

Post Implementation Review

Mangatawhiri Deviation

Waikato Highways and Network Operations



May 2013

The purpose of NZ Transport Agency Post Implementation Reviews are to:

- assess how well a project (or package) has delivered its expected benefits
- explain any variation between actual results and expected benefits and costs
- identify any lessons learned that can be used to improve future projects

Executive summary

Project description

This project replaced a previously winding and dangerous stretch of State Highway 2 through the Mangatawhiri settlement in the Waikato region with a two lane undivided deviation. The previous route had been notorious for serious and fatal head-on crashes. The project included passing lanes to improve passing opportunities and several grade separated intersections to allow local traffic to safely access and cross the highway.

Figure 1 on page 3 shows the location of this project and its main features.

Summary assessment of project outcomes

Overall, this project's projected outcomes and benefits have been achieved, with no fatal or serious crashes recorded along the deviation to date (July 2013). The shorter and straighter deviation with two passing lanes has also generally achieved travel time savings and congestion relief, although these benefits are eroded during holiday periods. At these times there are significant peaks in traffic volumes from holiday traffic travelling between Auckland and Coromandel and the Bay of Plenty. The deviation's passing lanes are closed during holiday periods for safety reasons and to help improve traffic flows.

The deviation's final construction costs was \$43 million, \$2.9 million (six percent) less than its original funding allocation. Cost savings were achieved by the project being completed more than half a year earlier than planned. This was mainly due to the contractor using innovative techniques to continue construction during winter.

Lessons learned

1. Use of value engineering processes on project designs can produce sought-after benefits for reduced cost. The deviation was originally going to be a four lane highway with median barrier. But the scope was reduced to a two lane undivided highway due to funding restrictions. Value engineering applied to the project's redesign ended up reducing the project cost by nearly \$10 million from the tender price received for the original scope. For future projects, a business case approach since adopted by the Transport Agency aims to ensure appropriate project scope and features are identified early on to achieve desired benefits.
2. It needs to be ensured that all relevant and required information and documents supporting a project's funding approval are provided to, and held by, the NZ Transport Agency. Assessment of the achievement of benefits for this project was hindered by an inability to identify baseline measures for comparing before and after outcomes.

Figure 1: Location of Mangatawhiri Deviation on State Highway 2 in Waikato



1. Project benefits

The primary benefits sought from this project were to improve safety and reduce crashes. Crash cost savings made up nearly 61% of the estimated benefits used in the Benefit Cost Ratio (BCR) that originally supported the project’s funding application. Predicted travel time savings contributed a further 21% of the expected benefits in the BCR, while the remaining 18% of benefits were spread across estimated vehicle operating cost, congestion, and reduced CO2 emission benefits.

Assessment of how well the benefits for this project were achieved was hindered by lack of relevant information recorded electronically in Transport Agency databases or held in files. This has prevented clear identification of baselines for measuring the “before and after” change in benefit measures.

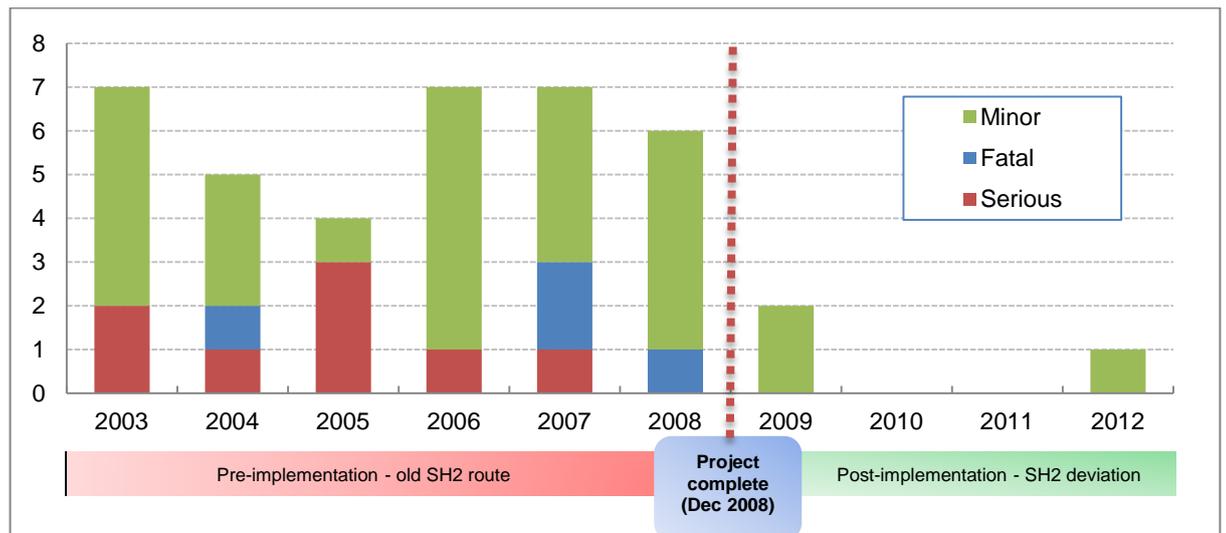
Crash reduction benefits

Overall, the safety benefits predicted by replacing a dangerous and winding 10 km stretch of State Highway 2 with the wider, straighter, and shorter deviation with passing opportunities have been achieved.

The former State Highway 2 route the deviation replaced had an unacceptably high crash rate. In the ten years to 2008 there were 11 fatal and 20 serious injury crashes between Mangatawhiri Bridge and the Maramarua Golf Course. The majority of these crashes were head-on collisions.

Figure 2 compares the incidence of reported crashes on the previous State Highway 2 route at Mangatawhiri in the six years preceding completion of the deviation, with the crash rate on the deviation since project completion in late 2008. This shows that there have been no fatal or serious injury crashes on the deviation since it opened in December 2008 and the end of 2012.¹ This compares with pre-deviation crash history, with a marked incidence of fatal or serious injury crashes.

Figure 2: Crashes by severity before and after completion of Mangatawhiri deviation



¹ Caution should be used when interpreting minor injury crash rates or incidences, as reporting and recording of these types of crashes is highly variable.

The former State Highway 2 through Mangatawhiri has become a local road servicing the local community. There have been three minor injury crashes recorded on this road since the deviation opened in late 2008, and no fatal or serious injury crashes.

Travel time and other expected benefit measures

A comparison of the characteristics and traffic data of the previous State Highway 2 route with the replacement deviation indicates that expected travel time, vehicle operating costs, and congestion relief benefit measures generally have been achieved but not necessarily during holiday periods.

The old state highway route had congestion and traffic hazards centred around the Mangatawhiri settlement, with people visiting a popular local “Castle” café on one side of the highway, or a service station on the opposite side. This resulted in large numbers of disruptive roadside parking and pedestrians crossing the highway in a 100km/h speed zone. An assessment of the route done in the late 1990s to support an early application for changes to the state highway design noted that speeds through the township had the greatest regional variability in average speed, with a range of more than 60km/h. The traffic capacity through Mangatawhiri was also estimated to be around 1,400 vehicles per hour as a result. This was lower than the Austroads capacity guidelines of between 1,600 and 1,800 vehicles per hour in a typical two way road capacity for State Highway 2.

In addition, seven adjoining side roads and nearly 100 legal access ways along the former route also reduced travel times and aggravated speed variability (which is an adverse influence on vehicle operating costs).

In contrast, the deviation has straightened and reduced the state highway length in the area by three kilometres. Access to the state highway along the deviation has been limited to access roads for local traffic at either end of the deviation and a single set of entry and exit roads midway along. The two passing lanes along the deviation provide safe passing opportunities and travel time benefits.

Before and after speed survey and travel time comparisons

Figure 3 on the next page compares speed survey and travel time related traffic data before and after construction of the Mangatawhiri deviation.² This indicates that the creation of the shorter, straighter deviation with passing lanes and reduced access to local roads and properties has generated travel time savings of around two minutes. These estimated travel time savings have occurred on the back of modest increases in overall traffic volume growth on State Highway 2 in the area in recent years. This is in contrast with many other projects completed and reviewed in recent years which have had their travel time benefits eroded by weaker-than-forecast traffic volume growth.

Holiday period traffic volume and travel time effects

Traffic volumes spike substantially along the stretch of State Highway 2 that includes the deviation during holiday periods, especially over Christmas/New Year. The highway is a main route for holiday travellers between Auckland and the Coromandel and Bay of Plenty regions. For example, the surveyed annual average daily traffic (AADT) volume on the highway in 2012 was 12,897 vehicles per day, whereas in December 2012 the monthly average daily traffic volume rose to 16,393 vehicles (27% higher than the AADT). The highest daily volumes in 2012 were on 27 December 2012, with 22,305 vehicles recorded travelling on the deviation.

These peak seasonal traffic volumes tend to lower average vehicle speeds on the deviation and cause fluctuations in travel times. But safety remains the most important consideration,

² The traffic volume and speed data for the “before” scenario is taken from a Scheme Assessment Report prepared for an early proposal for changes to State Highway 2 around Mangatawhiri done in 1997. Traffic volume data for the “after” scenario is taken from the NZ Transport Agency State Highway Traffic Data Booklet, and commissioned speed surveys done on the deviation in April 2012.

and the deviation's two passing lanes are temporarily closed over holiday periods for both safety reasons and to improve traffic flows.

Figure 3: Before and after travel time and traffic volume comparisons

	Old State Highway 2 route through Mangatawhiri township (1997)	State Highway 2 Mangatawhiri deviation (2012)	Difference
Road length	10km	7km	-3km
Traffic volumes (Annual Average Daily Traffic)	11,000 vehicles per day	12,900 vehicles per day	+1,900
% heavy vehicles	15%	13%	- 2 percentage points
Average vehicle speed	90km/h	95km/h	+5km/h
Estimated average travel time*	6.7 minutes	4.4 minutes	-2.3 minutes

* Calculated by dividing road length by average vehicle speed and multiplying by 60.

2. Project implementation (scope, cost, and timeframe)

Project scope

There were no major scope changes to this project after the contract was awarded. It was delivered under budget and was completed nearly half a year earlier than planned.

Project cost and timeframe

The project's final construction cost was \$42.997 million, \$2.9 million (-6%) less than its original funding allocation of \$45.900 million.

The most significant contribution to construction cost savings was the result of the project being completed significantly ahead of schedule. The construction contract was awarded in late October 2006 with construction begun in December 2006. It was estimated that the project would be completed by May 2009, dependent on weather. But the project ended up being completed in early December 2008, 24 weeks earlier than estimated.

The timeframe for the project had originally allowed for avoiding construction during winter. However, the project contractor developed a good technique for doing earthworks that included building all-weather haul roads to move heavy equipment and materials along the project length. This, and permission by Environment Waikato (the local regional council) for the contractor to work through winter, reduced the project's timeframe. The project also benefited from favourable fine weather conditions in the summer months.

Figure 4 summarises the variance between estimated and actual results with the cost and completion date for the project.

Figure 4: Cost and timeframe comparisons

	Approved/estimated at start of project	Actual result	Variance
Practical completion date	31 May 2009	11 December 2008	-24 weeks
Total project construction cost	\$45,900,000	\$42,996,500	-\$2,903,500 (-6%)

3. Lessons learned

It was originally proposed that the Mangatawhiri deviation would be four lane highway with a median barrier. But funding restrictions and reprioritisation of state highway investment in the Waikato region subsequently reduced the scope to the two lane undivided highway design. The application of value engineering processes with this scope reduction have achieved the originally sought safety and travel time benefits at nearly \$10 million less than the tender price received with the original scope proposal. This is a good value for money result, but it also raises the question of whether the Transport Agency would have over-invested in the project by \$10 million to achieve the same outcomes had the tightened funding changes not occurred?

Since this project was funded, the Transport Agency has introduced a “business case approach” to guide its planning, investment and project development processes. The aim is to make better investments (increased effectiveness and outcomes delivered) and efficiency savings. This includes involving key stakeholders early on in an Investment Logic Mapping process to clearly identify and understand the problem to be addressed along with the desired benefits, before looking at possible solutions. For future projects of similar size and scale to the Mangatawhiri Deviation, this business case approach should help ensure fit-for-purpose (value for money) solutions are identified and funded to achieve desired benefits.

4. Waikato Highways & Network Operation’s response to findings

This report was provided to Waikato Highway & Network for comment on the findings. The Project Manager responsible for the project said he was satisfied with the report. No further comments were made about this review.