
Economic Impact of the SH3 Manawatu Gorge 2011-12 Outage- MERIT pilot

SUMMARY

The NZ Transport Agency engaged Market Economics to adapt its economic assessment tool (MERIT) so that it can be applied to road outages. The purpose of the tool is to help understand and quantify the economic impact of a road outage. This information can be used within business cases which investigate potential improvements to the resilience of the State highway network.

Through the development of the new application of the tool, pilot trials were run on real life scenarios, including a large 2011-12 slip in the Manawatu Gorge that closed State Highway 3. The pilot trials assisted with confirming the operation of the tool as well as developing the user interface and reporting needs.

BACKGROUND

The SH3 Manawatu Gorge is an important link through the lower central North Island connecting Palmerston North to Napier. The highway is narrow and winding along the south side of the gorge. The route has been subject to frequent rock slips that often close the road.

In 2011 a large slip closed the route for 183 days with ongoing restricted access for a further 8 months. A total of 370,000 cubic metres of soil, rock and debris was removed from the site in an effort to reopen the road. Alternative routes were available via the Pahiatua Track or Saddle Road, which added up to 20 minutes to each journey.



Image 1. Manawatu Gorge Slip (Source: Google)

MEASURING THE ECONOMIC RESILIENCE OF INFRASTRUCTURE TOOL (MERIT)¹

Market Economics, along with GNS Science and Resilient Organisations developed² a tool known as ‘MERIT’ (Measuring the Economic Resilience of Infrastructure Tool). MERIT is used to assess the economic impacts associated with infrastructure outages.

MERIT is a dynamic, multi-regional and multi-sectoral economic model that contains the core features of a Computable General Equilibrium (CGE) model. CGE models are the favoured approach in the modelling of regional and national level economic impacts. The advantages of this type of model include:

1. Whole-of-economy coverage
2. The capture of *indirect* (upstream and downstream multiplier effects generated through supply chains) and *induced* (generated through household consumption) economic consequences
3. The ‘general equilibrium’ impacts that result from price changes in an economy
4. The ability to describe the distribution through time of impacts across different economic sectors and regions.

The model produces a variety of indicators to help evaluate the impacts in aggregate and by industry of an infrastructure outage, including Gross Domestic Product, regional Value Added (similar to a regional equivalent of GDP), value of exports and imports, and household utility.

There are four steps in using MERIT:

1. Generate a description of the road outage scenario (illustrated in Table 2 below). Each run of MERIT considers a specific outage scenario (location and duration). It does not consider the likelihood of the outage.
2. Transport network analysis – the tool needs to know the travel time and distance changes resulting from the road outage. This can be done through either a transport model, or through an online rerouting system that has been developed in conjunction with MERIT.
3. Analysis of direct impacts – the cost changes from the travel rerouting are translated into altered economic flow cost rates for input into MERIT. This determines the type of goods and services which receive the additional expenditure, such as petrol and road transport services, and how these are allocated to industry types and households. This is done through a module called the Direct Impact Analyser (Table 1 below)
4. Run MERIT – the model is run to calculate the net change of economic activities due to the road outage, by simulating adjustment to a new equilibrium that reflects the altered road network effects.

Finally, it is important to understand what impacts are considered in the Direct Impact Analyser. This is illustrated in Table 1 below.

¹ This section is based on M.E report *Dynamic Economic Model – A technical report prepared under the Economics of Resilient Infrastructure Programme July 2016*

² On behalf of the Ministry of Business, Innovation and Employment

Impact	In the model		Possible?	Not in the model	
	Complete	Method identified		Non-market	Outside scope
Freight					
Time costs	X				
Vehicle operating costs	X				
Emission costs				X	
Perisable commodities					
Loss of product			X		
Loss of product value			X		
Tourism					
Loss of tourism spend					X
Loss of scenic value				X	
Travel to work/school					
Time costs				X ¹	
Reduced supply of labour		X			
Vehicle operating costs	X				
Emission costs				X	
Shopping					
Time costs				X ¹	
Vehicle operating costs	X				
Emission costs				X	
Recovery and rebuild					
Increased construction		X			
Opportunity costs of capital		X			
Business to business travel					
Loss of staff time		X			
Vehicle operating costs		X			

1. MERIT could be adapted to include but thus far only considers market impacts

Table 1. Road outage impacts in the Direct Impact Analyser

Two versions of MERIT have been developed under the Transport Agency project: a full desktop version which can consider a staged sequence of recovery phases from an outage, and an on-line slightly simplified version which can only assess one level of outage state per run. The full version was run for this pilot test.

SH3 MANAWATU GORGE OUTAGE

In order to make an assessment of a road outage, MERIT requires the following information to develop the outage scenario:

- Outage ID
- State highway
- Region
- Road type
- Post speed limit
- GPS coordinates (start and end)
- Direction of impacted travel
- Start and end dates (duration)
- Damage state (shoulder, one lane, two lanes, complete closure)
- Speed limits during the effect
- Cost of repair
- Funding source and split (generally NLTP) for repair work

For simplicity, these details are abbreviated for SH3 Manawatu Gorge in the following table.

Start Date	End Date	Damage state	Post event Speed Limit	Cost of repair	Duration
31-Aug-2011 01:50:00	01-Mar-2012 08:58:34	Road fully closed, no vehicular access in either direction. Works ongoing to clear material and make site safe. Regular assessments of the slip face and road asset being undertaken.	0 km/hr	\$23.5M	183 days

Table 2. SH3 Manawatu Gorge Outage MERIT Inputs

Results

MERIT calculates the total net change in Gross Domestic Product (GDP) of certain periods of time, in this instance it was reported for 3 months, 6 months and 1 year following the road outage. It also presents the average total cost per day.

Table 3 below contains the results for the SH3 road outage. It shows that the total loss in GDP 1 year following the outage was \$6.3M, and that the cost per day was approximately \$34,200.

Interestingly, the GDP loss over 6 months was higher than over 12 months. This is likely because the dynamic oscillation of the economy moves towards a new equilibrium, such that over time industry tested and found methods to reduce the economic loss from the outage.

These results may seem lower than what may intuitively be expected. This is due to the fact the alternative route to the Gorge does not create significant travel cost increases, and does not substantially change travel patterns. Also, the model does not currently capture the loss of value or perishable goods, or social non-market costs such as non-work travel time.

	3 months (\$ ₂₀₀₇ mil)	6 months (\$ ₂₀₀₇ mil)	1 Year (\$ ₂₀₀₇ mil)	Total cost per day road out (\$ ₂₀₀₇ 000)
Increase in costs of road freight				
Manawatu-Wanganui Region	1.3	2.6	2.6	14,200
Rest of New Zealand	3.1	6.2	6.2	33,900
Total	4.4	8.7	8.8	48,200
Household travel to work				
Total	0.0	0.1	0.1	500
Net Change in GDP				
Total	-3.4	-6.5	-6.3	-34,200

Table 3. Economic impact of SH3 Slip