MONETISING RESILIENCE:

UNLOCKING HIDDEN VALUE IN MAJOR TRANSPORT INFRASTRUCTURE PROJECTS

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Waitematā Harbour Connections is one of the most-travelled pieces of road in New Zealand, carrying approximately 180,000 vehicles per day, including 12,000 freight vehicles and 25,000 bus passengers during peak hours.

QUIZ – Highest Benefit Cost Ratio (BCR)?

TREC

Northland RoNS

Waitematā Harbour Connections (WHC)

Agenda

01	WHY Monetising Resilience Matters
02	HOW to Monetise Resilience
03	Use of National Resilience Assessment Tool (NRAT)
04	Research Report 670 - Better measurement of the direct and indirect costs and benefits of resilience

WHY Monetising Resilience Matters

Supports funding and **prioritisation** of major transport projects within business and investment cases.

Addresses the under-prioritisation of resilience caused by benefits that are hard to quantify.

Improves decision-making by **enabling transparent comparison** of interventions and avoided losses.

HOW to Monetise Benefits

Transport Economics Benefits

Travel time, Vehicle Operation Costs, Safety, Active Modes, Emission, **Resilience**

Wider Economics Benefits

GDP Benefits Economics Impact

Monetised benefits and costs manual - volume 1: procedures

NZ Transport Agency Waka Kotahi

1 August 2025

Version 1.7.4

HOW to Monetise Resilience

Reinstatement/repair costs

User disruption costs

HOW to Monetise Resilience - User disruption costs

When encountering an extreme disruptive event, transport users may:

- postpone their trip(s) while they wait for the disruption to be resolved
- divert their trip(s) via an alternative route or mode
- cancel their trip(s) outright.

$33.37 - $38.53 composite values of travel time ($/h/vehicle July 2021)

Estimating avoided user disruption costs

Three parameters are needed in order to estimate avoided user disruption costs, these are:

- the average annual time of closure (AATOC) in days
- the average annual daily traffic (AADT), and
- the proportion of transport users who wait (PW), divert (PD), and cancel (PC) their trips.

NZTA Traffic Road Event Information System (TREIS)

Avoided user disruption costs can be estimated by subtracting the sum of annual waiting costs (AWC), annual diversion costs (ADC), and annual cancellation costs (ACC) for the intervention (i) from the sum of AWC, ADC, and ACC of the counterfactual (c), as per the following formulae:

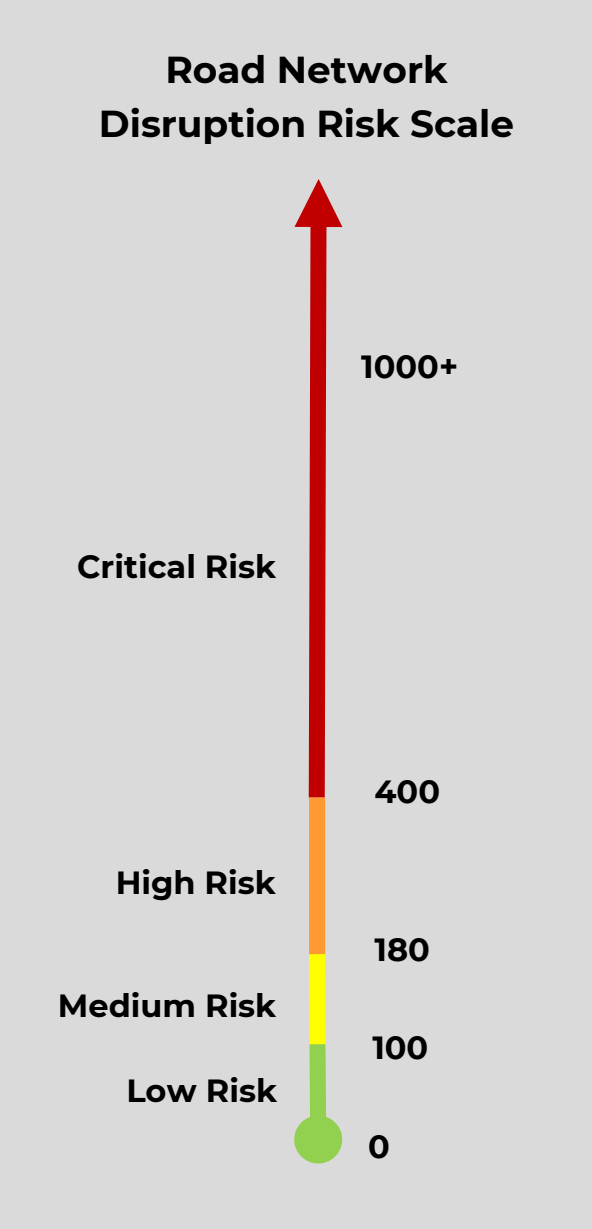
$$\text{Avoided user disruption costs} = \sum_{y=1}^{n} (\text{AWC} + \text{ADC} + \text{ACC})_{c,y} - (\text{AWC} + \text{ADC} + \text{ACC})_{i,y}$$

$$\text{AWC} = \text{AATOC}^2 \text{ x AADT x PW x 12 x } \text{VoT}_o{}^9$$

$$\text{ADC} = \text{AATOC x AADT x PD x } (\text{AGC}_d - \text{AGC}_p)$$

$$\text{ACC} = \text{AATOC x AADT x PC x AGC}_p$$

NATIONAL RESILIENCE ASSESSMENT TOOL (NRAT)



Context

What is NRAT?

The NZTA National Resilience Assessment Tool (NRAT):

- **Tool to assess disruption risk from natural hazards**
- Enables prioritisation of repairs
- Used to identify opportunities for increased resilience to reduce damage from future events

It is an emerging NZTA requirement

- NZTA require industry to adopt NRAT on state highway resilience projects, during initial damage assessment and as part of prioritising investment.

Scoring System

Input in Advance:

- ONRC,
- Lifeline,
- Detour,
- AADT

Workshop focuses on:

- **scale,**
- **duration,**
- **likelihood**

Fibonacci Weighting	Consequence criteria						Likelihood
	Scale of Outage	Duration of Outage	ONRC[1]	Lifeline Criticality	Detour Length if Closed[2]	AADT	
1				Low	Short (<30mins extra time)	<1000	
2	Partial closure	<12 hours	Primary/ secondary collector			1001-5000	Rare (>1 in 50yr)
3		12-48 hours		Medium	Moderate (30-90 mins extra time)	5001-10,000	Unlikely (1 in 30 yr)
5		48 hrs to 7 days					
8	Full closure	7 days to 1 month	Regional/ arterial			10,001-20,000	Possible (1 in 10yr)
13		1-3 months		High	Long (>90mins extra time)	20,001-40,000	Likely (1 in 5yr)
21		3-6 months	National (including High Volume)		None	>40,000	Almost certain (<1 in 2yr)
34		>6 months					

NRAT Score = (AADT + Scale of Outage + Duration + ONRC + Lifeline Criticality + Detour Length) x Likelihood

Please see - Resilience tools and guidance | NZ Transport Agency Waka Kotahi for the latest version of NRAT.

Results

- **Number of sites:**
  - Within each NRAT band
  - By failure type
- **Range of scores:**
  - Highest NRAT score (i.e. Worst site)
  - Average NRAT score
- **Cumulative scores:**
  - Total NRAT score for project extent
  - Total score for project type (e.g. score for all rockfall sites where corridor wide scaling is proposed)
  - Score per km (density)
- **Maps**

Critical >400
High 181-400
Medium 101-180
Low <100

	Do minimim Option (i.e. post recovery)				Option 1B (widen at critical loactions)			
	Scale of Outage	Duration of Outage	Likelihood	Current NRAT	Scale of Outage	Duration of Outage	Likelihood	Opt 1B NRAT
52	Partial Closure	3 - 6 month	Almost Certain	966	Partial Closure	48hrs - 7 days	Rare	60
53	Full Closure	12 - 48 hours	Possible	376	Partial Closure	12 - 48 hours	Possible	328
54	Partial Closure	3 - 6 month	Unlikely	138	Partial Closure	48hrs - 7 days	Rare	60
55	Partial Closure	3 - 6 month	Likely	598	Partial Closure	48hrs - 7 days	Rare	60
56	Full Closure	12 - 48 hours	Possible	376	Partial Closure	12 - 48 hours	Possible	328
57	Partial Closure	3 - 6 month	Possible	368	Partial Closure	48hrs - 7 days	Rare	60
58	Partial Closure	6 month +	Rare	118	Partial Closure	7 days - 1 month	Rare	66
59	Partial Closure	6 month +	Rare	118	Partial Closure	7 days - 1 month	Rare	66
60	Partial Closure	3 - 6 month	Unlikely	138	Partial Closure	7 days - 1 month	Unlikely	99
61	Partial Closure	3 - 6 month	Unlikely	138	Partial Closure	48hrs - 7 days	Rare	60
62	Partial Closure	3 - 6 month	Possible	368	Partial Closure	48hrs - 7 days	Rare	60
63	Full Closure	12 - 48 hours	Possible	376	Partial Closure	12 - 48 hours	Possible	328
64	Partial Closure	3 - 6 month	Unlikely	138				0
65	Full Closure	12 - 48 hours	Possible	376	Partial Closure	12 - 48 hours	Possible	328
66	Partial Closure	3 - 6 month	Possible	368	Partial Closure	48hrs - 7 days	Rare	60
67	Partial Closure	3 - 6 month	Unlikely	138	Partial Closure	7 days - 1 month	Rare	66
68	Partial Closure	3 - 6 month	Possible	368	Partial Closure	7 days - 1 month	Rare	66
69	Partial Closure	3 - 6 month	Possible	368	Partial Closure	7 days - 1 month	Rare	66
70	Partial Closure	3 - 6 month	Likely	598	Partial Closure	7 days - 1 month	Rare	66
71	Partial Closure	3 - 6 month	Likely	598	Partial Closure	7 days - 1 month	Rare	66
72								
		%Critical	Max	966		%Critical	Max	328
		14%	Average	360		0%	Average	109
		%High and Critical	Min	92		%High and Critical	Min	0
		75%	Ave reduction	n/a		21%	Ave reduction	70%

Results – Value for Money

	Do Min	Option [redacted]	Option [redacted]	Option [redacted]	Option [redacted]
Max	966*	328	328	328	320
Average	360**	108	109	98	88
Min	92	0***	0	0	0
Average Reduction (compared to Do Min)	n/a	70%	70%	73%	75%
P50	-	-	-	-	-

wsp

RESEARCH REPORT 670

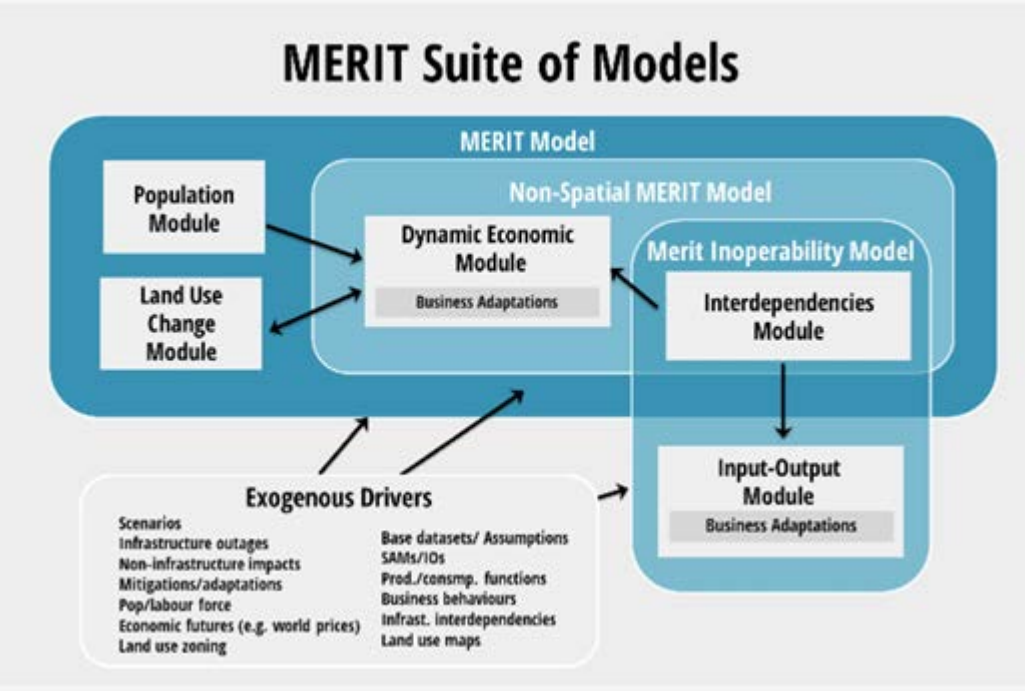
Better measurement of the direct and indirect costs and benefits of resilience

September 2020

V McWha and R Tooth

Research Report 670 - Direct and Indirect Costs

MERIT (Measuring the Economics of Resilient Infrastructure)



Unexpected Delay Time

THANK YOU

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