

Rural roundabouts

SAFE SYSTEM
CASE STUDY

Roundabouts are a great safety solution for rural intersections

Roundabouts have been used in New Zealand for many decades, historically they have mainly been used in urban environments. More recently, a number of rural roundabouts have been installed at high speed main road intersections in Waikato and Auckland to address serious crash concerns.

Recent analysis looking at the results of nine sites confirms just how effective they are.

This case study includes the analysis of these nine sites:

| Site | Installed | Cost |
|---|-----------|---------|
| SH1/5 intersection at Tirau | 2014-15 | \$4.7M |
| SH27/Paeroa-Tahuna Rd | 2009-10 | \$2.5M |
| SH3/37 Waitomo Rd | 2015-16 | \$3.3M |
| SH26/Ruakura Rd | 2016-18 | \$6.8M* |
| SH3/21 Airport Road, Hamilton | 2016-19 | \$3.9M |
| SH2/25 intersection, Mangatarata | 2014-17 | \$3.2M |
| SH26/27 intersection, Tatuani | 2011-13 | \$3.5M |
| Glenbrook/Kingseat Int. South-West Auckland | 2013 | |
| Whitford Park Rd/Sandstone Rd Int. South-East Akl | 2014-15 | |

*Part of a wider Waikato Expressway project



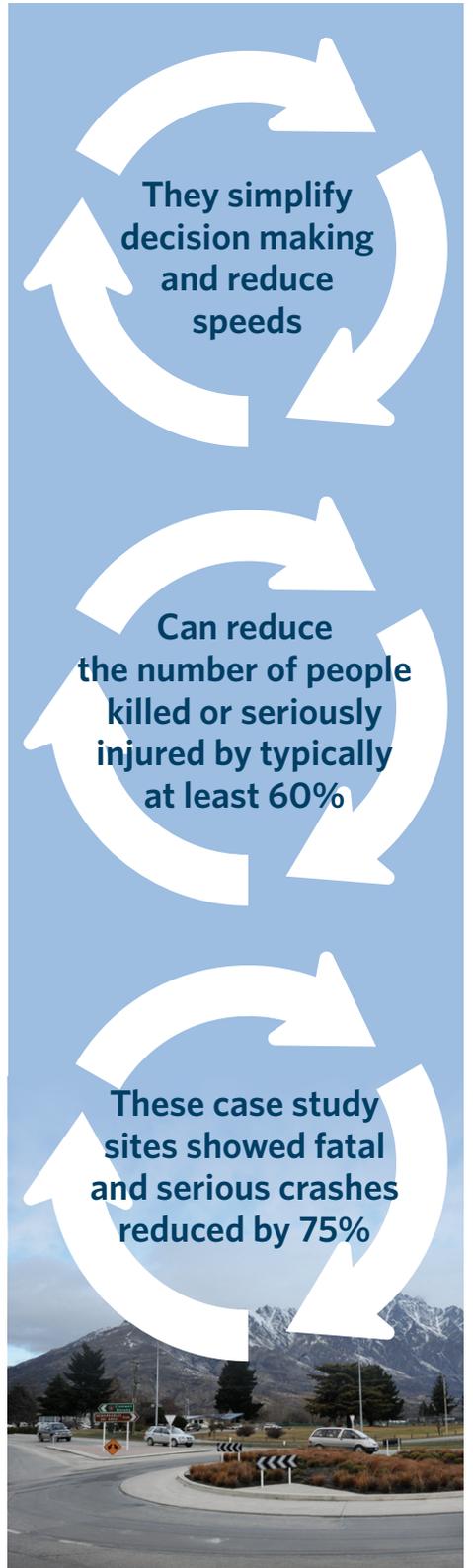
How much do rural roundabouts usually cost?

The **Standard Safety Intervention Toolkit** includes a cost range of \$2M-\$5M. Costs are heavily dependent on size, land, services and traffic management during construction.



How effective are rural roundabouts?

- Austroads found roundabouts were effective in reducing fatal crashes by 63-100% and severe crashes by 37-90%.
- The Waka Kotahi NZ Transport Agency **Standard Safety Intervention Toolkit** says rural roundabouts have an assumed death and serious injury reduction of 60%.



Our recent New Zealand analysis of nine sites

Across the nine sites:

- In the five years before installation, there were 46 reported injury crashes.
- Since installation, there have been nine reported injury crashes, with no fatal crashes and three serious crashes.

A statistical analysis undertaken by Waka Kotahi data analysis team has compared the crash rates on a monthly basis across all sites individually and combined, noting that post-construction periods vary but are typically less than five years and hence are not directly comparable to the pre-construction period.

Our analysis found:

- The fatal and serious crashes, and deaths and serious injury equivalents (the estimated number of deaths and injuries), have **reduced by 75%**. From an average of 0.04 per month (0.5 per year) to 0.01 per month.
- Total crashes (Injury and non-injury) **reduced by 50%**. From a monthly average of 0.26 per month to 0.13.

A review of crashes after installation also found:

- Loss of control was the most common type, followed by changing lanes.
- There were two motorcycle injury crashes, compared to 16 motorcycle injury crashes in the before period.
- There have been no reported cyclist or pedestrian crashes, however numbers of pedestrians and cyclists would be extremely low at rural sites.

Total crashes per month - pre- and post-construction

| Site name | Fatal and serious (pre) | Fatal and serious (post) | Total* (pre) | Total* (post) |
|---------------------------------|-------------------------|--------------------------|--------------|---------------|
| SH1/5 Tirau | 0.02 | 0.03 | 0.5 | 0.17 |
| SH27/Paeroa-Tahuna Rd | 0.02 | 0.01 | 0.07 | 0.15 |
| SH3/37 Waitomo Rd | 0.07 | 0 | 0.17 | 0.08 |
| SH26/Ruakura Rd | 0.03 | 0 | 0.13 | 0.12 |
| SH3/21 Airport Road | 0.05 | 0 | 0.22 | 0.07 |
| SH2/25 Mangatarata | 0.05 | 0 | 0.22 | 0.37 |
| SH26/27 Tatanui | 0.02 | 0.01 | 0.38 | 0.12 |
| Glenbrook/Kingseat intersection | 0.08 | 0 | 0.38 | 0.07 |
| Whitford Park Rd/Sandstone Rd | 0 | 0 | 0.27 | 0.1 |
| Total | 0.04 | 0.01 | 0.26 | 0.13 |

*Total crashes includes all reported injury and non-injury crashes

All combined results are statistically significant.

Please note that pre- and post-construction time periods are not the same. This is a simple before and after analysis without control site comparison.

Roundabouts are one of the best Safe System solutions for intersections, because:

- **They make it easier for people by simplifying decision making and reducing errors people may make.** With one clear direction to focus on, it's easier for people to choose the right time to enter the flowing traffic.
- **Everyone slows down as they approach the roundabout,** which encourages safe and alert behaviour. Everyone is prepared to potentially stop and give way.
- **Roundabouts can reduce the number of people killed or seriously injured by typically at least 60%,** because they significantly reduce the chance of head on and side impact crashes and vehicle speeds are lower. While crashes may still happen, they are less likely to result in people being killed or seriously injured.

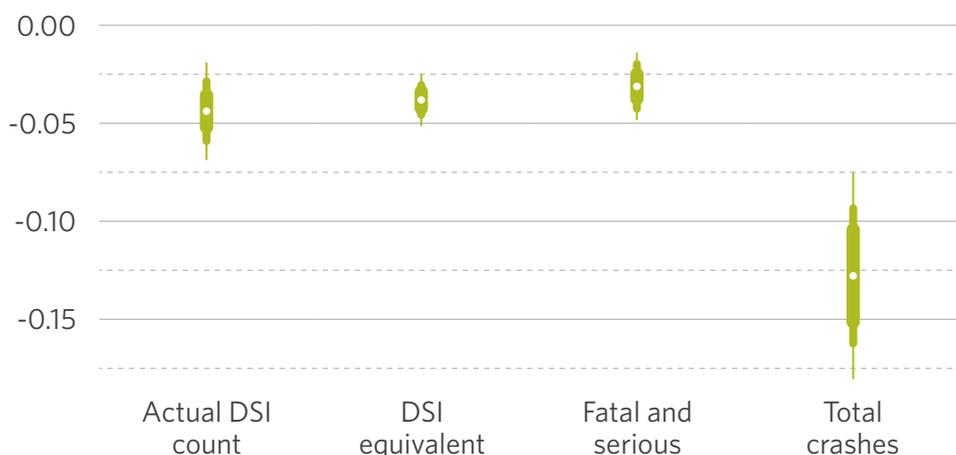
BEFORE



AFTER



Glenbrook/Kingseat intersection



Dsi = Death and Serious Injuries

Figure 1: Comparison of crash statistics before and after roundabout construction. Showing post-construction change in monthly rates with mean, 65%, 80% and 95% confidence intervals



Key tips for practitioners



- Roundabouts are a great Safe System intersection solution, with significant reductions in deaths and serious injuries, even in remote high-speed locations. Simplified decision making reduces errors and speeds, and low impact angles reduce injury severity when mistakes are made.
- The Waka Kotahi NZ Transport Agency **Standard Safety Intervention Toolkit** also rates rural roundabouts as a 'Safe System Transformation' treatment philosophy. Roundabouts are included as a 'Primary Safe System Treatment' as they significantly reduce the risk of someone being killed or seriously injured.
- The key to a safe outcome is managing entry speed. Single lane roundabouts should be used wherever possible, as this minimises the risk of crashes when changing lanes and is safer for vulnerable road users. Large roundabouts can be expensive, and exploring the opportunity for low-cost compact roundabouts, with innovative speed management techniques, offer potential opportunities.
- We can take more **innovative approaches** to rural roundabouts to gain the benefits at intersections. Recently Victoria Australia has been trialling the installation of lower cost compact rural roundabouts, with raised platforms on the approaches to help manage traffic spreads.
- Roundabouts deliver near Safe System outcomes for vehicle occupants and should be the starting point for any road project considerations. This doesn't mean roundabouts must be used in all circumstances, context is important, however they should at least be considered first due to their superior harm reduction potential over other intersection types.

Thank you to Colin Brodie for leading the analysis of this case study