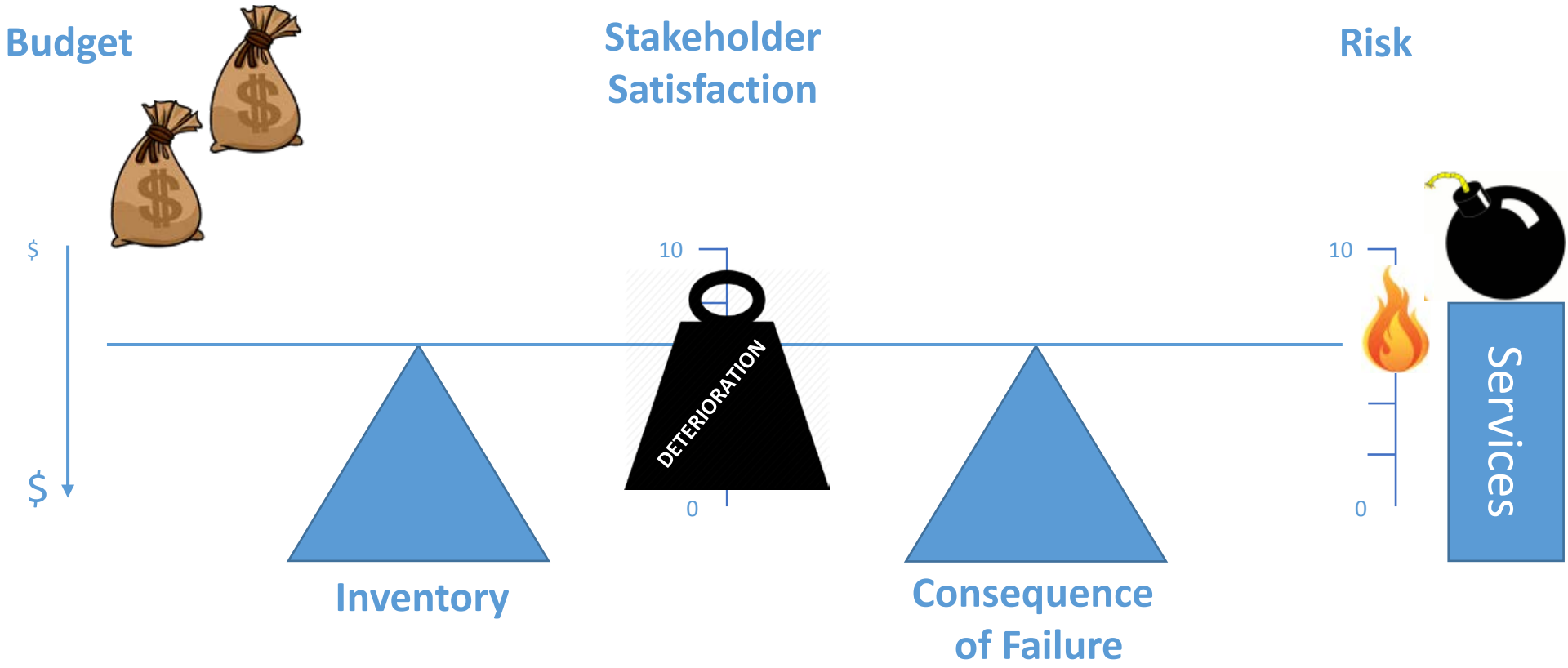
- Typical triggers for intervention:
  - Condition
  - Obsolescence
  - Capacity

  } Technical Approach
- Where do the users come into this discussion?

A sociotechnical approach…

- Explore stakeholder reactions to investment decisions
- Combine with technical requirements
- Result?
  - An investment program that looks after the asset and the people

Socio Technical Asset Management is a Balancing Act!



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CONTEXT – HOW DOES IT WORK?

Sea to Sky Highway, Canada

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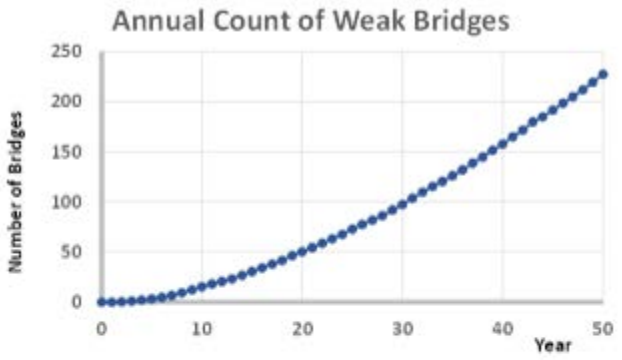
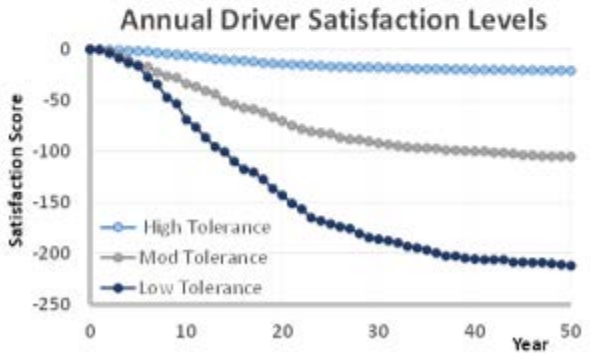
Leveraging Agent Based Modelling as the enabler

- Helps us understand asse performance
- And gauge stakeholder reactions
- Historically used by
  - Behavioral economists
  - Socials scientists





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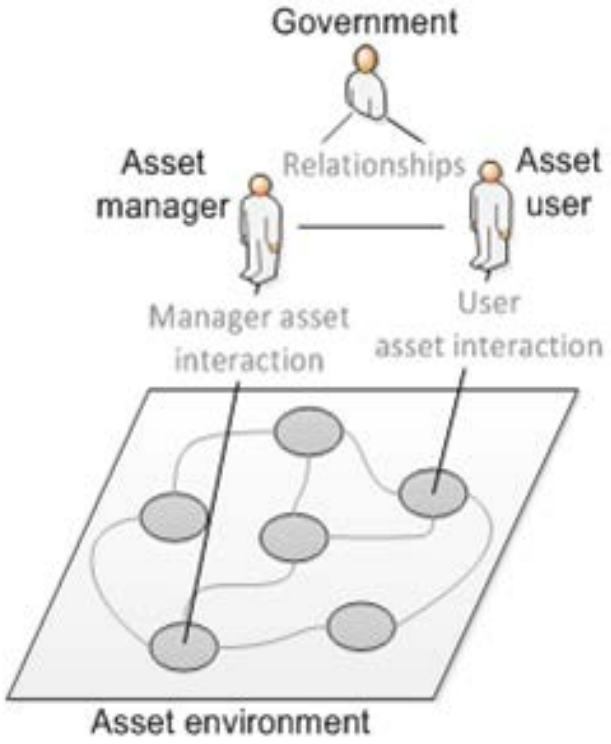
What does an ABM include?

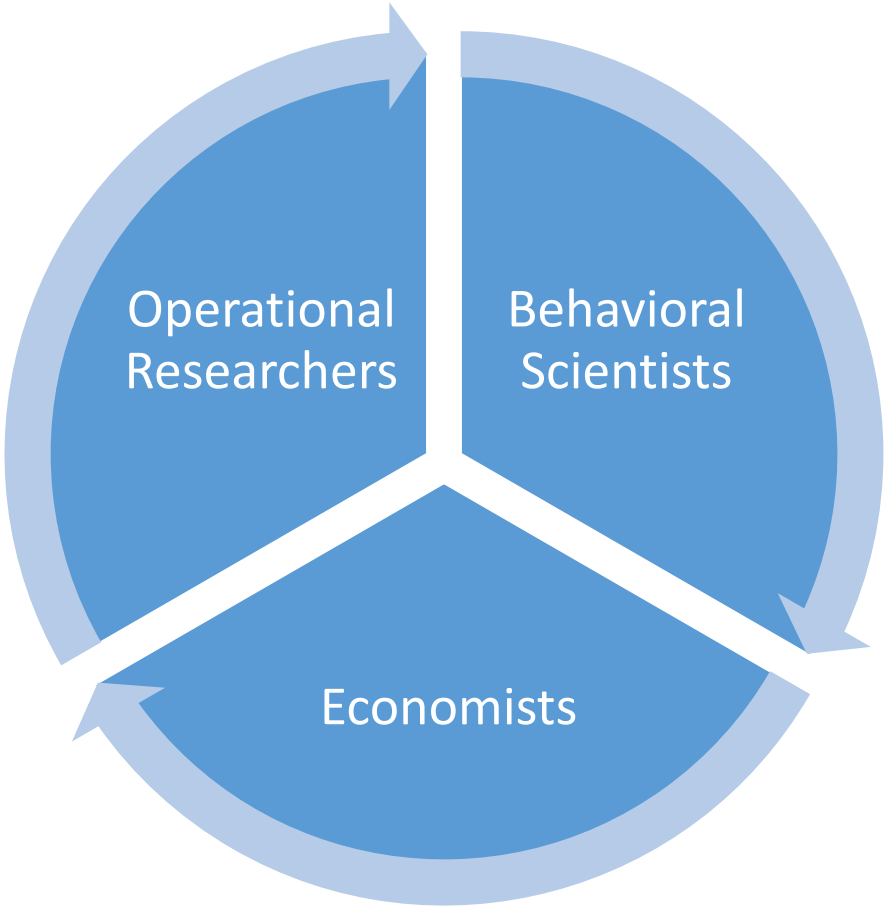
- Three components
  - Stakeholders
  - Relationships
  - Environment



Understanding the Stakeholder is key!

- Who are they?
- How do they interact with each other?
- How do they interact with the asset?
- This helps define the rules in the model
  - Satisfaction
  - Thresholds

We need more than just engineers and asset managers!



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To run the model…

- Programmers if developing own model
- COTS Software
  - Over 70 packages (Wikipedia 2016)
  - Varying degrees of GIS capability

APPLYING THE MODEL – NZ CASE STUDY

Sea to Sky Highway, Canada

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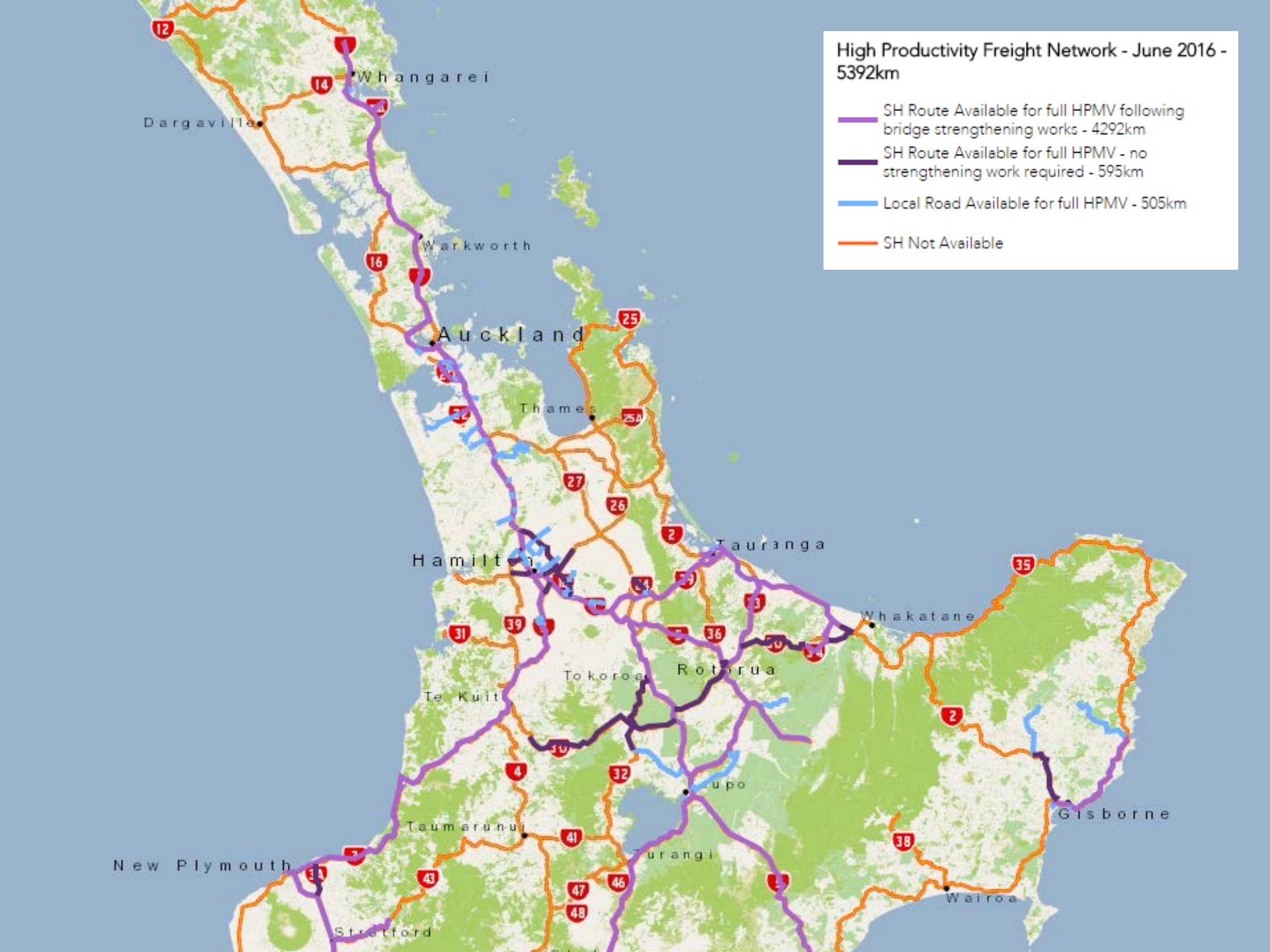
Applying ABM to NZ Bridges

- Increase in truck mass by ~ 15%
- Limited routes initially
  - Due to bridges across network
- Routes expected to grow, but performance variable
- Strengthening need > $$


High Productivity Freight Network - June 2016 - 5392km
SH Route Available for full HPMV following bridge strengthening works - 4292km
SH Route Available for full HPMV - no strengthening work required - 595km
Local Road Available for full HPMV - 505km
SH Not Available
Whangarei
Dargaville
Warkworth
Auckland
Thames
Hamilton
Tauranga
Whakatane
Rotorua
Tokoroa
Te Kuiti
Taumarunui
New Plymouth
Stratford
Gisborne
Wairoa

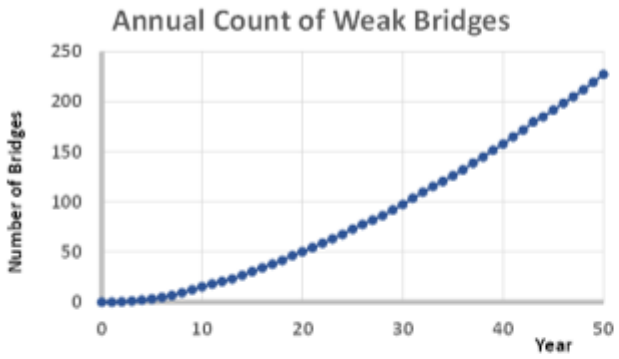
Applying ABM to NZ Bridges

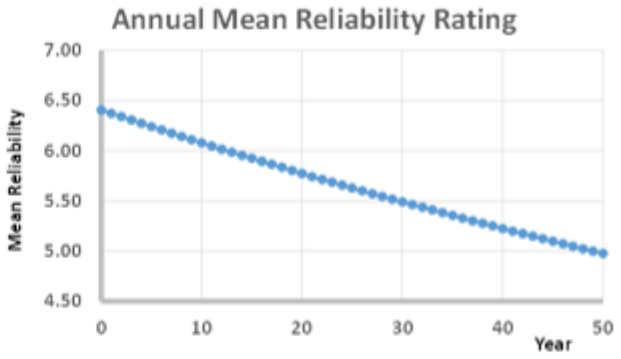
- Technically knew what was required
  - List of bridges requiring strengthening
  - Technically prioritized
- But what was socially required?
  - Would that change the technical prioritization?

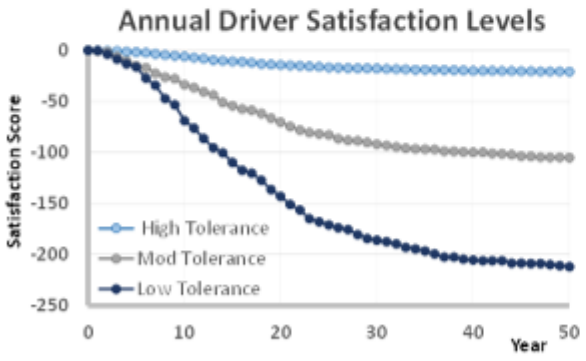
Applying ABM to NZ Bridges

- Solution - ABM:
  - Engage with the trucking industry to understand their needs and constraints
- Outcome:
  - Prioritized Bridge Performance Improvement Program that catered for the asset as well as the users

Applying ABM to NZ Bridges







Things to note:

1. The tipping point in satisfaction, which results in the system entering a new state of equilibrium
2. The small number of bridges that cause the tipping point
3. The non-linear relationship between the numbers of weak bridges and satisfaction
4. Although mean bridge reliability is good and bridges are still safe (i.e. above 3) driver satisfaction levels are still dropping.

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BENEFITS

Northern Busway, Auckland, New Zealand

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Stakeholder Engagement

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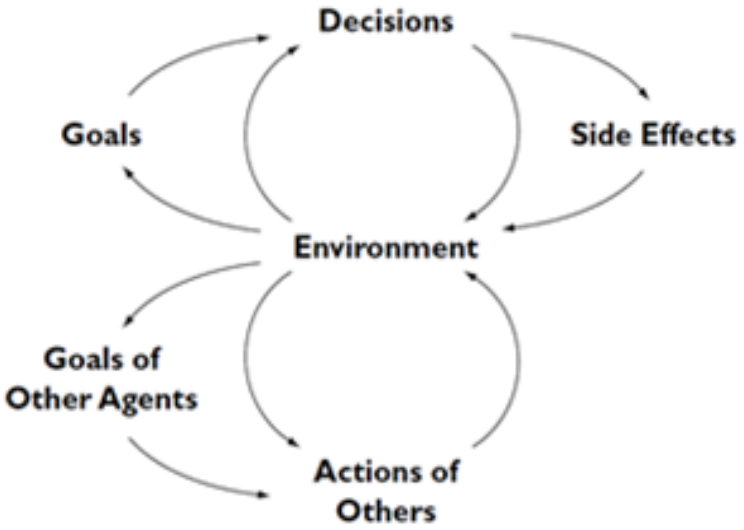
Challenges our thinking*....

The outdated linear view of the world



The modern feedback view of the world

*Sterman 2001

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SUMMARY

Hertfordshire County Council, United Kingdom

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Key Points

- Socio technical AM brings together the needs of the people and the needs of the asset
- Agent Based Modelling is enabler

Key Points

- Very powerful tool in asset devolution situations
- Gets our communities involved in our decisions
- Allows us to be better asset managers



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Acknowledgements

- Simon Bush – Opus New Brunswick
- Dr. Thuens Henning
- Prof Jason Ingham
- Dr. Andrea Raith

} University of Auckland




One last thing…

KPI Achieved! 174 days ahead of schedule….

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THANK YOU FOR LISTENING

QUESTIONS?

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