

System Dynamics Modelling of Traffic Flows between Auckland, Hamilton & Tauranga

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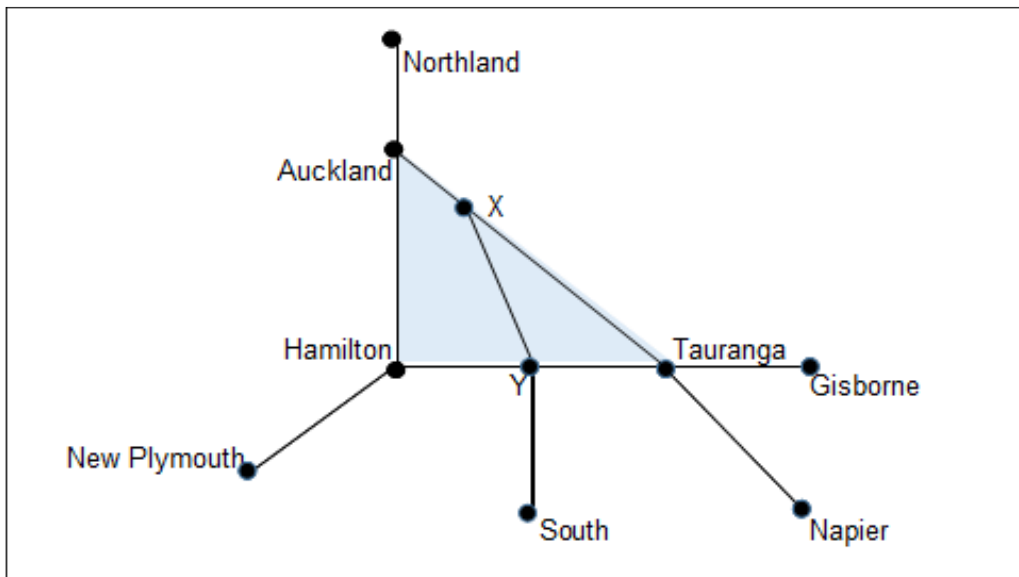
A note to the audience

- This presentation is based on research report *Systems dynamics investigation between freight flows, economic development/productivity and network performance in the upper North Island*.
- While the NZ Transport Agency provided investment, the research was undertaken independently, and the resulting findings should not be regarded as being the opinion, responsibility or policy of the Transport Agency or indeed of any NZ Government agency.
- The Transport Agency is established under the Land Transport Management Act 2003. The objective of the Transport Agency is to undertake its functions in a way that contributes to an efficient, effective and safe land transport system in the public interest. The Transport Agency funds innovative and relevant research that contributes to this objective.
- People using this research should apply and rely on their own skill and judgement and, if necessary, they should seek appropriate legal or other expertise regarding its use.

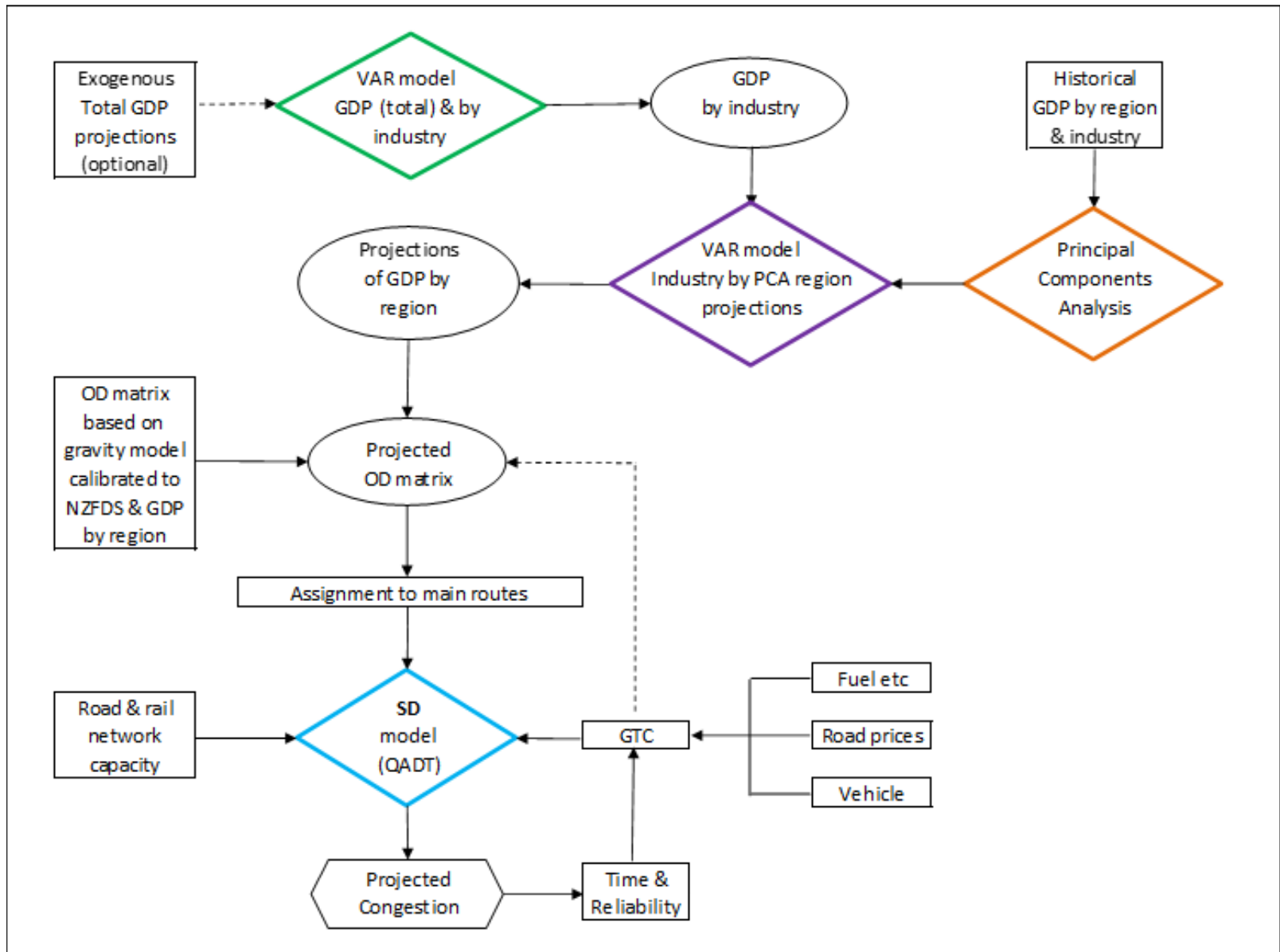
Model Area



- Intercity only; three main routes:
 - SH1 – SH29
 - SH2
 - SH2 – SH27 – SH29
- Six road segments
- Intersection Y is a simplification
- Traffic to/from Northland, New Plymouth, Gisborne & Napier treated as going to/from Auckland, Hamilton, Tauranga.



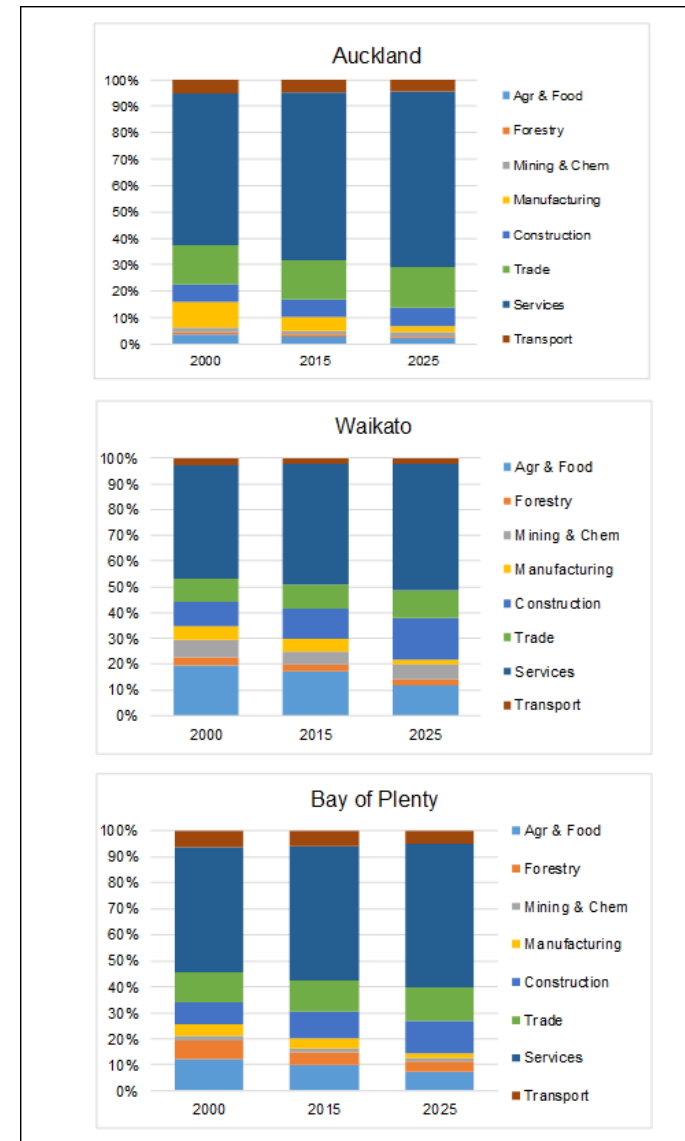
Model Framework



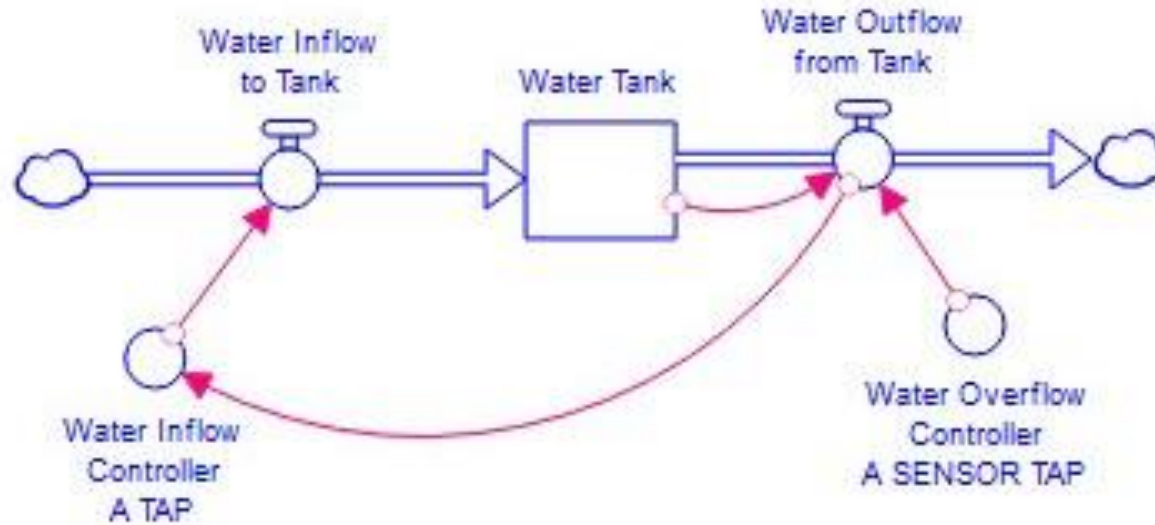
Regional Composition of Industry GDP



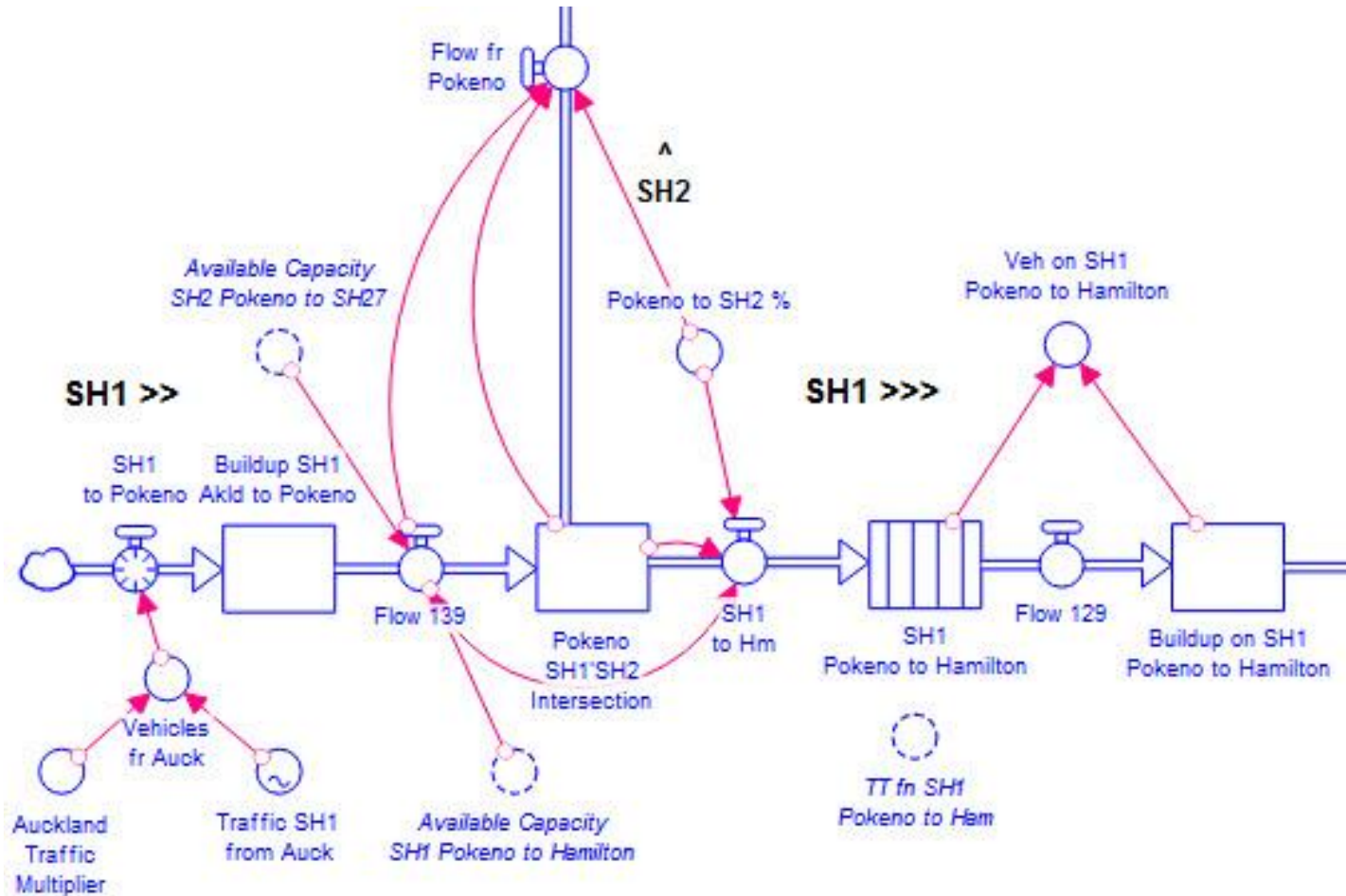
Industry Composition of Regional GDP



System Dynamics Models

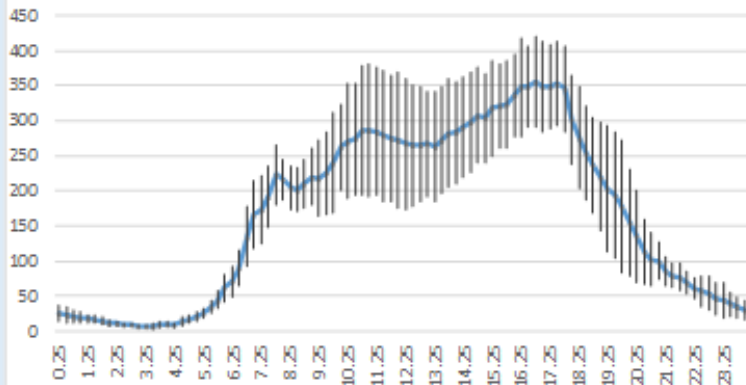


System Dynamics Models

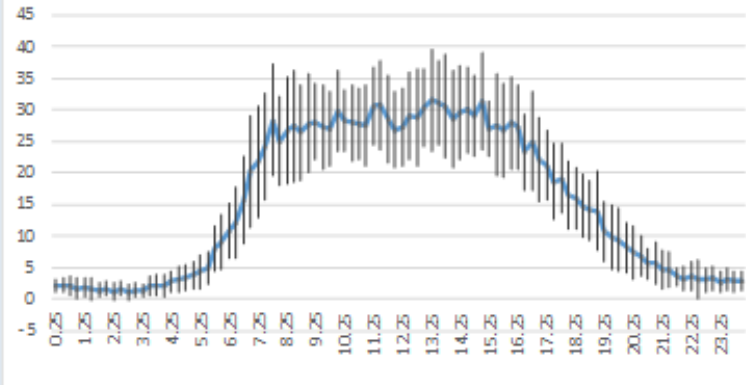


Traffic Flows

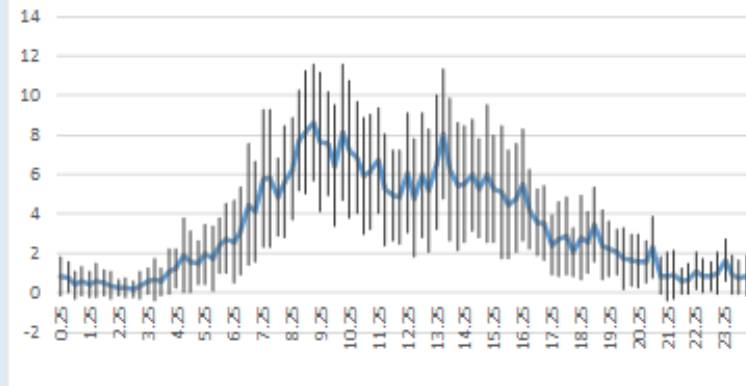
Mean Daily Vehicle Count, Class 1, South,



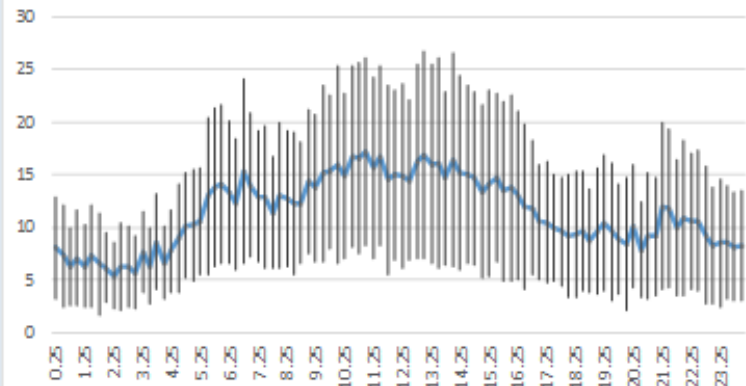
Mean Daily Vehicle Count, Class 2, South,



Mean Daily Vehicle Count, Class 3, South,

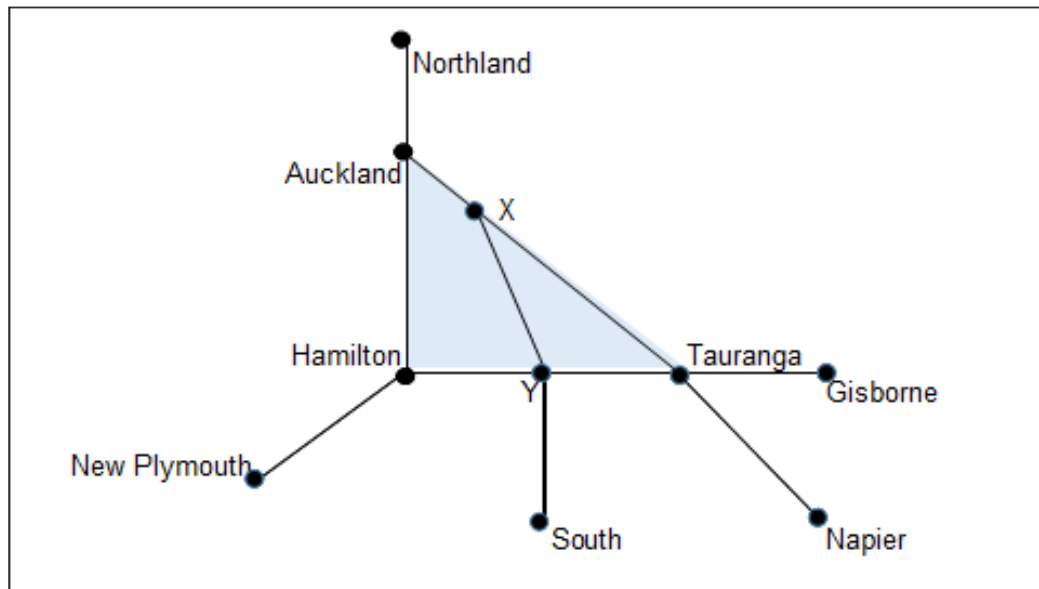
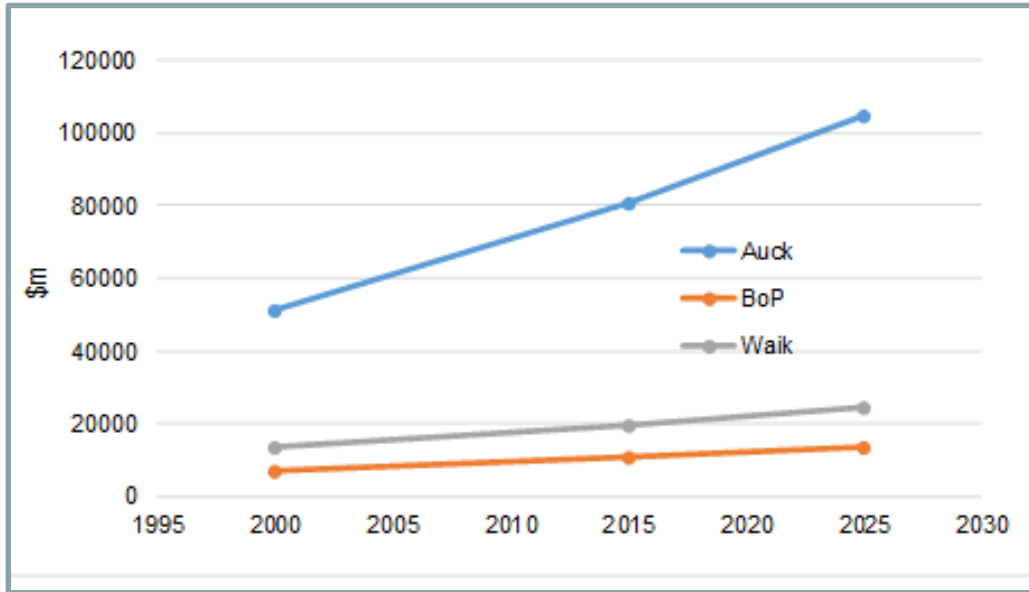


Mean Daily Vehicle Count, Class 4, South,



August 2016 Site: 01N10474 (BOMBAY - Telemetry Site 72 - SB) location: 461/12.790

Projections to 2025



Route	Direction	Change
AH	S	60.7%
	N	60.2%
HY	E	57.1%
	W	56.4%
AX	S	60.3%
	N	60.0%
XY	S	60.8%
	N	61.6%
XT	S	57.9%
	N	58.2%
YT	E	55.0%
	W	54.0%

Case Study

Waikato Expressway & Kaimai Ranges

	Time saving	Distance saving
Pokeno to Horotiu	-14min	-3.0km
Horotiu to Hamilton & Cambridge South	-10min	-2.5km
SH24/SH29 intersection and bottom of old Kaimai road	-7min	-2.5km

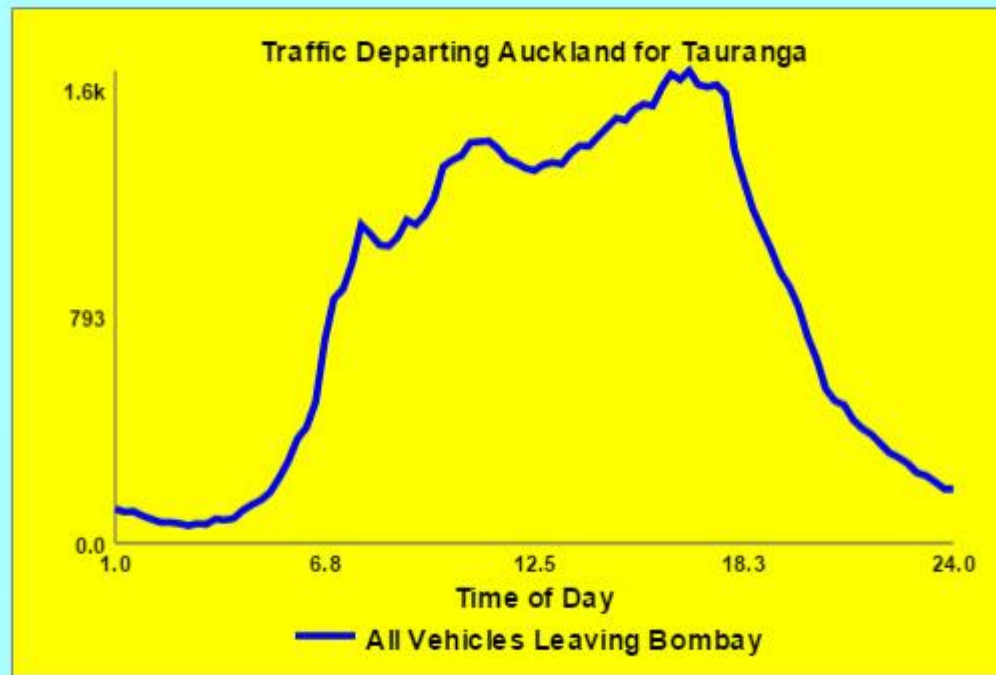


- Simulate as improvements in efficiency of relevant road segment.
- Consider different route choices.
- Also looked at more HPMVs and road-rail substitution

SD Model Front Page

NZTA GOLDEN TRIANGLE TRAFFIC FLOWS

A System Dynamics Model



Run

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Restore Inputs

Restore Outputs

2. Bombay Traffic by Class

3. Scenario Inputs

4. Vehicle Nos

5. Road Section #

6. Compare Flow #

7. Travel Times

8. Compare Scenarios

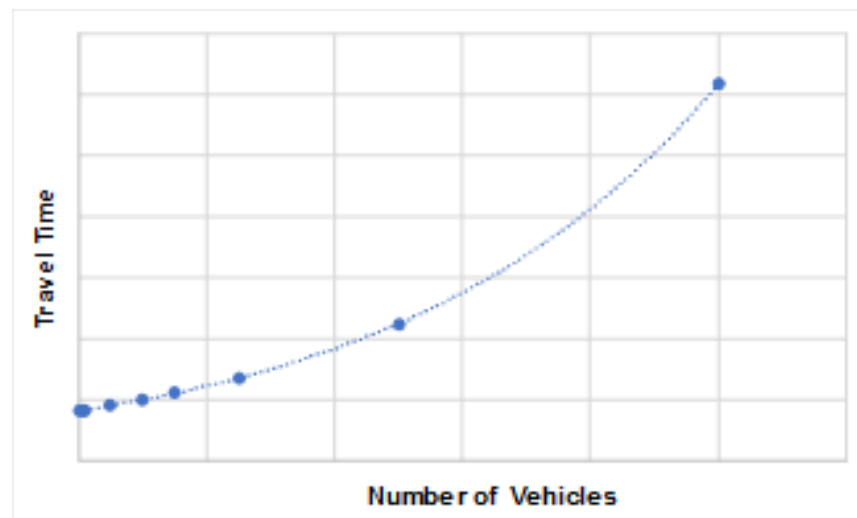
9. Go to Table 1

Scenario Setup

SD Model Caveats



- Still a pilot model
- Needs more calibration
- Does not optimise
- Road segments should be shorter
- Manual link to economic models
- Intended to be user friendly
- Simple travel time function



Conclusions



- The main determinant of travel time for trucks is the space on the road; a combination of the total number of vehicles (notably Class 1 vehicles) and road capacity.
- Induced traffic could offset some or all of the benefits without necessarily generating a compensatory reduction in travel times on alternative routes - the whole road network needs to be efficient.
- For road-rail substitution to have a meaningful effect on road travel times the amount of freight transferred would have to be significant.
- Or remove freight from particular segments of the road network at particular times.

Future Improvements?



Test the model with data from other months and randomly shock the traffic flows according to the known distributions.

If possible, compare the results with output from the Waikato Regional Transport Model.

Undertake sensitivity testing to determine which variable and parameters are important. Test different scenarios of freight growth.

Where scenarios produce large changes in travel time, analyse possible demand-side reactions.

The modelling system that is developed here is specific to the issues and the Auckland – Hamilton – Tauranga area. Nevertheless it is envisaged that the modelling system would be amenable to being adapted to consider other areas and other spatial disaggregation.