Appendix S Merit analysis (resilience economics)

Ashburton Bridge Duplication MERIT Analysis

Prepared for	Stantec NZ Ltd
Job Number	STNNZ-J012
Revision	B
Issue Date	2 February 2022
Prepared by	Chris Blackmore, Senior Transportation Planner
Reviewed by	Stephen Carruthers, Associate Transportation Planner

1. Overview and Context

1.1 Ashburton Bridge and available detours

Abley were commissioned to assist Stantec in valuing the resilience improvements resulting from the duplication of the SH1 Ashburton Bridge by undertaking an appraisal of the corridor using the MERIT framework. The 'Measuring the Economics of Resilient Infrastructure Tool' (MERIT) system is a tool developed by Waka Kotahi and Market Economics to help roading authorities assess the economic impact of outages on a road network.

Closure of the SH1 Ashburton Bridge results in significant delays to traffic, with the approved detour routing vehicles to the closest alternate river crossings at Mayfield Valetta Road and Thompsons Track. The approved detour route is shown in Figure 1.1.

It should be noted that the MERIT process is intended for closures of one week or longer. This means that traffic routing follows the shortest path between origin and destination for each Statistical Area pair across New Zealand, rather than strictly following the SH1 – detour – SH1 loop.

If an event, for example a significant rainfall or flooding, results in the closure of the SH1 Ashburton River Bridge there is a chance that upstream crossings will also be affected. This is especially significant because the approved detour route includes three river crossings for rivers which all run into the Ashburton River / Hakatere. In this case vehicle detours are much larger, routing via Mt Somers and Methven. This scenario is modelled in Section 4.

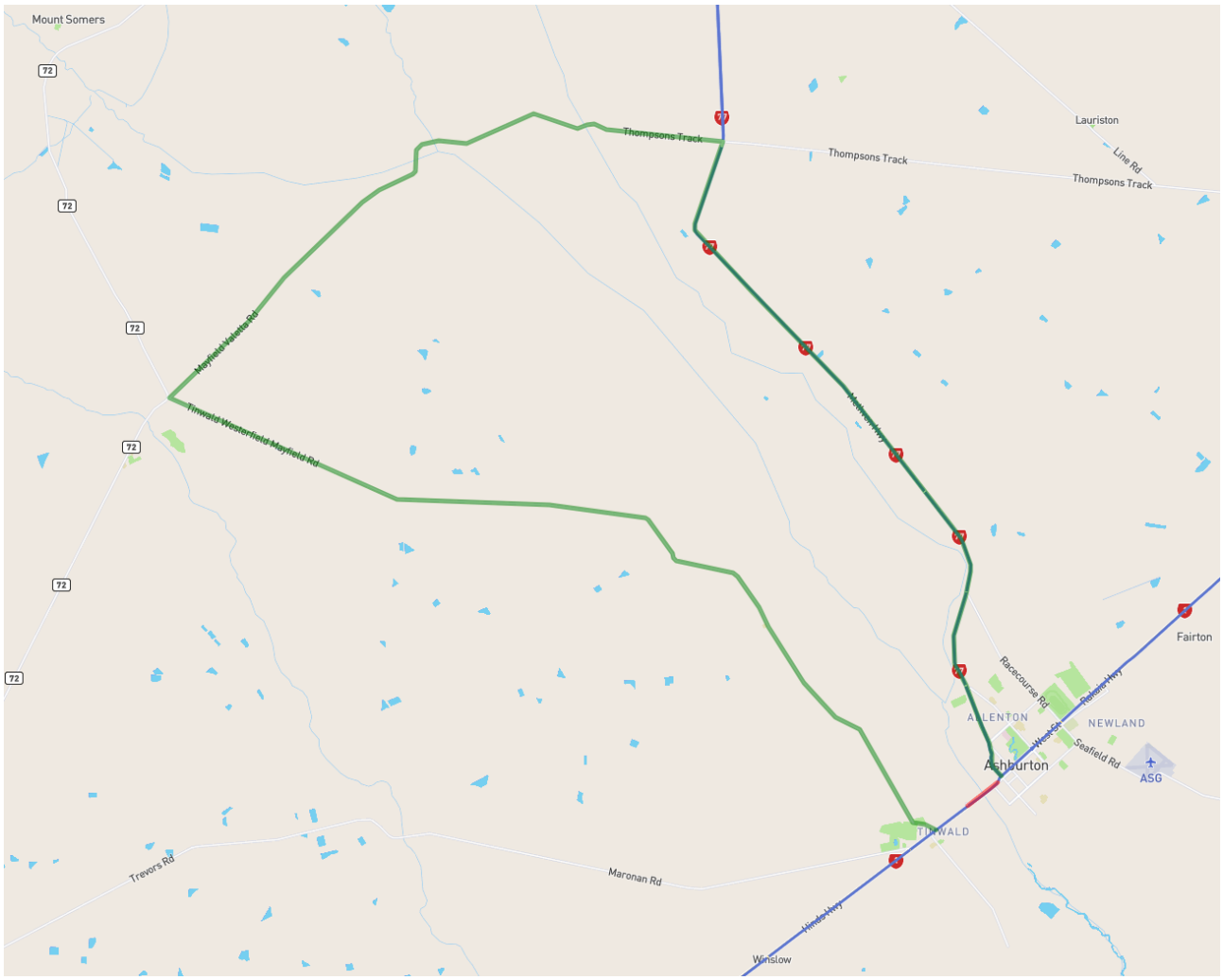

Figure 1.1 Approved detour route from Waka Kotahi Detours web app

1.2 MERIT process overview

The MERIT tool consists of two distinct stages, as shown in Figure 1.2; the first is the Direct Impact Analysis (DIA) stage. This section assesses the impact of a road closure on the travel time and distance between defined statistical areas (formerly Census Area Units) across the country, using a GIS-based network analysis. This information is then used to calculate the direct costs of the road closure. The second stage is the MERIT Economic Model. This assesses the wider impacts of the road closure for New Zealand's economy.

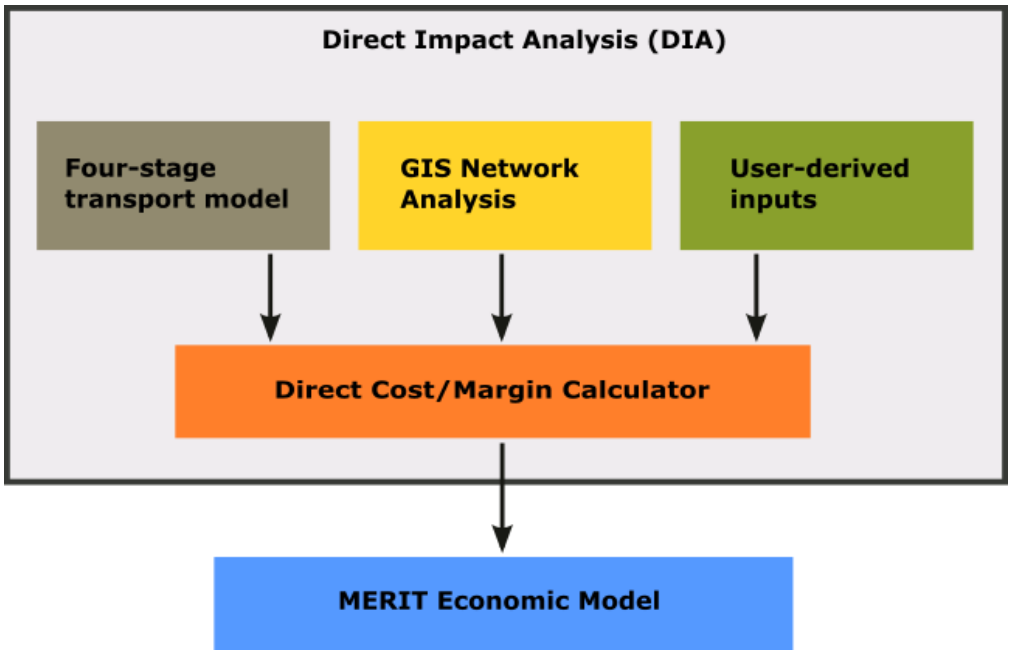

Figure 1.2 MERIT Analysis Framework

The analysis process is undertaken in several steps, as detailed below:

1. Creation of matrices describing the time and distance changes nationally between Census Area Units as a result of the closure of the SH1 Ashburton River Bridge.
2. Running the Direct Impact Analysis tool to calculate direct travel cost impacts and estimate the change in margin for various import and export sectors.
3. Running the MERIT Economic model to calculate the GDP impact for various closure lengths. The minimum closure length able to be run is for 7 days and it is suggested that three closure lengths are analysed to provide estimated impacts for a short, medium, and long closure length.

Results from the Direct Impact Analysis are summarised in Section 2 and are the main inputs into the MERIT Economic Model. The MERIT Economic Model provides results for specified closure lengths, which are summarised in Section 3.

2. Closure Impact on Commodity Transport Costs

The Direct Impact Analysis tool divides the country into two distinct regions – the study region and the rest of New Zealand. This is in order to fit the form of the MERIT Economic Model and is not able to be adapted for closures spanning regions. In this analysis the study region is Canterbury.

The Direct Impact Analysis outputs three key metrics, separated by Canterbury and the Rest of New Zealand:

- Additional direct transport costs to private households, in $m / year
- Additional transport margins for internationally traded commodities, in $ / $m traded
- Additional transport margins for domestically traded commodities, in $ / $m traded

The outputs for a closure of the SH1 Ashburton Bridge are shown below in Table 2.1 through Table 2.3.

Table 2.1 Additional direct household transport costs

	Increase in $NZ2006Q2m / year	
	Canterbury	Rest of New Zealand
Increase in HH Travel Cost	$9.55	$8.78

Table 2.2 Additional transport margins for internationally traded commodities

	Addn margin for imported commodities		Addn margin for exported commodities	
Commodity	Canterbury Imports	RoNZ Imports	Canterbury Exports	RoNZ Exports
Hort & fruit	$1,170	$724	$1,354	$2,969
Livestock prods	$556	$636	$954	$2,494
Timber & forest prods	$3,865	$3,856	$4,179	$18,715
Mining prods	$79	$28	$239	$376
Food prods	$778	$427	$749	$1,089
Chemical & mineral prods	$1,035	$914	$522	$2,137
Wood & paper prods	$4,134	$2,151	$2,265	$10,114
Other manuf prods	$29	$26	$49	$224

Table 2.3 Additional transport margins for domestically traded commodities

	Addn margin for domestically traded commodities			
Commodity	Within Canterbury	Within RoNZ	RoNZ to Canterbury	Canterbury to RoNZ
Hort & fruit	$1,354	$946	$2,969	$2,455
Raw Milk	$12,555	$7,223	$18,442	$9,980
Livestock prods	$954	$1,287	$2,494	$1,664
Timber & forest prods	$4,179	$4,313	$18,715	$14,995
Mining prods	$239	$243	$376	$1,190
Food prods	$749	$254	$1,089	$1,632
Chemical & mineral prods	$522	$805	$2,137	$2,282
Wood & paper prods	$2,265	$2,287	$10,114	$9,620
Other manuf prods	$49	$41	$224	$229

3. Closure Impact on Gross Domestic Product

The MERIT Economic Model is run using the outputs of the Direct Impact Analysis tool for specific closure lengths. The model calculates the impact on Gross Domestic Product and Gross Regional Product value-added over the 12 months following the start of the closure.

Three closure lengths were analysed – 7, 14, and 28 days. The model output for the year following the closure, and the change in value-added GDP is shown in Section 3.1 – Section 3.3 for each closure length.

3.1 7-day closure of SH1 Ashburton Bridge

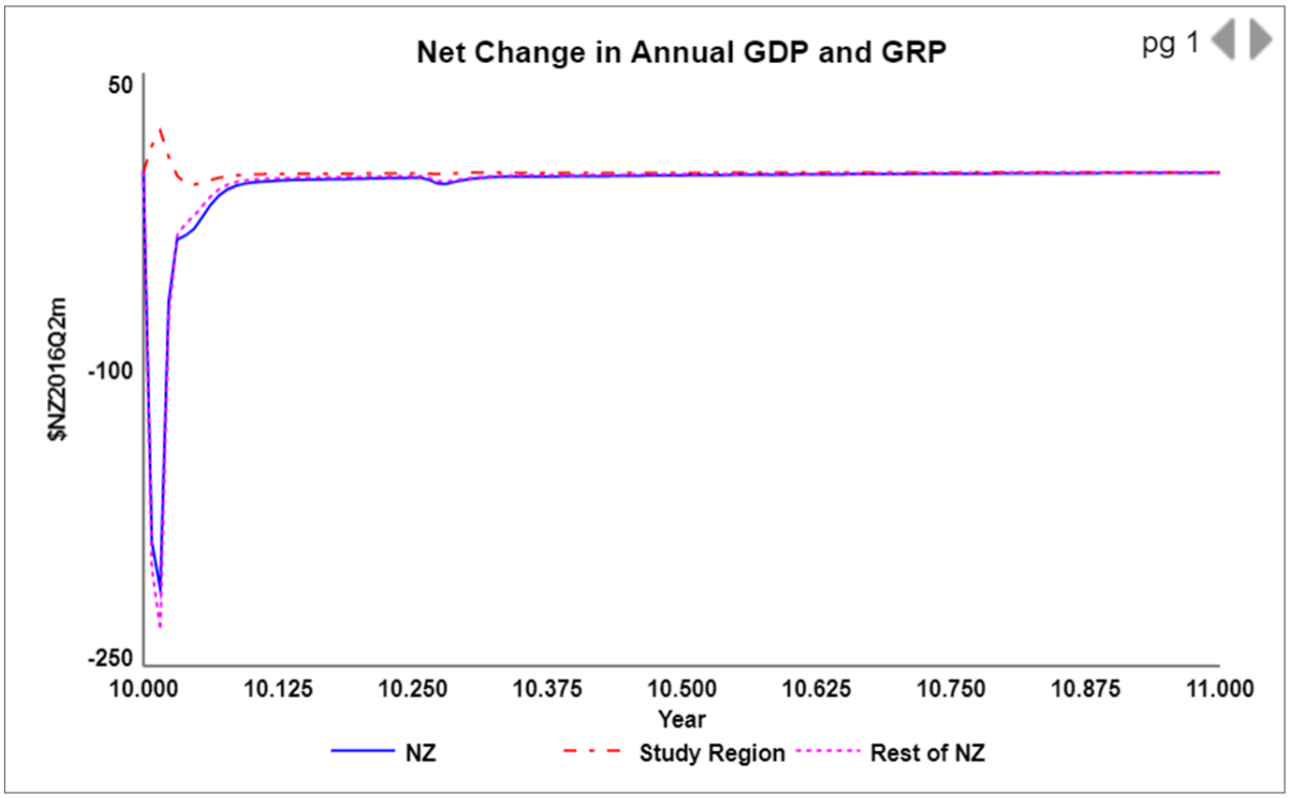

Figure 3.1 Net change in annual GDP and GRP - 7-day closure

Table 3.1 Change in Value-Added ($2016Q2m) - 7-day closure

Commodity	Canterbury	RoNZ	National
Sheep, beef & grain farming	$0	-$0.2	-$0.2
Dairy cattle farming	-$0.1	-$0.2	-$0.3
Forestry & logging	-$0.1	-$1.9	-$2
Other agriculture	-$0.1	-$0.3	-$0.4
Mining	$0	$0	$0
Food manuf	-$0.3	-$2	-$2.3
Wood & paper manuf	-$0.1	-$2.9	-$3
Chemical & mineral manuf	$0	-$0.2	-$0.2
Other manuf	$0	$0	$0
Utilities & construction	-$0.1	-$0.2	-$0.3
Trade & hospitality	$0	$0.1	$0.1
Road transport	$0.5	$2.3	$2.8
Other transport & storage	-$0.1	-$0.6	-$0.7
Other services	-$0.1	$0.1	$0
Overall Change in GRP and GDP	-$0.5	-$6	-$6.5

3.2 14-day closure of SH1 Ashburton Bridge

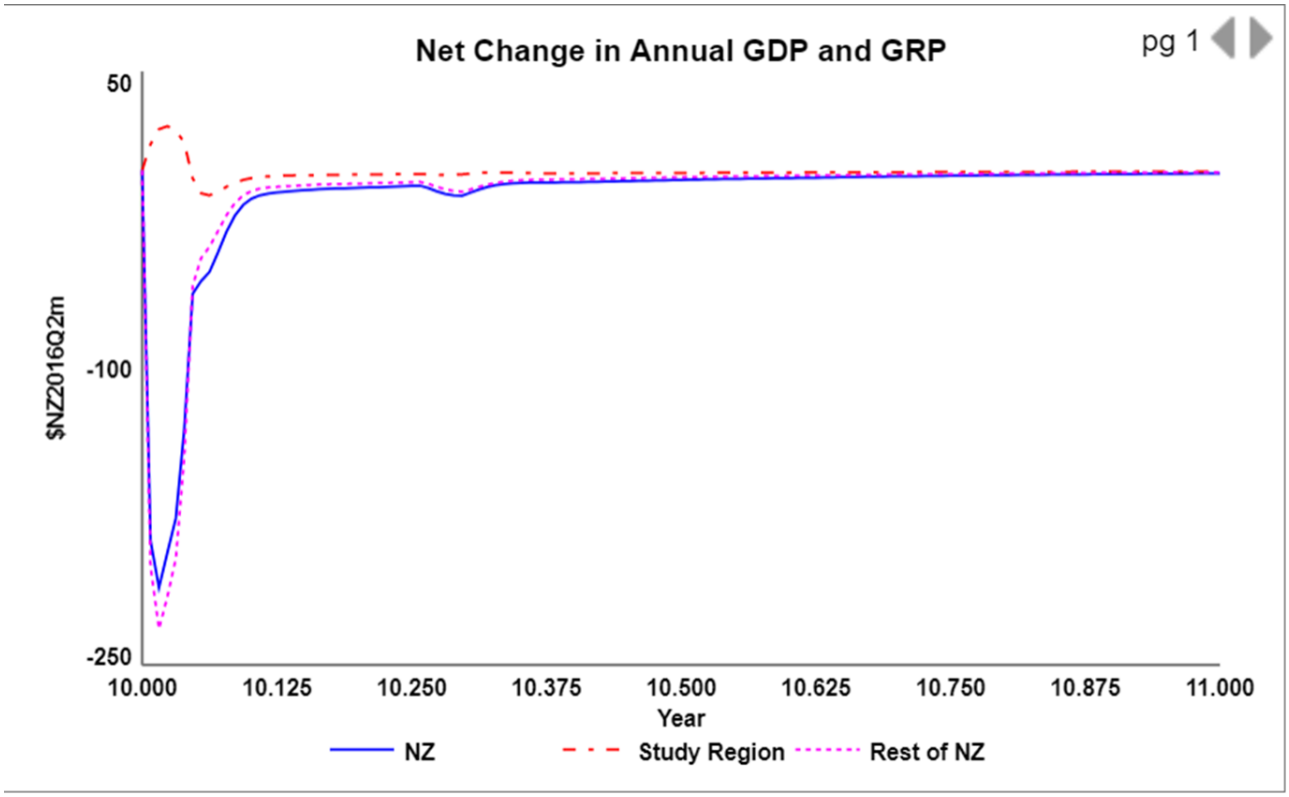

Figure 3.2 Net change in annual GDP and GRP - 14-day closure

Table 3.2 Change in Value-Added ($2016Q2m) - 14-day closure

Commodity	Canterbury	RoNZ	National
Sheep, beef & grain farming	-$0.1	-$0.4	-$0.5
Dairy cattle farming	-$0.3	-$0.4	-$0.7
Forestry & logging	-$0.1	-$3.7	-$3.8
Other agriculture	-$0.1	-$0.6	-$0.7
Mining	$0	$0	$0
Food manuf	-$0.8	-$4.7	-$5.5
Wood & paper manuf	-$0.1	-$5.7	-$5.8
Chemical & mineral manuf	$0	-$0.5	-$0.5
Other manuf	$0	$0	$0
Utilities & construction	-$0.1	-$0.5	-$0.6
Trade & hospitality	-$0.1	$0.1	$0
Road transport	$1.2	$5.5	$6.7
Other transport & storage	-$0.2	-$1.3	-$1.5
Other services	-$0.2	-$0.1	-$0.3
Overall Change in GRP and GDP	-$0.9	-$12.3	-$13.2

3.3 28-day closure of SH1 Ashburton Bridge

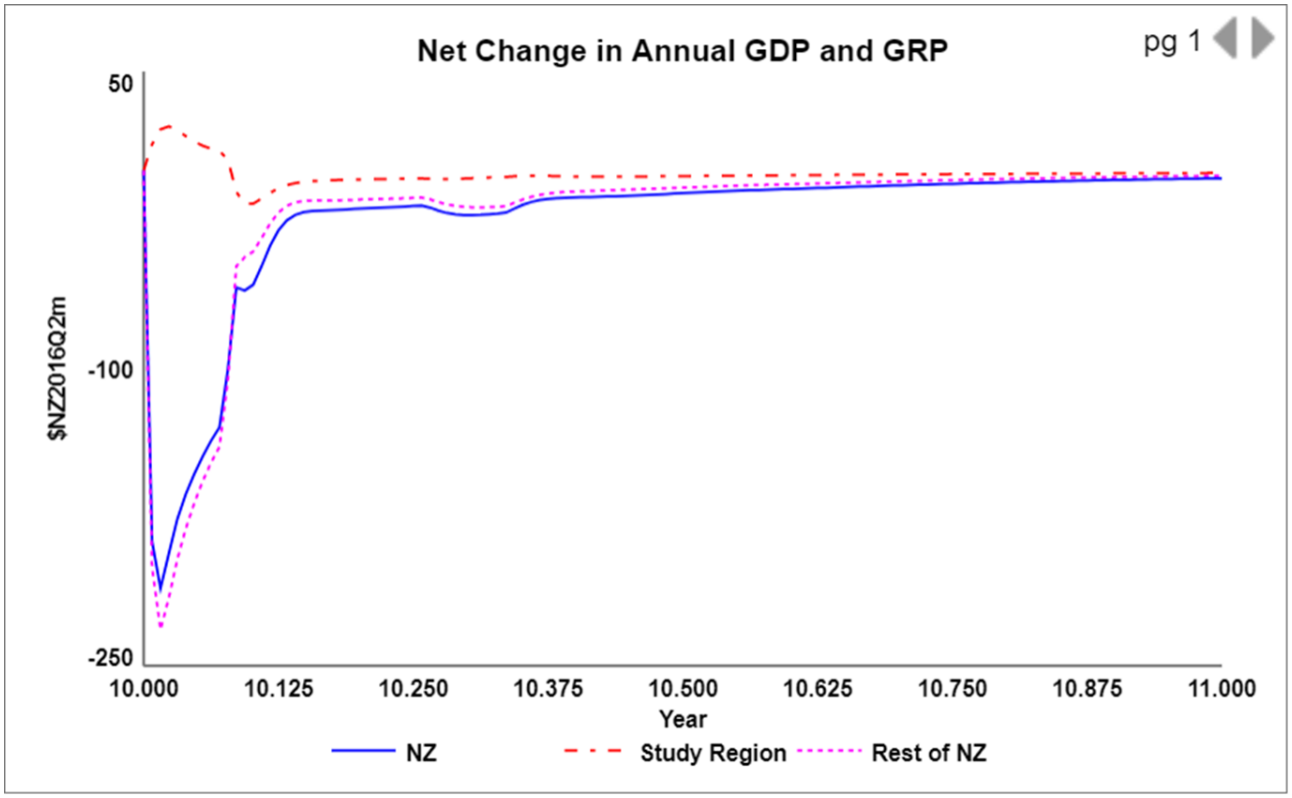

Figure 3.3 Net change in annual GDP and GRP - 28-day closure

Table 3.3 Change in Value-Added ($2016Q2m) - 28-day closure

Commodity	Canterbury	RoNZ	National
Sheep, beef & grain farming	-$0.2	-$0.7	-$0.9
Dairy cattle farming	-$0.6	-$0.7	-$1.3
Forestry & logging	-$0.2	-$6	-$6.2
Other agriculture	-$0.2	-$1.1	-$1.3
Mining	$0	$0	$0
Food manuf	-$1.6	-$10	-$11.6
Wood & paper manuf	-$0.2	-$9.4	-$9.6
Chemical & mineral manuf	$0	-$1.1	-$1.1
Other manuf	-$0.1	$0	-$0.1
Utilities & construction	-$0.3	-$1	-$1.3
Trade & hospitality	-$0.2	-$0.1	-$0.3
Road transport	$2.6	$11.6	$14.2
Other transport & storage	-$0.4	-$2.3	-$2.7
Other services	-$0.4	-$0.7	-$1.1
Overall Change in GRP and GDP	-$1.8	-$21.5	-$23.3

4. Additional Scenario – Closure of primary detour route

4.1 Detail of additional closures

An additional closure scenario was examined which represents a wider impact than solely the SH1 Ashburton Bridge. This is similar to the 2020 Ashburton River / Hakatere flooding event where Thompsons Track was affected as well as to SH1. The bridge closures modelled are shown in Figure 4.1. This forces traffic to detour via Inland Scenic Route 72 and State Highway 77, a significantly longer detour than when only the SH1 Ashburton Bridge is closed.

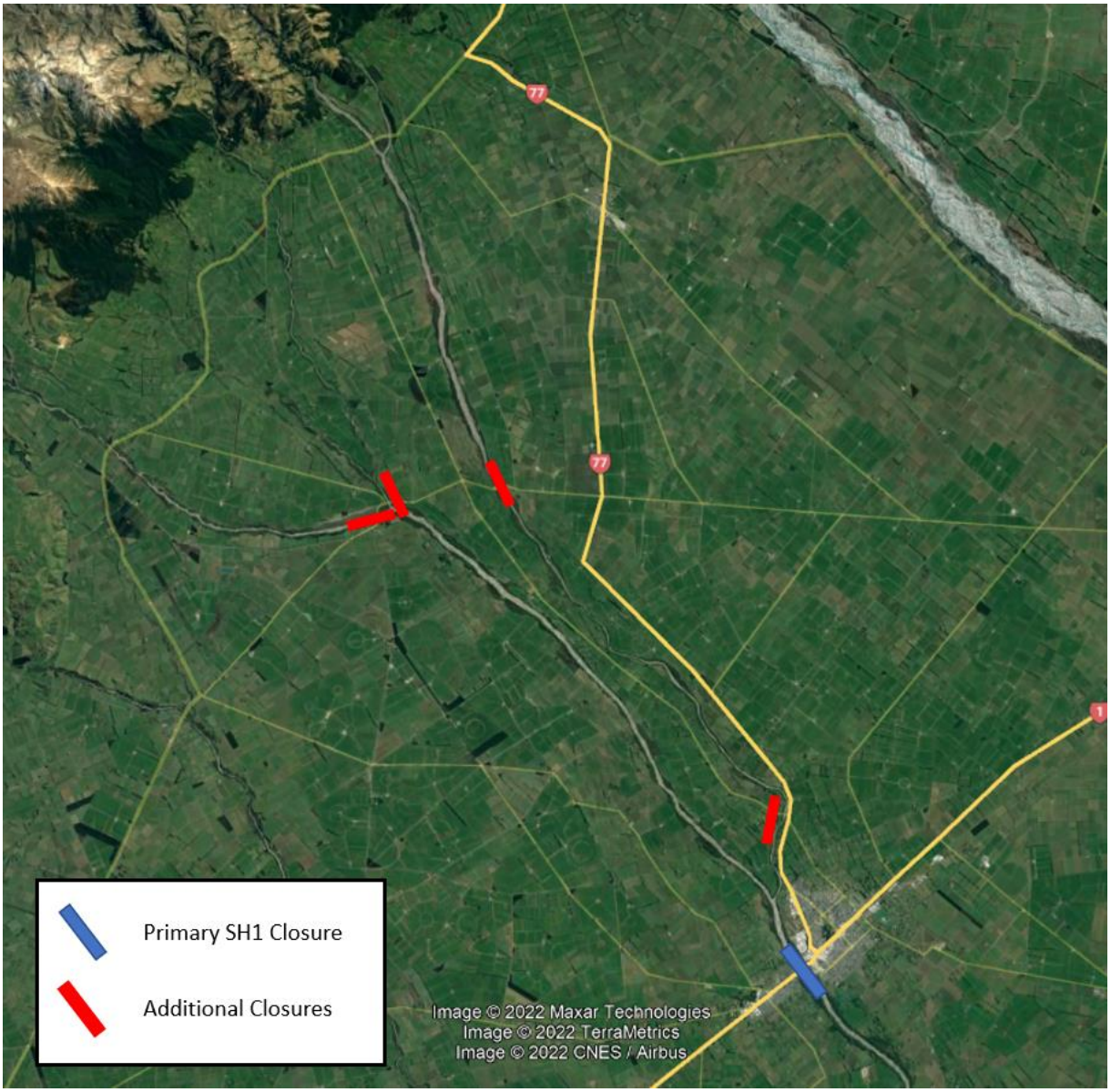

Figure 4.1 Additional Bridge Closures

As with the central case, three closure lengths were analysed – 7, 14, and 28 days. The model output for the year following the closure, and the change in value-added GDP is shown in Section 4.2 – Section 4.4 for each closure length.

4.2 7-day closure of SH1 Ashburton Bridge and Thompsons Track Bridges

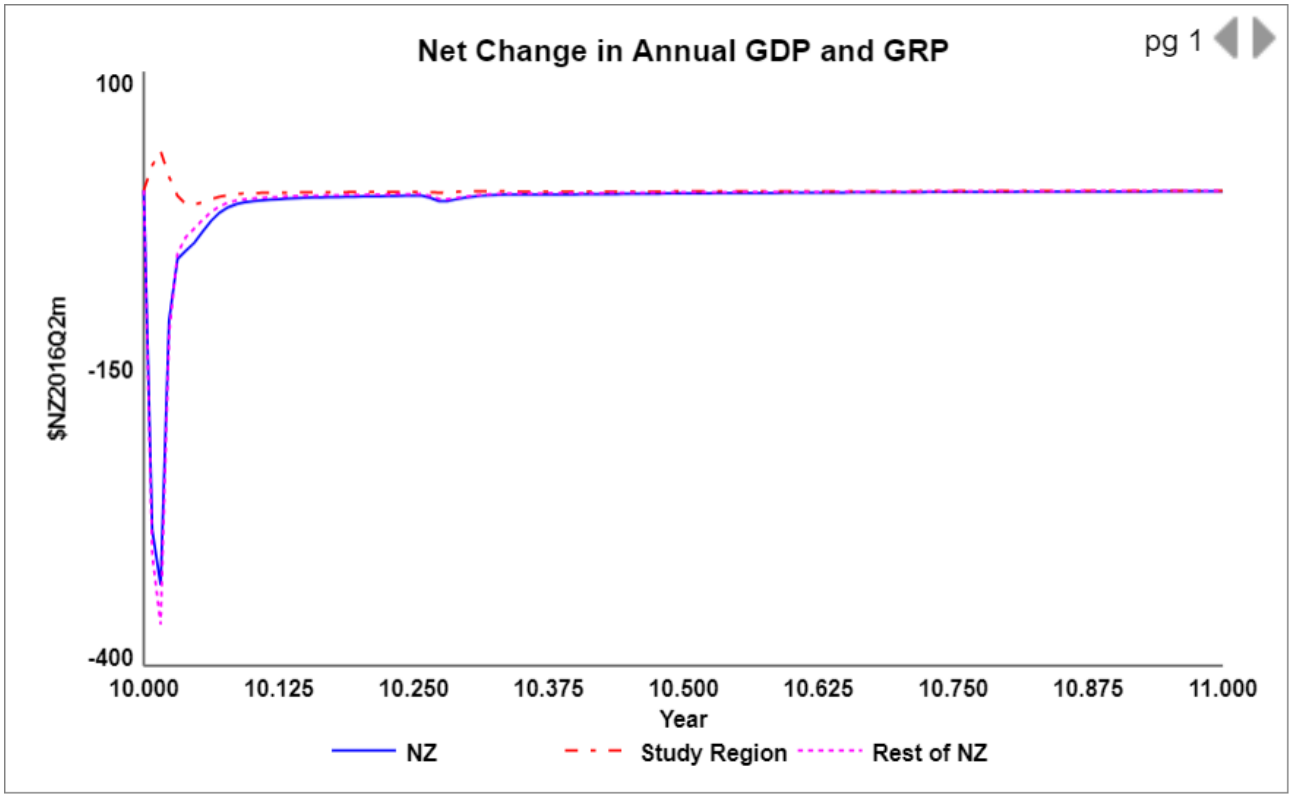

Figure 4.2 Net change in annual GDP and GRP - 7-day closure including additional bridge closures

Table 4.1 Change in Value-Added ($2016Q2m) - 7-day closure including additional bridge closures

Commodity	Canterbury	RoNZ	National
Sheep, beef & grain farming	-0.1	-0.3	-0.4
Dairy cattle farming	-0.2	-0.3	-0.5
Forestry & logging	-0.1	-3	-3.1
Other agriculture	-0.1	-0.4	-0.5
Mining	0	0	0
Food manuf	-0.6	-2.9	-3.5
Wood & paper manuf	-0.1	-4.4	-4.5
Chemical & mineral manuf	0	-0.5	-0.5
Other manuf	0	0.1	0.1
Utilities & construction	-0.1	-0.3	-0.4
Trade & hospitality	0	0.2	0.2
Road transport	0.9	3.3	4.2
Other transport & storage	-0.2	-1	-1.2
Other services	-0.1	0.4	0.3
Overall Change in GRP and GDP	-0.7	-9.1	-9.8

4.3 14-day closure of SH1 Ashburton Bridge and Thompsons Track Bridges

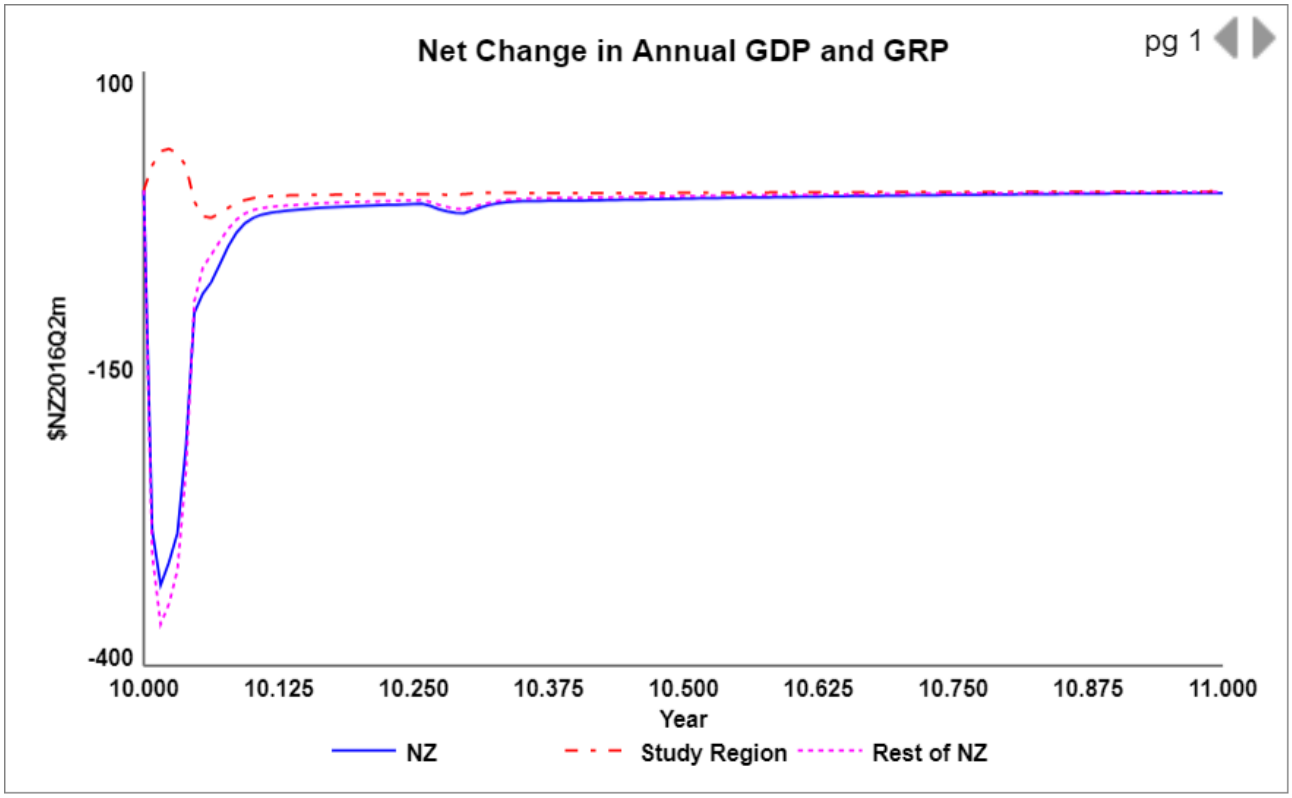

Figure 4.3 Net change in annual GDP and GRP - 14-day closure including additional bridge closures

Table 4.2 Change in Value-Added ($2016Q2m) - 14-day closure including additional bridge closures

Commodity	Canterbury	RoNZ	National
Sheep, beef & grain farming	-0.2	-0.6	-0.8
Dairy cattle farming	-0.4	-0.6	-1
Forestry & logging	-0.2	-6	-6.2
Other agriculture	-0.2	-0.9	-1.1
Mining	0	0	0
Food manuf	-1.5	-6.7	-8.2
Wood & paper manuf	-0.2	-8.7	-8.9
Chemical & mineral manuf	0	-1	-1
Other manuf	-0.1	0.1	0
Utilities & construction	-0.2	-0.7	-0.9
Trade & hospitality	-0.1	0.3	0.2
Road transport	2	7.9	9.9
Other transport & storage	-0.4	-2	-2.4
Other services	-0.3	0.3	0
Overall Change in GRP and GDP	-1.8	-18.6	-20.4

4.4 28-day closure of SH1 Ashburton Bridge and Thompsons Track Bridges

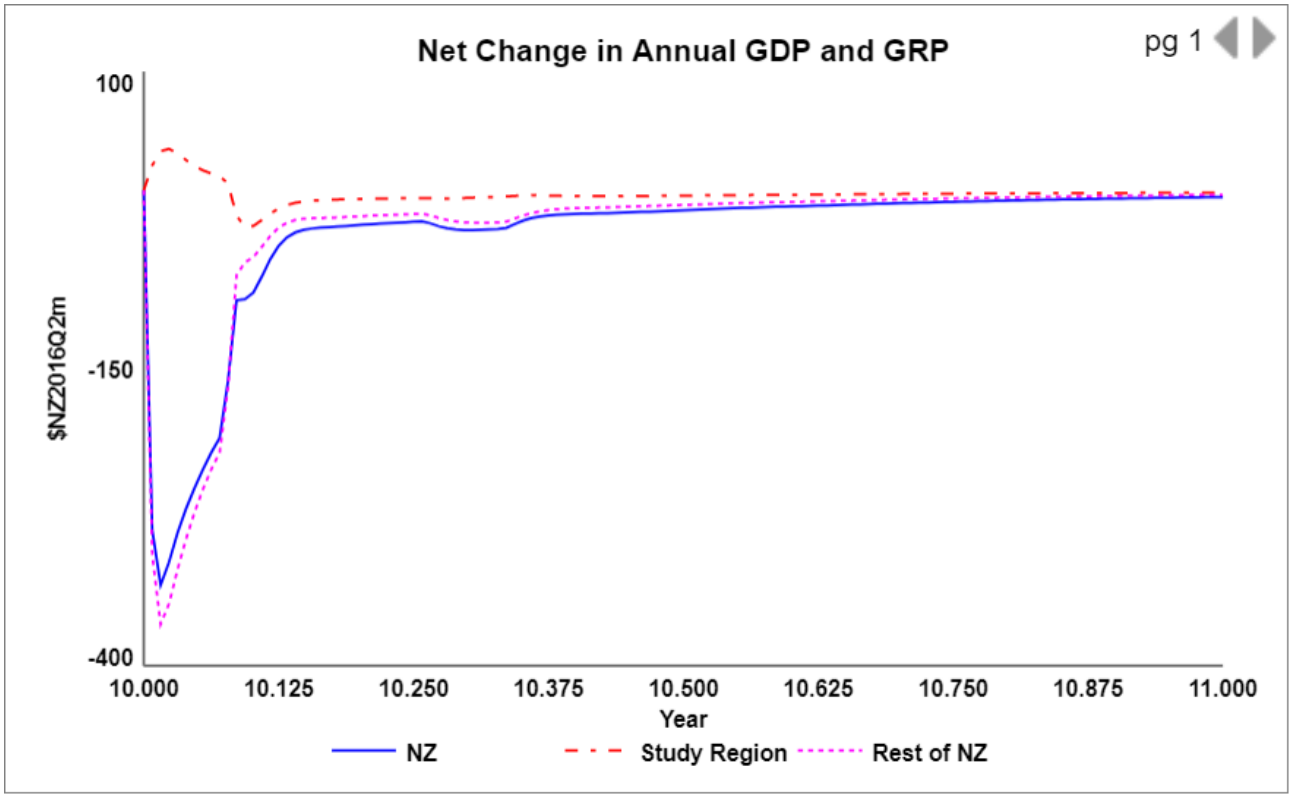

Figure 4.4 Net change in annual GDP and GRP - 14-day closure including additional bridge closures

Table 4.3 Change in Value-Added ($2016Q2m) - 28-day closure including additional bridge closures

Commodity	Canterbury	RoNZ	National
Sheep, beef & grain farming	-0.3	-1.1	-1.4
Dairy cattle farming	-0.7	-1.2	-1.9
Forestry & logging	-0.3	-10	-10.3
Other agriculture	-0.4	-1.7	-2.1
Mining	0	0	0
Food manuf	-3.1	-14	-17.1
Wood & paper manuf	-0.4	-14.2	-14.6
Chemical & mineral manuf	0	-2	-2
Other manuf	-0.1	0	-0.1
Utilities & construction	-0.4	-1.4	-1.8
Trade & hospitality	-0.3	0.1	-0.2
Road transport	4.2	16.9	21.1
Other transport & storage	-0.7	-3.6	-4.3
Other services	-0.6	-0.6	-1.2
Overall Change in GRP and GDP	-3.1	-32.8	-35.9

5. MERIT Economic Model Result Summary

It should be noted that the direct household transport costs are output as $2006Q2m and the reduction in value-added GDP is output as $2016Q2m. Values have been updated to $2021Q4m using the Transport inflation index published by Stats NZ, utilised within the Reserve Bank of New Zealand inflation calculator[1].

The factors used in this analysis are:

- Direct household transport costs: $2006Q2m to $2021Q4m factor 1.24
- GRP and GRP reductions: $2016Q2m to $2021Q4m factor 1.18

The overall impact of the closure of SH1 Ashburton Bridge is the additional direct transport costs faced by households plus the reduction in value-added GDP resulting from changes in economic behaviour resulting from changes in transport costs. The total impact is summarised in Table 5.1, increasing from around $8.1m for a 7-day closure to around $29.2m for a 28-day closure.

The total impact including the additional bridge closures is summarised in Table 5.2, increasing from around $12.2m for a 7-day closure to around $45.1m for a 28-day closure.

Table 5.1 Summary of Closure Impacts, updated to $2021Q4

	Direct HH Transport Costs ($m)		Reduction in GRP ($m)		
	Canterbury	RoNZ	Canterbury	RoNZ	Total Impact
7-days	$0.23	$0.21	-$0.59	-$7.08	$8.11m
14-days	$0.45	$0.42	-$1.06	-$14.51	$16.45m
28-days	$0.91	$0.84	-$2.12	-$25.37	$29.24m

Table 5.2 Summary of Closure Impacts including Additional Bridge Closures, updated to $2021Q4

	Direct HH Transport Costs ($m)		Reduction in GRP ($m)		
	Canterbury	RoNZ	Canterbury	RoNZ	Total Impact
7-days	$0.45	$0.23	-$0.83	-$10.74	$12.24m
14-days	$0.89	$0.46	-$2.12	-$21.95	$25.43m
28-days	$1.79	$0.93	-$3.66	-$38.70	$45.08m

[1] https://www.rbnz.govt.nz/monetary-policy/inflation-calculator