Installation of throat & fishtail islands at intersections

June 2001

Executive Summary

The Joint Crash Investigation Programme identifies sites suitable for low cost crash reduction treatments and recommends suitable engineering treatments for each site.

Since the programme began in 1985, throat or fishtail islands have been recommended as a safety treatment at a number of intersections, usually in conjunction with other works such as improving traffic signs, installing bulbous kerbs or increasing street lighting. Up to the present, throat or fishtail islands have been a major component of the safety works at 134 intersection sites. Crash reduction results from these 134 sites are analysed in this report.

Crashes in the same local area as the site were used to control for underlying changes in crash patterns. Using this method, the following total reductions in injury crashes (since treatment) were estimated at intersection sites where throat or fishtail islands were installed:

- All sites: **44%**
- Urban sites: 45%
- Open road sites: 38%

Crash movement type:

- Crossing: 57%
- Turning: 31%
- Pedestrian: 61%
- Loss of control: 37%

- Crashes in daylight: 43%
- Crashes in darkness/ twilight: 50 %

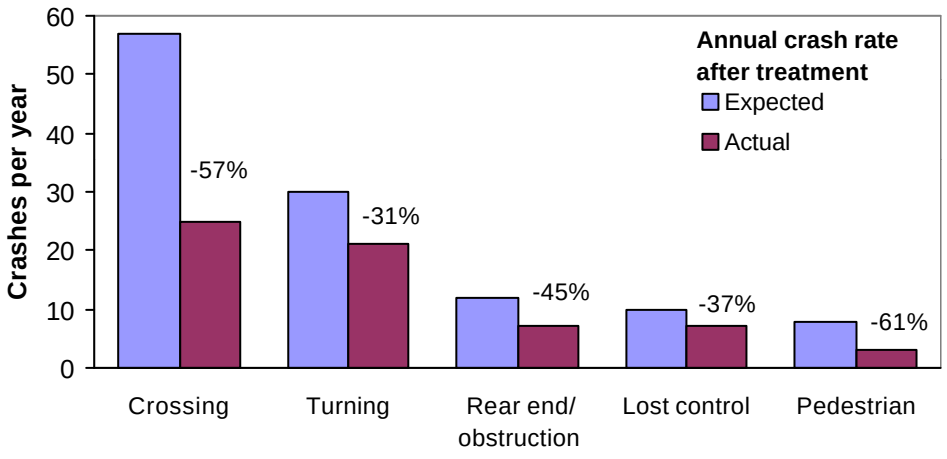
- Fatal crashes: 46%
- Serious injury crashes: 38%
- Minor injury crashes: 48%

The overall saving in social cost was approximately **$95 million**[1]. (The above figures do not take into account regression to the mean).

There was no evidence of an increase in crashes involving collision with a non-vehicular obstruction.

1. Social cost in June 2000 prices.

Fig 1: Crash reductions by crash movement type



1. Introduction

The Joint Crash Investigation Programme was set up in 1985 to undertake a continuous programme of systematic investigation of all roads in New Zealand. Since 1989 the Land Transport Safety Authority (then the Land Transport Division, Ministry of Transport), has progressively developed a monitoring system to gather data on sites investigated under the programme. This analysis uses data on the Crash Reduction Study Monitoring System database, now part of the LTSA's Crash Analysis System, to analyse the effects of specific "actions" or treatments at sites.

This paper looks specifically at the effect of installing throat or fishtail islands at sites.

2. Site selection

The criteria for site selection were:

1. Installation of a throat or fishtail island had been completed at the site

2. The installation of a throat or fishtail island was considered to be a major or minor component of the safety interventions at the site

3. Only intersection sites were included in the analysis.

Altogether, there were 181 sites meeting criteria 1 & 2 above where throat or fishtail islands were installed. Islands were installed on 43 routes, at 4 non-intersection sites and at 134 intersection sites. Only the intersection sites were included in this evaluation.

Intersection types were as follows:

- 87 X-intersections
- 31 T-intersections
- 6 skewed offset intersections
- 3 right-angle offset intersections
- 4 roundabouts
- 2 multileg intersections
- 1 Y-intersection.

The installation of a throat or fishtail island was considered to be a major component of treatments at 99 sites and a minor component at the remaining 35 sites.

At 13 of the studied sites islands were installed for reasons other than as part of the crash reduction study.

Table 1 shows the speed zones and road classifications of intersection sites where throat or fishtail islands were installed. In this table and elsewhere in this report, "urban" refers to roads or sites with speed limit 70 km/h or less, and "open road" to those in 80-100 km/h speed limit zones. Two thirds of sites where throat or fishtail islands were installed were on urban local roads.

Table 1. Number of intersection sites by speed zone and road classification

Sites	Local Rd	State H'way	Total
Urban	91	16	107
Open	8	19	27
Total	99	35	134

In addition to the treated sites there were several sites where the installation of throat or fishtail islands was recommended but has not been implemented. The table below shows the number of years since the recommendations were made.

Table 2. Sites with throat/ fishtail islands still to be installed.

Years since recommendation made	Sites
More than 10	3
7 - 10	4
5-7	7
3-5	8
Less than 3	0
Total	22

(Excludes sites where action was recommended but will not be implemented).

3. Other works at treated intersections

Works other than throat and fishtail islands were also implemented at treated intersections. The number of additional actions implemented at treated sites ranged from 0 to 10, with 50% of sites having between 2 and 5 other works implemented. There were four sites where installation of a throat or fishtail island was the only treatment.

The most common actions implemented at the 134 selected intersections, in addition to the installation of throat and fishtail islands, were:

- Improve traffic signs (101 sites)
- Install/ upgrade lighting (31 sites)
- Move/ upgrade limit lines (29 sites)
- Install bulbous kerbs (24 sites)
- Alter lane markings (24 sites)
- Alter centreline (20 sites)
- Improve/ modify carriageway (17 sites)
- Install RRPMs (16 sites)
- Paint continuity line (14 sites)

There were 78 other types of actions implemented at 12 or fewer treated sites each.

4. Crash data

The crash data used in this analysis are from the LTSA's Crash Analysis System, which includes all crashes reported to the LTSA by NZ Police. These results are based on injury crash data up to and including 31 December 2000. Non-injury crashes have lower and more variable reporting rates than injury crashes, and were not used in this analysis.

The average study period before treatment was 5.1 years, and the average post-implementation study period was 5.5 years.

Changes in crash patterns were examined for different types of crashes as well as for the different site groups shown in Table 1. Crash types of interest selected for analysis were light conditions (daylight or dark), crash movement type and crash severity. Selected crash types were examined across all intersection sites.

5. Controlling for crash trends

Underlying crash trends within each local area and speed limit zone (urban or open road) were taken into account when calculating reductions at the monitored sites.

Each site was assigned a comparison group of injury crashes in the same local area and urban or open road speed limit category. Where crash numbers permitted controls were drawn from the same Local Authority; in areas with low crash numbers crashes were aggregated across the Local Government Region or in some cases a slightly wider area[2]. Only crashes occurring outside designated monitoring sites were included in the comparison group.

6. Analysis method

The number of injury crashes at each site was adjusted for underlying crash trends in the local area, to give an estimated number of injury crashes expected if the improvements had had no effect. The resulting expected number of injury crashes at a site or group of sites was calculated as follows

$$\text{CrashesExpected} = \text{BeforeCrashes} \times \frac{\text{ControlAfter}}{\text{ControlBefore}}$$

where

CrashesExpected is the expected number of injury crashes at the site in the 'after' period (ie the period of monitoring after all treatments were implemented), assuming the treatment had no effect;

[2] For details see the report 'Overall Results of Crash Reduction Study Monitoring, Feb 2001'.

BeforeCrashes is the actual number of injury crashes at the site in the (usually five-year) period before treatment;

ControlBefore and *ControlAfter* are the actual number of injury crashes in the control area during the site's 'before' and 'after' periods respectively.

Actual and expected numbers of 'after' injury crashes were summed across the chosen group of sites and the totals compared to give the crash reduction result as

$$\%\text{Reduction} = \frac{\text{CrashesExpected} - \text{AfterCrashes}}{\text{CrashesExpected}} \times 100$$

7. Regression to the mean

When, as in the Crash Reduction Programme, sites are selected for treatment on the basis of high crash counts, there is likely to be some reduction in crashes in subsequent years even if no works were carried out. This is due to a statistical phenomenon which is referred to as 'regression to the mean'.

The controls described above have been applied to account for underlying crash trends in the local area, but the reductions quoted have not been corrected for possible regression to the mean. Methods for doing this are under investigation. When regression to the mean is taken into account, crash reductions attributable to the programme may be smaller than the changes quoted here.

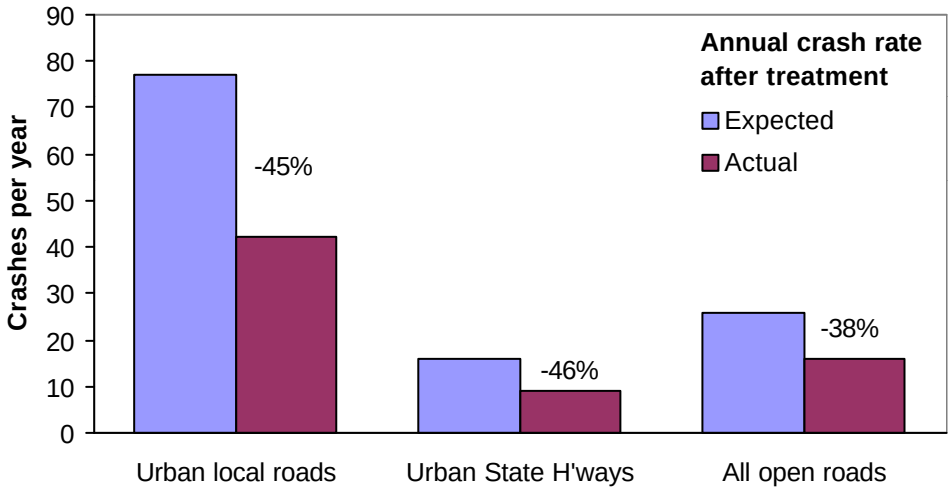
8. Injury Crash Reductions

Overall, there were 289 fewer injury crashes since treatment at sites where throat or fishtail islands were installed (after allowing for underlying crash trends in each site's local area). This represents a reduction in injury crashes at the treated sites of **44%** and an estimated social cost saving of approximately **$95 million** (at June 2000 prices).

8.1 Site type

Injury crash reductions of between 40% and 50% were achieved across most types of sites. Urban sites had a higher overall injury crash reduction (45%) than open road sites (38%). Fig 2 and Table 3 show the change in crash rate and the percentage reduction in crashes for various types of intersection sites.

Fig 2: Crash reductions by speed limit area



8.2 Crash type

Table 4 shows the reduction in various types of crashes experienced at treated intersections.

Substantial crash reductions were observed for all injury crashes regardless of severity, though there is some indication that greater reductions were achieved for minor injury crashes than for serious injury crashes. Both daytime and nighttime crashes decreased after site treatment.

Sites at which throat and or fishtail islands were installed have experienced a large reduction of over 50% in crashes involving vehicles crossing, and of over 30% in turning crashes, after accounting for underlying crash trends (see Figure1). Results also indicate a reduction in the number of loss of control crashes and crashes involving pedestrians, although in these cases the small number of crashes makes it difficult to estimate accurately the size of the reduction.

It is possible that the installation of throat/ fishtail islands might increase the number of collisions with obstructions, in this case islands (EC type crashes). There was no evidence that this was the case at the treated sites. There were four crashes of this type at the selected intersections in the study "before" period and four afterwards, which is slightly below the number expected based on the overall trend in this type of crash. The overall group of crashes classified as 'rear end/ obstruction' reduced by 45% after treatment.

Fig 3: Crash reductions by crash severity and night/day

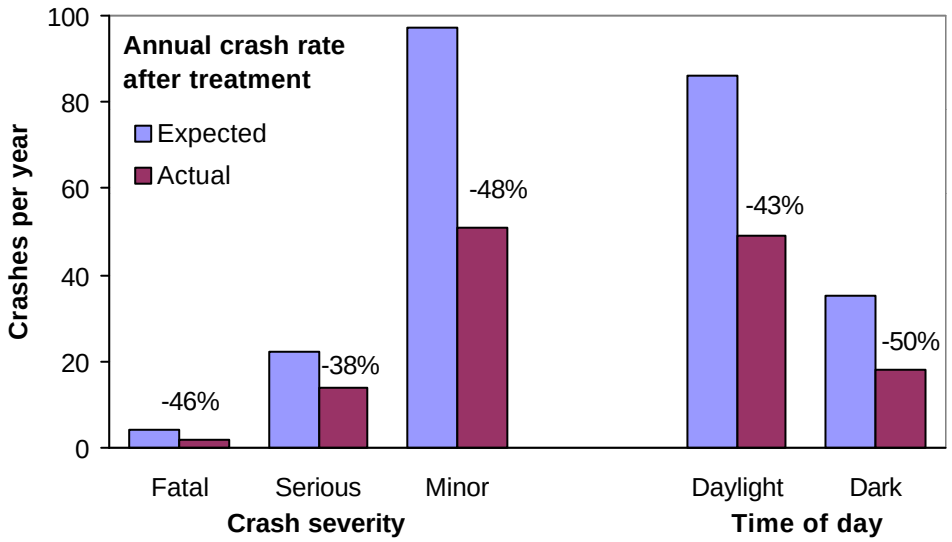


Table 3. Crash reductions at sites overall and by site type

	Number of sites	Expected annual crashes after treatment	Actual annual crashes after treatment	% reduction in injury crashes[3]
All intersections	134	120	67	44
Site type				
Local roads	99	84	46	45
State highways	35	36	22	41
Speed limit area				
Open road	27	26	16	38
Urban roads	107	94	51	45
Urban local roads	91	77	42	45
Urban State H'ways	16	16	9	46
Intersection type				
X-intersections	87	75	43	43
T-intersections	31	25	13	48
Other intersections	16	19	11	42

Table 4. Crash reductions at intersection sites by crash type

	Number of sites	Expected annual crashes after treatment	Actual annual crashes after treatment	% reduction in injury crashes[3]
Light conditions				
Daylight	134	86	49	43
Dark/ twilight	126	35	18	50
Movement group				
Rear end/ obstruction	91	12	7	45
Crossing	95	57	25	57
Turning	110	30	21	31
Pedestrian	39	8	3	61*
Lost control	70	10	7	37*
Crash severity				
Fatal	44	4	2	46*
Serious	108	22	14	38
Minor	134	97	51	48

*Reductions marked * are based on small numbers of crashes and should be treated with caution.*

[3] Percentage reduction includes adjustment for underlying crash trends, as described in *5. Controlling for crash trends.*