

# Operational Resilience of the Road Network (ASM and South Island)

Auckland System Management (ASM)

Journey Optimisation Team (JOT)

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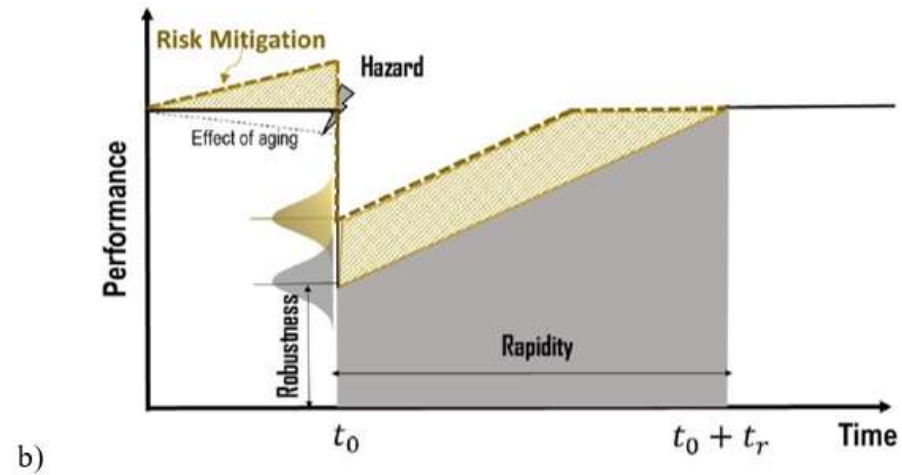
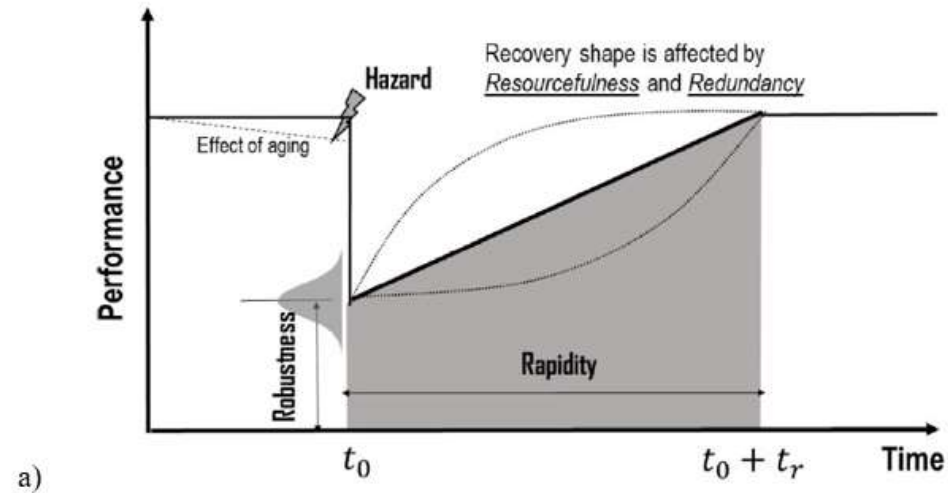


# Outline

- Introduction (Resilience Concept)
- State Highway Incident Prioritisation Tool
- Alpine Fault M8 (AF8) Trip Resilience

# Introduction

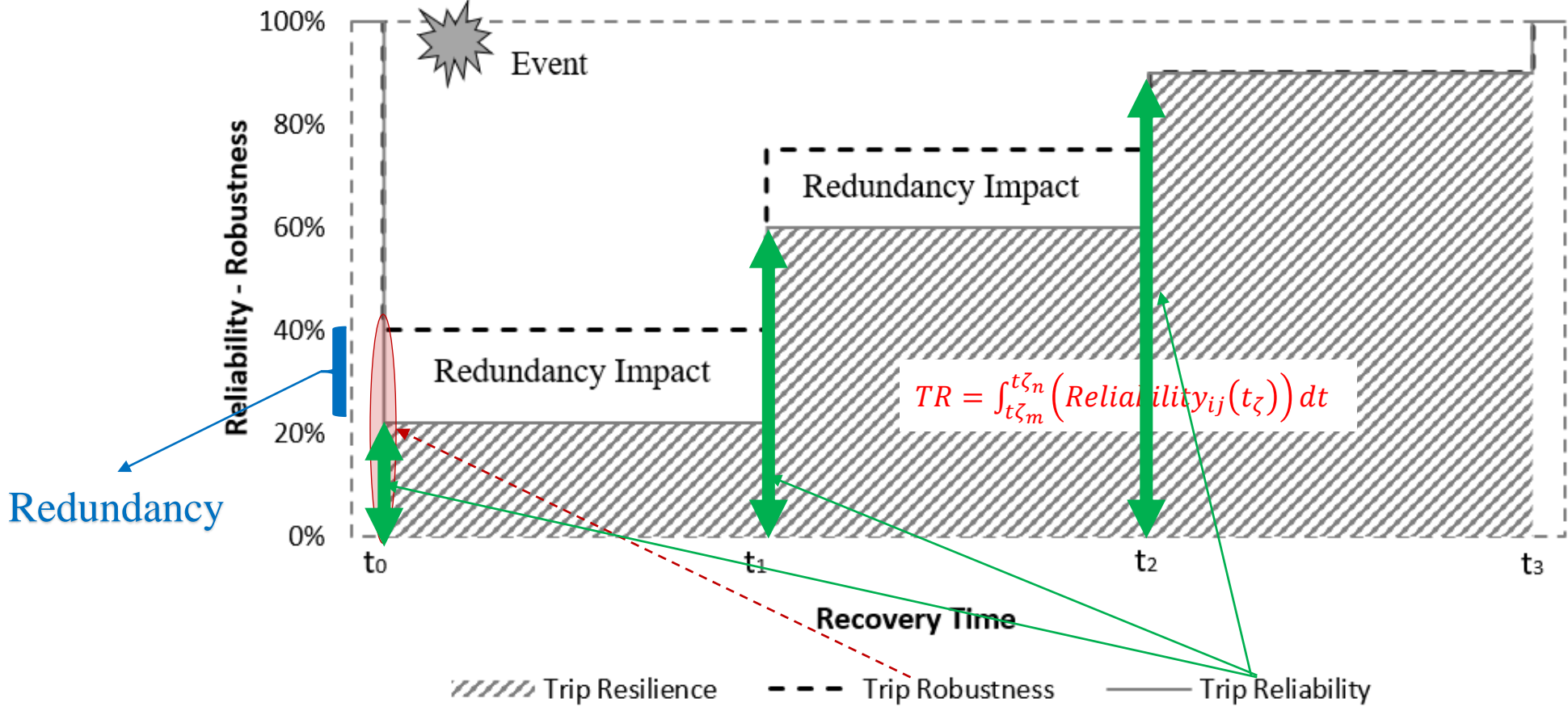
# Resilience Concept



Source: Zhang, W. & Wang, N. 2016. Resilience-based risk mitigation for road networks. *Structural Safety*, 62, 57-65.



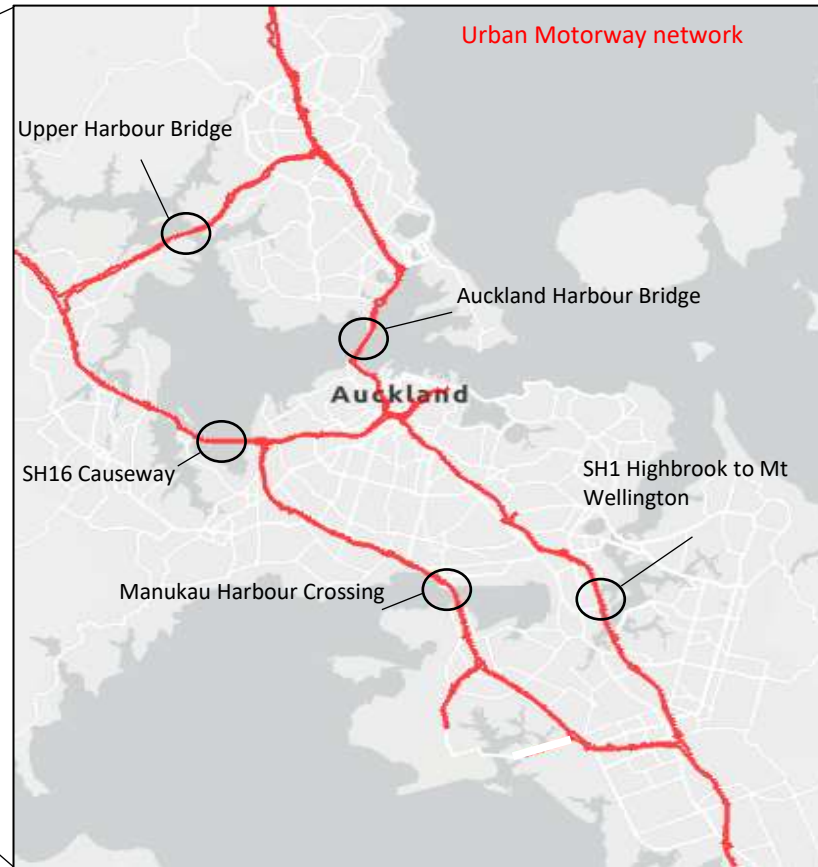
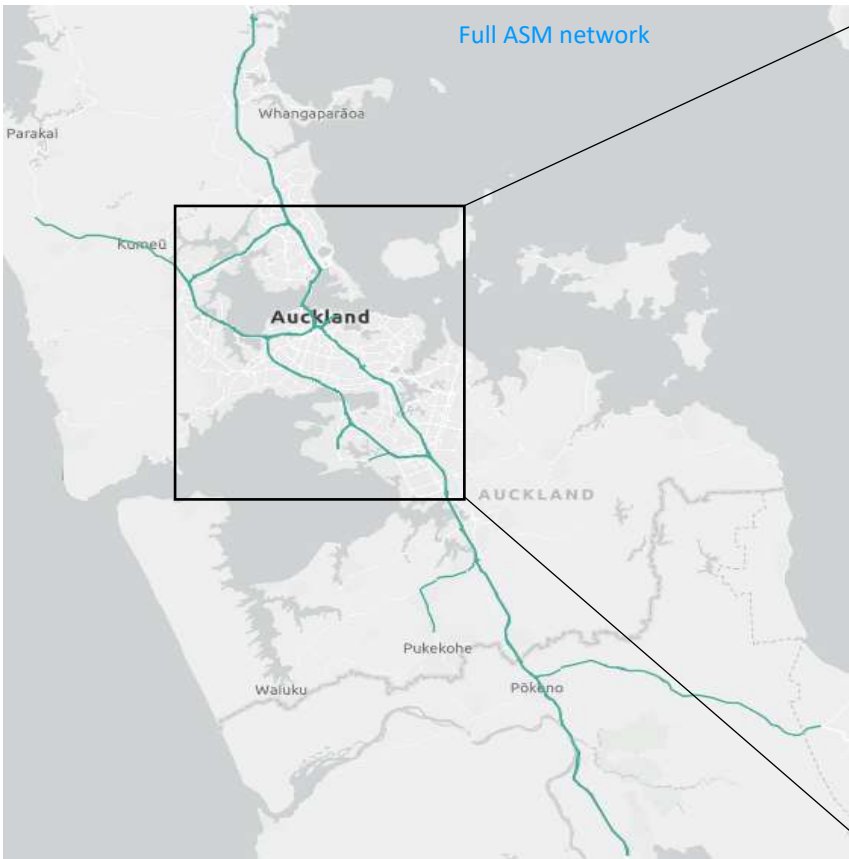
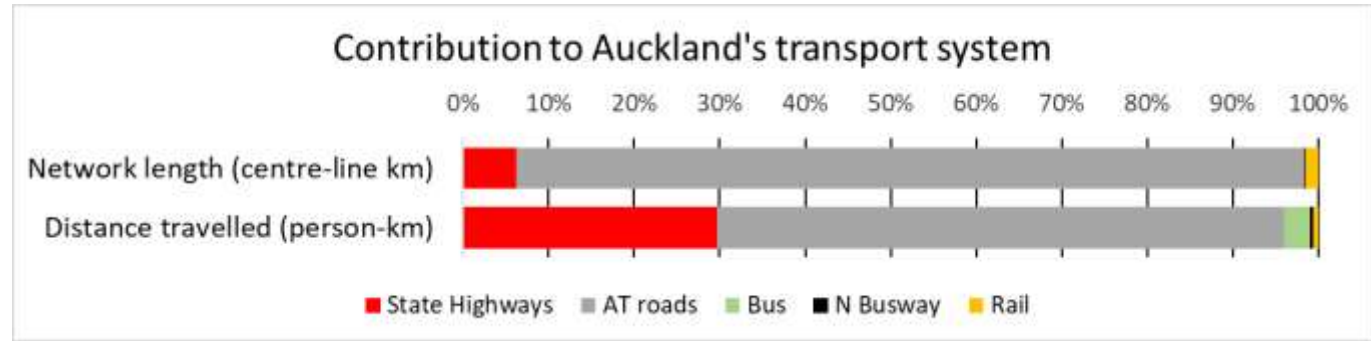
# Trip Resilience



Source: S. Aghababaei, SB Costello, P Ranjitkar (2021). Measure to evaluate post-disaster trip resilience. Journal of Transport Geography, Volume 95, July 2021, 103154; <https://doi.org/10.1016/j.jtrangeo.2021.103154>

# State Highway Incident Prioritisation Tool (SHIPT)

# Auckland Network





# Problem Statement



238 Onehunga Wharf PTZ (238) 5/23/2023 10:38:34.506 AM Auckland FLIR Latitude 8.0 Prod

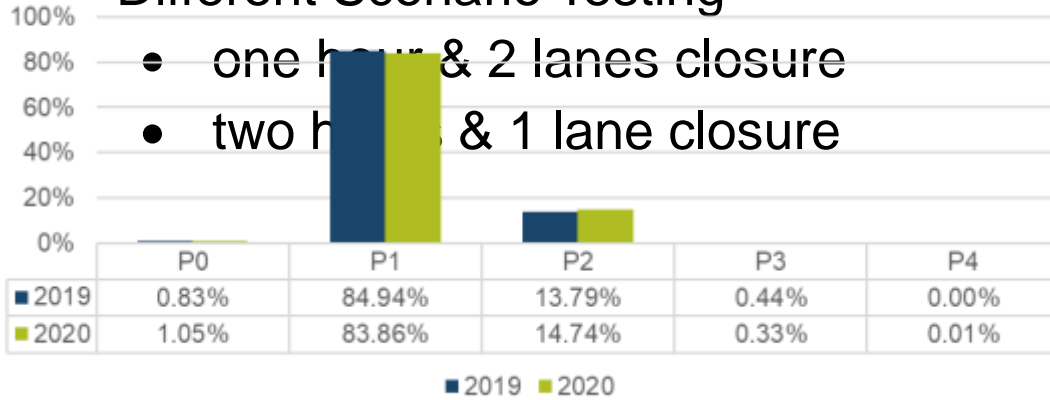


# Client Need

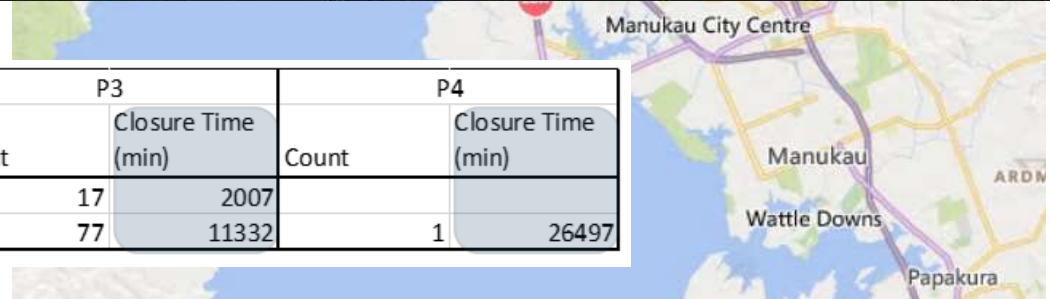
- ASM Operation Team Request
- Several Incidents, limited resources

## Different Scenario Testing

- one hour & 2 lanes closure
- two hours & 1 lane closure



	P0		P1		P2		P3		P4	
	Count	Closure Time (min)	Count	Closure Time (min)	Count	Closure Time (min)	Count	Closure Time (min)	Count	Closure Time (min)
2019	37	14	2955	3681	455	8770	17	2007		
2020	203	8	15826	12198	2782	63113	77	11332	1	26497





# State Highway Incident Prioritisation Tool

## Closure Information

### Select Day of Week\* :

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- Sunday

Start Time: 00 : 00

Duration\* : 00 : 00

End Time: 00 : 00

### Open Lanes\* :

Select Number of Lanes

Calculate

Add Data



Result

# Summary

- Using the Resilience Concept to provide a Tool:
  - To assess the **impact of incidents** on the motorway **quickly** (partial closure)
  - To help the **ASM operation team test different scenarios**

# Alpine Fault M8 (AF8) Earthquake

# AF8 Earthquake

- One of the **major fault** systems in New Zealand
- **High possibility** in the next 50 years
- **Severe damage to lifelines**

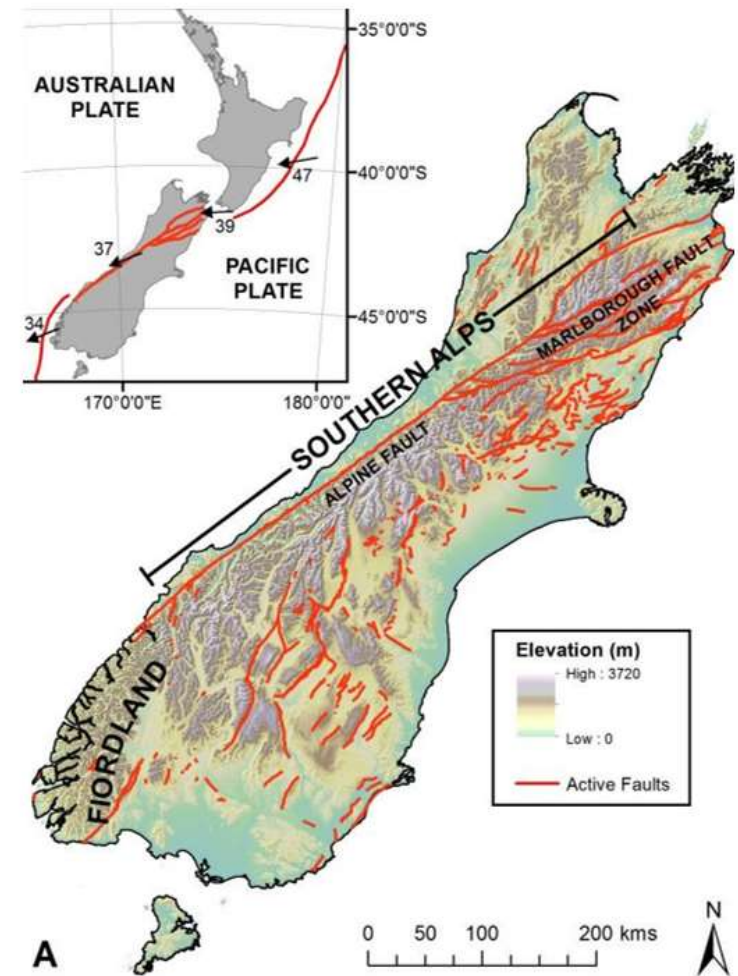
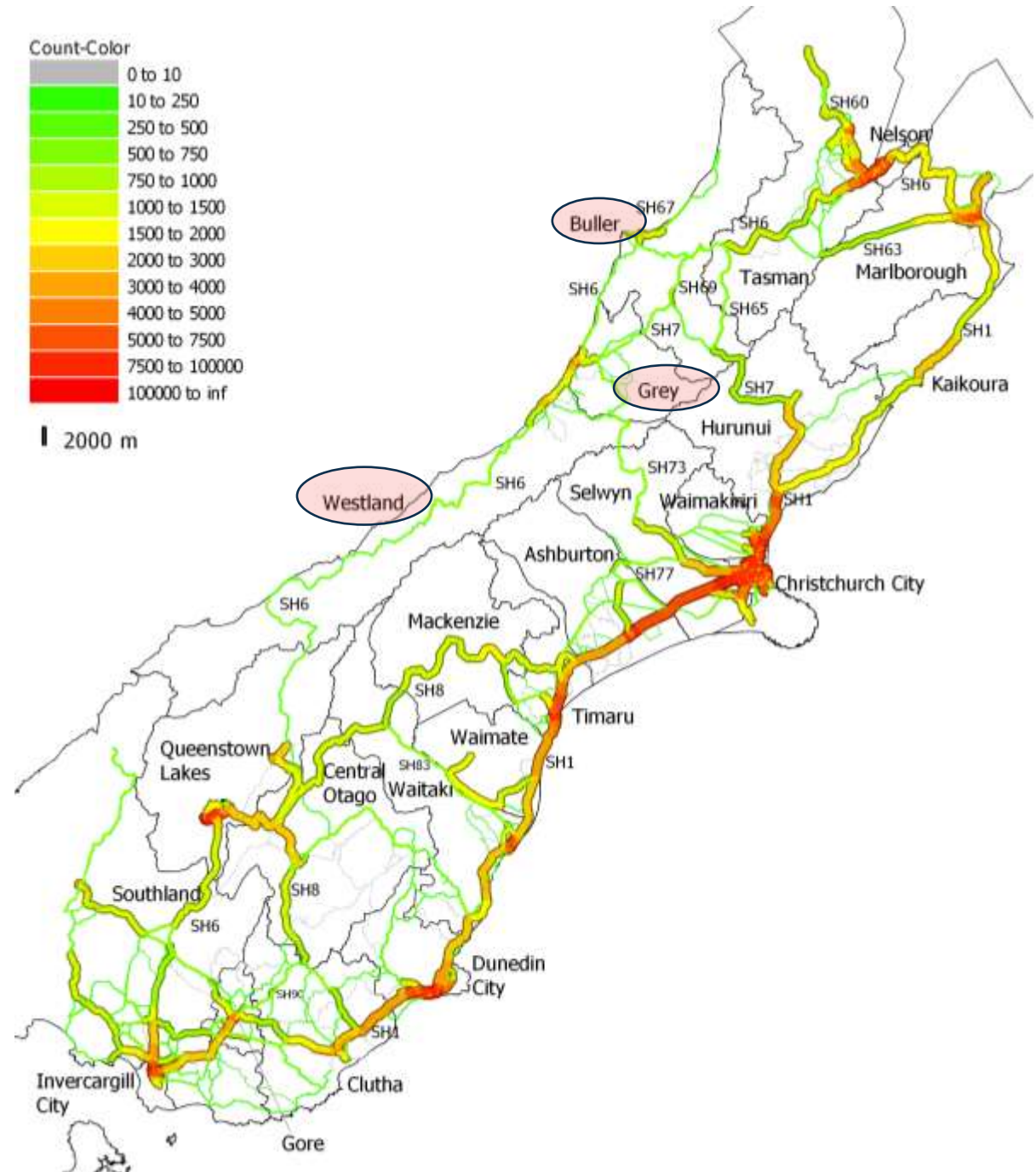


Figure 1-5: Active Faults in the South Island of New Zealand (Robinson et al. (2016))

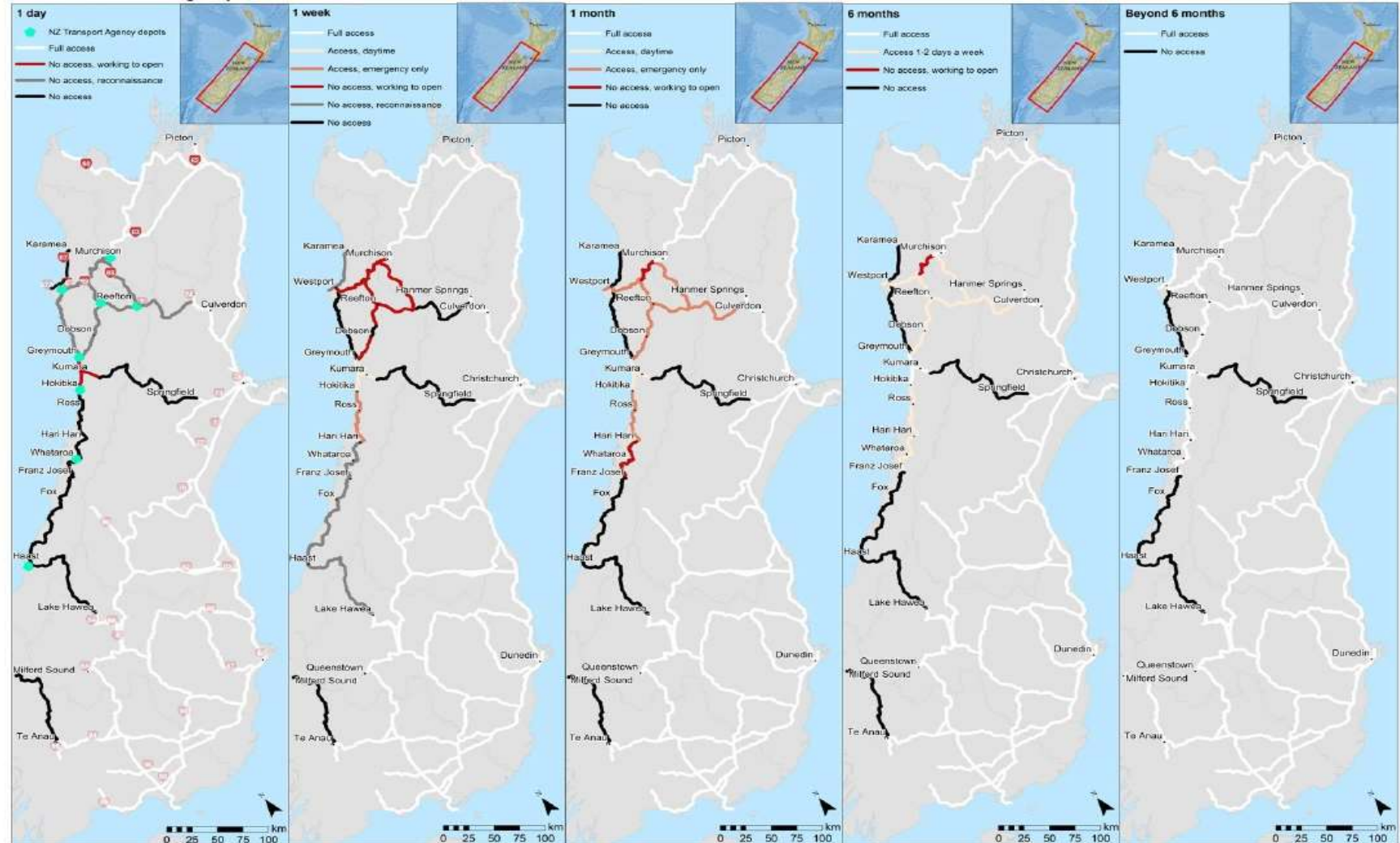
**Source:** Robinson, T. R., Wilson, t. M., R. Buxton, cousins, w. J. & Christophersen, a. M. 2016. An alpine fault earthquake scenario to aid in the development of the economics of resilient infrastructure's MERIT model. *NZSEE conference*.

# South Island Network



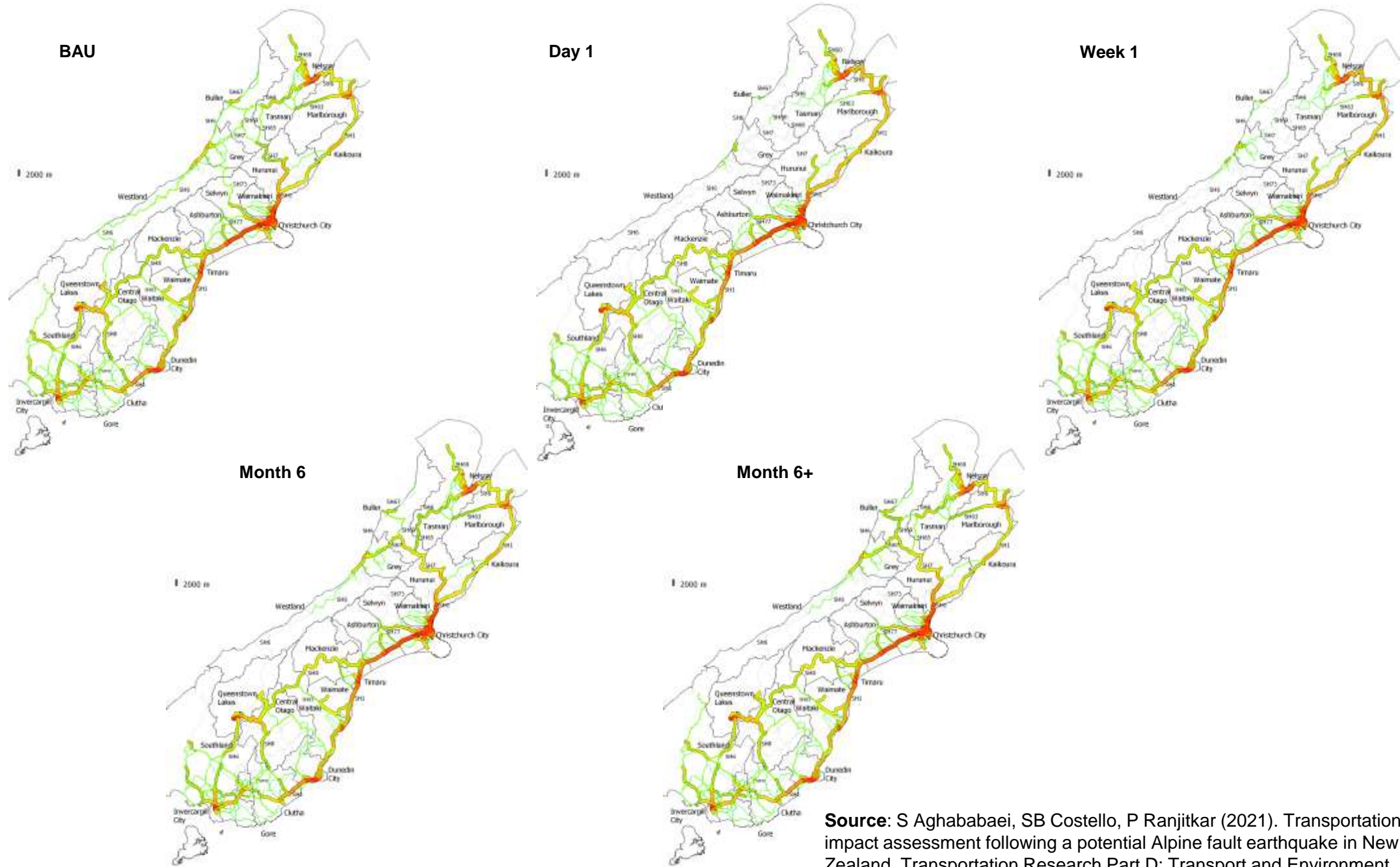
Source: S Aghababaei, SB Costello, P Ranjitkar (2021). Transportation impact assessment following a potential Alpine fault earthquake in New Zealand. Transportation Research Part D: Transport and Environment 87, 102511

# AF8 Scenario



**Source:** Davies, A. (2019). Increasing the disaster resilience of remote communities through scenario co-creation. Doctor of Philosophy, University of Canterbury





**Source:** S Aghababaei, SB Costello, P Ranjitkar (2021). Transportation impact assessment following a potential Alpine fault earthquake in New Zealand. Transportation Research Part D: Transport and Environment 87, 102511

# AF8 Trip Resilience (TR)

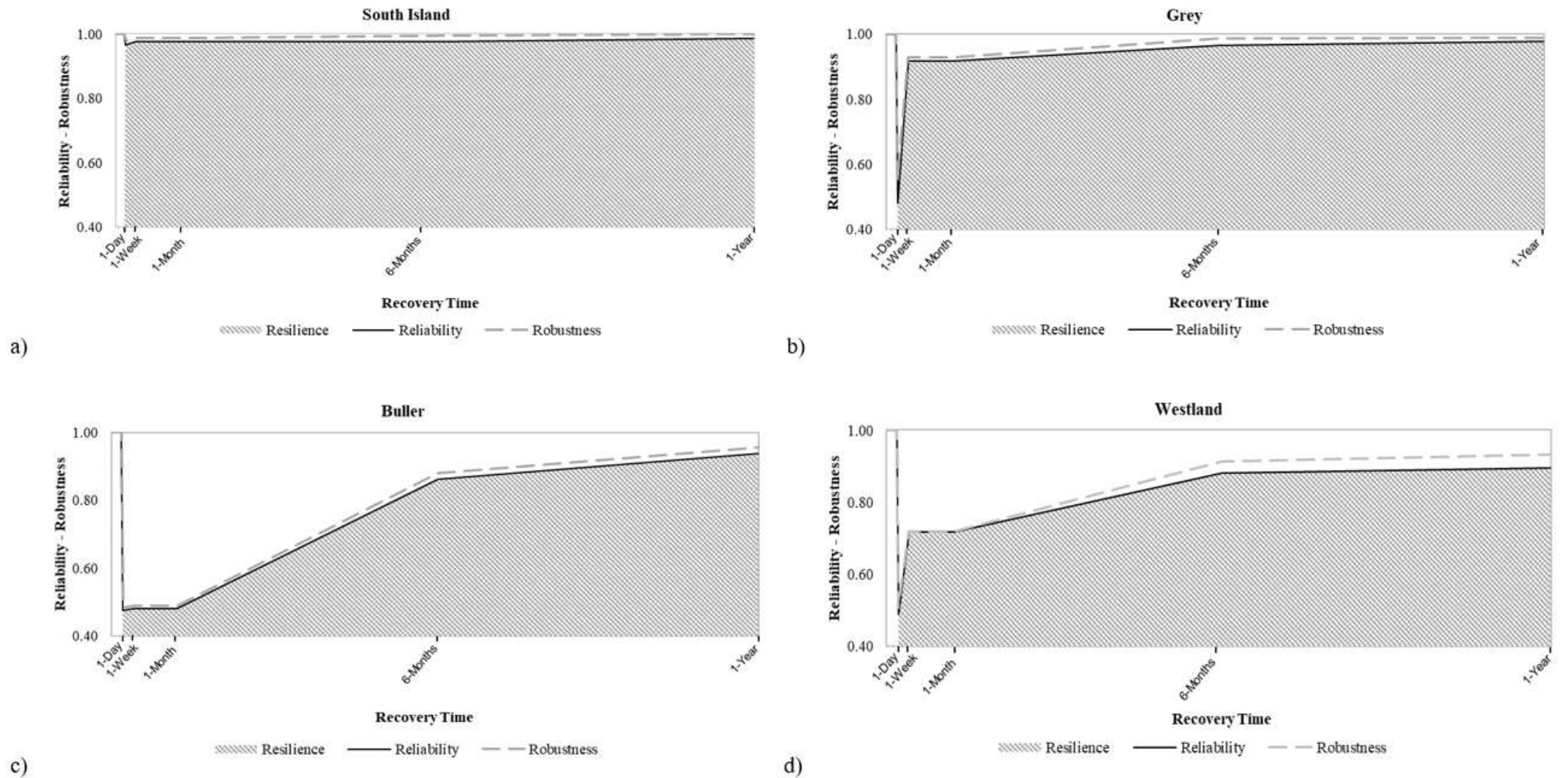


Figure 4: Robustness, Reliability and Resilience of Trips a) on the whole network b) from Grey District c) from Buller District d) from Westland District

**Source:** S Aghababaei, SB Costello, P Ranjitkar (2021). Measure to evaluate post-disaster trip resilience. Journal of Transport Geography, Volume 95, July 2021, 103154; <https://doi.org/10.1016/j.jtrangeo.2021.103154>

# Application of Operational Resilience

- To support the **increase of resilience** in transport infrastructure,
  - *Comparing different **recovery plans** (order of reopening or shorter recovery period)*
- To assist with the **prioritisation of proposed resilience mitigation measures**
- To determine the relative **criticality** of particular road links.
- To investigate the **order of reopening** blocked links

# Question?

## State Highway Incident Prioritisation Tool (SHIPT)

Auckland System Management (ASM)

Journey Optimisation Team (JOT)

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