

Post Implementation Review

Kaingaroa Safety Improvements (State Highway 10)

Auckland Highway & Network Operations



December 2012

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

The purpose of this project was to make safety improvements on a short stretch of State Highway 10 at Kaingaroa, Northland. Kaingaroa is a small settlement located approximately 15km north-east of Kaitaia (see Figure 1). It is made up of several houses, a community hall, timber mill, and the rural Kaingaroa school.

The project involved three main changes at the location:

- The widening of the existing Kaingaroa bridge on the state highway;
- Widening and realignment of the state highway approaches to the bridge; and
- Construction of a footpath alongside the state highway, principally to provide pedestrian access off the highway from the school to the settlement and its community hall.

Figure 2 on page 4 shows the location and main features of the project site.

Summary assessment of project outcomes and benefits

The benefits sought from this project were to reduce the number and severity of crashes at the site, and address local community concern about the safety of pedestrians walking along the state highway. Overall, this project has delivered its predicted benefits.

There have been no crashes recorded at the site since project completion, nor at a wider area around it to take account of any possible crash migration impacts. However, only two full years of crash data were available for post project analysis (2010 and 2011). The safety improvement effects are therefore only indicative, with a longer period of post implementation crash data of around five years required to determine the significance and size of the improvement. But we can be reasonably confident that an improvement in safety has occurred.

The provision of a footpath alongside the state highway has improved pedestrian amenity and access between Kaingaroa School and the rest of the Kaingaroa settlement.

The project took substantially longer to complete than planned due to technical and contractual issues with the bridge widening (see section 2 below). It was finally completed in December 2010, two and a half years later than was originally planned. Negotiation and completion of remedial work with the bridge escalated the final cost of the project to \$1.88 million, 57% more than the estimated \$1.20 million cost when project funding was approved.

Lessons learned

Lessons that can be learned from this project for future projects and the NZ Transport Agency's processes and procedures include:

- ensuring procedures and support are in place when projects encounter problems that require remedial work or may result in contractual issues;
- the importance of using formal handover processes when there are changes in project managers to ensure clear understanding and knowledge of projects is retained throughout their delivery and completion; and

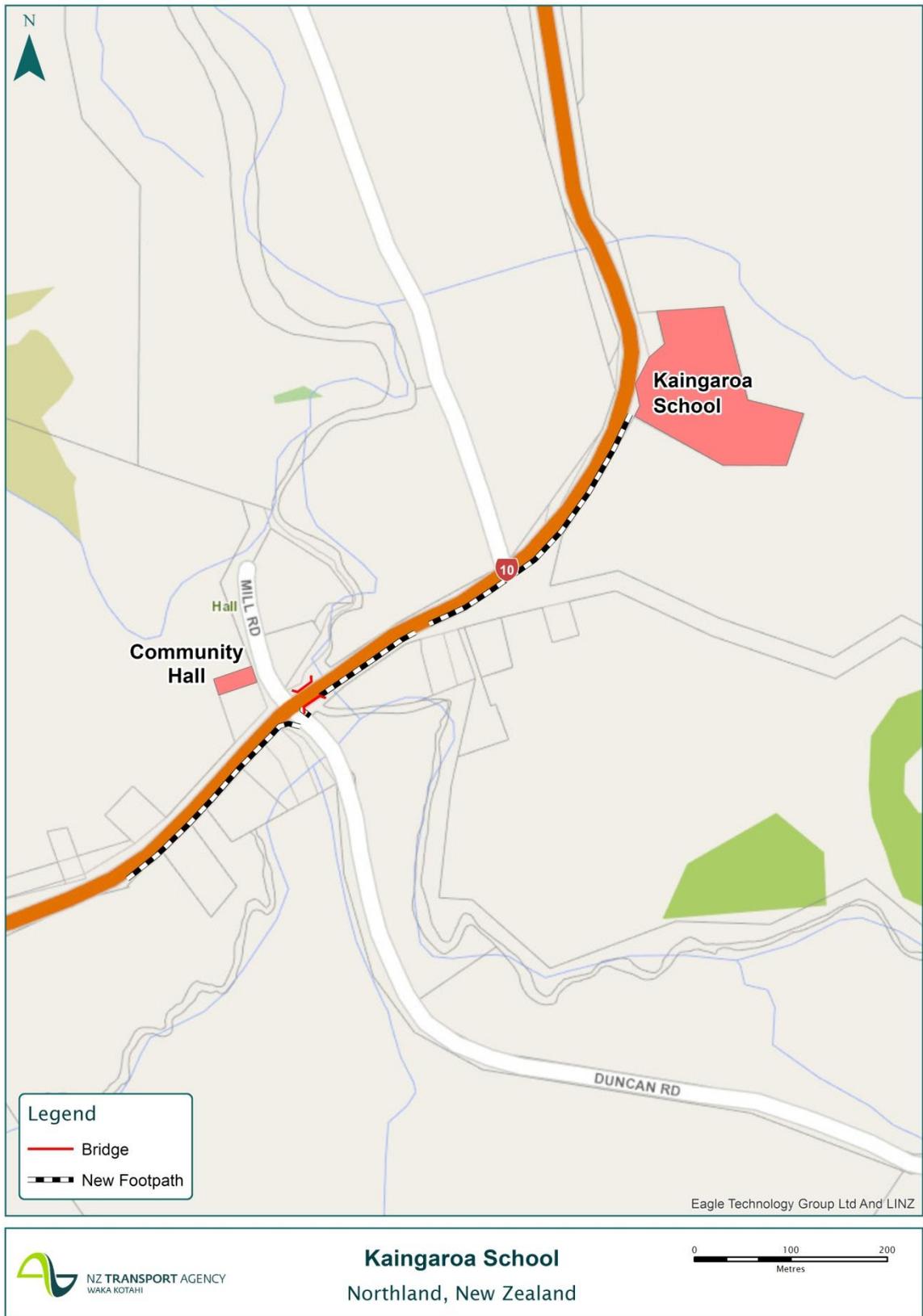
- considering how to increase the dissemination and learning of findings from inhouse Lessons Learnt Reviews.

Lessons learned identified in this post implementation review are discussed in more detail in section 3 below.

Figure 1: Location of Kaingaroa on State Highway 10 in Northland



Figure 2: Kaingaroa safety improvements project site



1. Project benefits

The benefits sought from this project were to:

- reduce the number and severity of crashes at the site, and
- address local community concern about the safety of pedestrians walking along the state highway.

Crash cost savings made up 62% of the estimated benefits used in the Benefit Cost Ratio supporting the project, while pedestrian benefits made up the remaining 38%.¹

Most crashes at the location before the project involved westbound vehicles turning at an intersection immediately west of the bridge. The remainder were from loss of control of vehicles crashing into roadside drainage ditches. Factors identified contributing to these crashes were: poor visibility of the intersection on its approaches, the narrow width of both the bridge and the state highway at the site, and insufficient traversable shoulder width.

Community concern for pedestrian safety related specifically to the occasional walking of the whole school population along the state highway to attend special occasions at the community hall (see Figure 2 for the location of the school and hall).

Before (left) and After (right) Photos



¹ No other benefits from the project, such as travel time savings or reduced vehicle operating costs, were predicted or factored into the Benefit Cost Ratio as there was no expected change to the road condition, traffic volume or composition.

Crash reduction benefits

The safety benefits for this project appear to be driven by two fatal loss of control crashes, in 1997 and 1998, and two subsequent intersection related crashes in 2000.

The project has involved widening of the under-width Kaingaroa bridge as well as improving sight lines associated with the adjacent intersection and would be expected to address the historic crashes.

Evaluation of the crash reduction benefits is difficult due to uncertainty around what qualifies as the before period, and what the after period should be.

It is unclear which period should be used for the before case as various assessments were undertaken before the project started, each using a different crash period:

- A Project Feasibility Report in 2001 used crashes between 1996 and 2000
- A Project Feasibility Report in 2002 used crashes between 1997 and 2001
- The Scheme Assessment Report produced in 2004 used two periods, 1999 to 2003 and 1994 to 2003.²

However, given the decision to proceed with the project should have been made on the basis of the Scheme Assessment Report, the analysis in this post implementation review is based on the Scheme Assessment crash analysis, using both five year and 10 year data.

In terms of the after period, the certificate of practical completion was issued in 2009, although there is some possibility that the site may have still been under temporary speed restriction until December 2010 pending final surfacing. The decision was made for this review to base the after crash analysis on 2010 and 2011 crash data. These are the two complete years since the issuing of the certificate of practical completion.

The crash reduction benefits used in the Scheme Assessment analysis were only those crashes in the immediate vicinity of the project. As the proposed works removed a width constriction and improved sight lines it is highly likely that speeds through the site and the surrounding areas have been increased. It is therefore prudent to extend the crash reduction analysis beyond the immediate site to ensure potential crash migration has been taken into account. It is also worthwhile taking into account any localised trend in crash or reporting rates.

This analysis considers three datasets as a result:

1. Crashes at the immediate site of the works;
2. Crashes at the site plus those occurring on the curves immediately downstream of the site which are expected to involve a speed component (crashes on subsequent curves are unlikely to be affected as the speed environment over the previous 500m will remain unchanged); and
3. A wider selection of crashes on the adjacent sections of SH10 in order to establish the local crash rate and reporting trend.

Working in the current environment we would focus only on the high severity crashes – those resulting in death or serious injury. However, there are too few such crashes at this site to be able to achieve any form of significance.

² A Project Feasibility Report is a broad assessments of a project's viability. A Scheme Assessment Report is a detailed report including a precise problem definition, project evaluation, assessment of environmental effects, and a recommendation.

As a result, we have looked at both the reported injury crashes and all reported crashes. Figure 3 shows there have been no crashes recorded at the site, nor the wider area which seeks to take account of possible migration impacts.

With an underlying crash rate of 0.8 either injury or reported crashes per year at the site (both for the five and 10 year before periods), the likelihood of two further years without a crash sits outside the 95% confidence limit for the underlying rate. The same applies when all reported crashes are considered.

Given that between 1999 to 2003 and 2010 to 2011 there has been an almost 20% increase in both reported injury crashes and all reported crashes on the surrounding network (see Figures 4 and 5), we can be reasonably confident that an improvement in safety has occurred. However, given the lack of crashes following completion of the works, a longer after period should really be considered to determine the size of the improvement.

Potential safety issue with widened bridge pavement

The widening of the Kaingaroa bridge involved constructing a new bridge next to the existing one. This has resulted in a visible crack between the two structures to allow them to contract and expand with temperature changes.³ We consider that this design detail has the potential to be a safety risk for motorcyclists, as it is positioned near the middle of one of the bridge lanes, and would not like to see it use on other projects.

Pedestrian amenity benefits

The pedestrian benefits have been calculated assuming an increase in pedestrian amenity and safety as a result of the increased shoulder width, and the construction of the footpath to the school. It should be noted that in the before situation only the sealed shoulder width was considered, not the unsealed. Furthermore, there was no consideration of the existing “footpath” over the bridge. That said, in order to access that footpath over the bridge, pedestrians making the trip from the school to the community hall would have been required to cross the highway twice. So while the calculation of pedestrian benefits may have included some questionable assumptions on the usage of the available shoulder, taking all things into account it is considered reasonable.

³ This crack is evident from the bridge photo on the cover of this report

Figure 3: Crash statistics, 1994-2011

	At Site			Site plus Extended Area			Wider Area		
	Fatal & Serious	All injury	All reported	Fatal & Serious	All injury	All reported	Fatal & Serious	All injury	All reported
1994							2	4	6
1995							6	9	12
1996	1	1	1		1	1	0	1	4
1997	1	1	1	1	1	1	2	4	13
1998		1	2	1	1	2	1	2	10
1999		1	1		1	1	2	4	10
2000		2	2		2	2	4	8	11
2001							1	5	15
2002		1	1		1	2	4	11	20
2003					1	1	1	8	28
2004			1			1	3	16	25
2005							5	9	19
2006							5	14	27
2007					1	1	3	10	24
2008			1			1	3	8	21
2009			1			2	4	13	27
2010							3	7	13
2011							2	12	27
Rate per year (1999 to 2003)	0	0.8	0.8	0	1	1.2	2.4	7.2	16.8
Rate per year (1994 to 2003)	0.2	0.7	0.8	0.2	0.8	1	2.3	5.6	12.9
Rate per year (2010 to 2011)	0	0	0	0	0	0	2.5	9.5	20

See Appendix 3 for graphs showing reported crashes on the network around Kaingaroa.

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

Project scope

There were no significant project scope changes from what was planned when funding was approved and the contract awarded for this project. But remedial work was required on the bridge widening and this substantially escalated project costs and delayed its completion.

Project cost and timeframe

The project was originally funded to cost \$1.2 million. Substantial issues with ground conditions downstream of the bridge being worse than expected, and problems with the bridge widening component of the project resulted in two project price level increases

totalling \$680,000 being approved, as shown in Figure 6. These contributed to a higher final project cost of \$1.884 million.

Figure 6: Description of project cost adjustments

Description and explanation of cost adjustments	Date	Cost implications	Revised total project cost
Project cost estimate when funding approved	31 October 2006		\$1,200,000
1. Additional rock spall buttress protection works as a direct result of ground conditions downstream of Kaingaroa bridge being worse than anticipated.	10 January 2008	+ \$200,000	\$1,400,000
2. Rehabilitation works, contingent liability and design fees associated with poor design and inadequate piling depths of the Kaingaroa bridge extension.	24 June 2009	+ \$480,000	\$1,850,000
Total final project cost (at date funding completed)	26 July 2011	+ \$34,200	\$1,884,200

Bridge widening problems

The option taken with this project was to widen the existing narrow bridge rather than replace it. It was not considered practical to close the bridge completely at any stage of construction. An alternative detour route is around 100km long and would have involved major disruption and inconvenience to the local community and other road users.

The plan was therefore to build a new bridge next to the existing one and open this to traffic (with restricted speeds) while temporarily closing the old bridge to improve it and join it to the new bridge.

Construction of the new bridge took place in early-mid 2008 and it was opened to traffic in August 2008. However, the new bridge piles started sinking shortly afterwards, with some piles sinking by up to 55cms. The new bridge was closed in September 2008, with traffic restricted to one lane on the old bridge.

Work at the project site stopped for more than a year while a resolution to the bridge problem was negotiated and agreed by the involved parties. A detailed review was also done to determine what caused the bridge to sink. This found that poor initial design resulted in the bridge piles not being drilled down deep enough.

Eventual remedial work done involved the construction of additional piles to support the bridge from subsidence.

Final timeframe for project completion

The problems associated with fixing the bridge subsidence considerably delayed the completion of the project. It was finally completed 20 December 2010, two and a half years later than the originally planned completion date of 31 May 2008.

3. Lessons learned

This project experienced unexpected but significant issues that greatly increased both the time and cost for it to be satisfactorily completed. Some lessons that can be learned from it are discussed below.

Lessons Learnt Review

A good practice initiative that has occurred after completion of the project is a Lessons Learnt Review, which was done in July 2010. The NZTA Lessons Learnt programme aims to learn from experience by project participants identifying successes and improvement areas. In the Kaingaroa project example, the review enabled the contract parties and key stakeholders to discuss (in particular) what things did not go as planned and identify lessons to be learnt from them. Results from the review were shared informally among the Highways Auckland office project staff.

However, in our view, the scope for more robust sharing of Lessons Learnt Review findings both within NZTA and with key stakeholders to ensure maximum learning from completed projects should be considered. This would require stronger summarising and anonymising of lessons learned for all parties. Currently, the Lessons Learnt Review Programme is limited to capturing lessons in a central register and then summarising and disseminating them in biannual roadshows and newsletters.

Recommendation: we recommend that Highways explore opportunities to increase the disseminating of findings from Lessons Learnt Reviews and other post completion reviews (including post implementation reviews).

Support processes when projects encounter difficulties

The problems that emerged with this project with the bridge piles sinking resulted in a protracted one-year stalling of the project while the reasons were investigated, and remedial and contractual issues negotiated and agreed.

It is important when projects encounter major difficulties that NZTA provides suitable procedures and support to project managers and other parties to reach optimal solutions for the projects.

Recommendation: we recommend that Highways ensures it has appropriate procedures and support in place to support and guide staff and related parties if contractual issue or unexpected project problems arise.

Formal project handover procedures

There were several changes in the project manager over the life of this project, but with no formal handovers done. This potentially resulted in the loss of valuable understanding of the project's details that may have impeded its implementation given the issues experienced.

Change in key personnel is common on NZTA Highways & Network Operation's projects. It is therefore important that clear and formal handover procedures are in place and used to ensure important project understanding and knowledge is not lost. We note that inadequate handovers have been identified as a shortcoming of other projects.

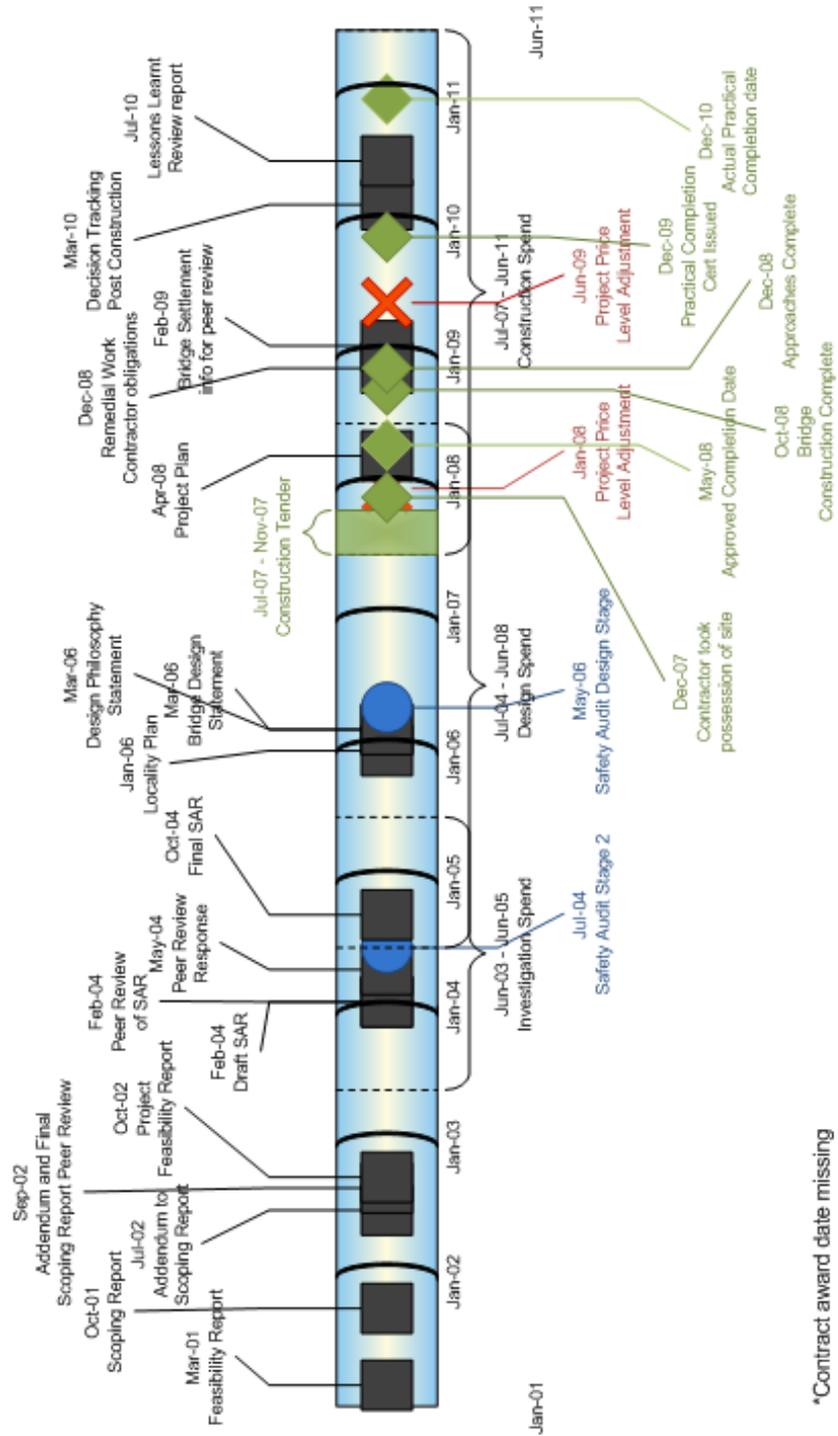
Recommendation: we recommend that Highways ensures it has appropriate handover procedures in place, for transitioning changes in key personnel managing projects.

4. Highway & Network Operation's response to findings

The findings and recommendations from this review have been included with a wider collection of review and lessons learned findings for addressing by the Highways & Network Operations group.

A1 Project Timeline

Kaingarua Safety Improvements



*Contract award date missing

A2 Crash Graphs

Figure 4: Reported injury crashes, network around Kaingaroa, 1994-2011

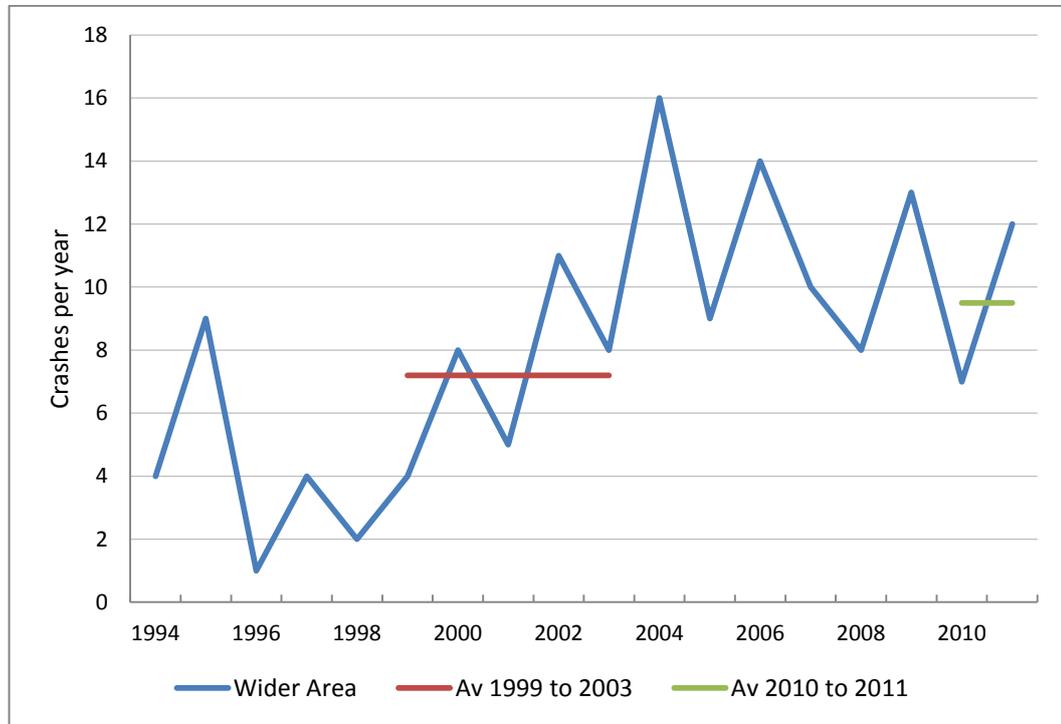


Figure 5: Reported crashes, network around Kaingaroa, 1994-2011

