

# RIGHT TURN TREATMENT

October 1994

## Executive Summary:

This report is an analysis of sites where right turn treatment was implemented - that is, where right turn bays were installed and/or right turn markings were painted. The overall accident reduction at the 37 sites included in this analysis was **33%**. The analysis is based on injury accidents only at the sites. (Note that this includes fatalities).

More specifically, analysis of the data showed that there were four movement types over-represented in accidents in comparison to other movement types, at sites where right turn treatment was suggested. These movement types were: turning accidents (both 'J-type' movements and 'L-type' movements), and rear-end and overtaking accidents which involved right turning traffic. See Appendix C for a list of movement types and associated movement codes. The reduction

(after right turn treatment) in 'J-type' turning accidents was 15%, reduction in 'L-type' turning accidents was 43 %, reduction in rear-end accidents was 64%, and reduction in overtaking accidents was 71%.

Other works may have been actioned at sites which had right turn treatment. The calculations do not attempt to account for the contribution of any particular other action (treatment) but simply show the reduction at the sites which did include right turn treatment.

The reductions in specific movement types which can be expected by undertaking right turn treatment, are shown in Figure 1.

The data used for analysis is from the Land Transport Safety Authority Accident Investigation Monitoring System. It is expected that this analysis will be repeated in the future as more data is available.

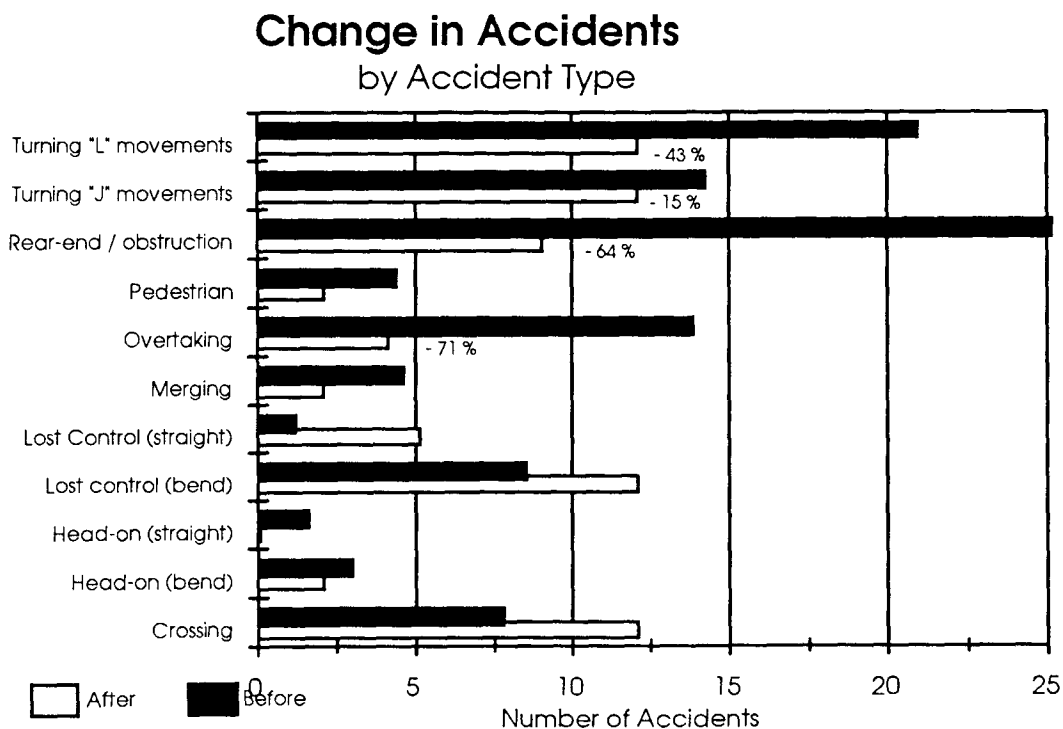


Figure 1

## 1. Introduction

In 1985, the government approved a programme of systematic accident investigation. The proposal was to establish accident investigation teams to undertake a "continuing programme of systematic accident investigation" of all heavily trafficked roads in New Zealand. The purpose of the investigation was to propose and implement low cost engineering methods to improve the roads and decrease traffic accidents on those roads.

As part of this programme, in 1989 a Monitoring System was developed to monitor the effects of the low cost improvements at the treated sites. There is now sufficient "after" data to produce some analysis of those effects.

## 2. Site Selection:

This report analyses the effect of right turn treatment. Right turn treatment includes sites where right turn bays have been installed and/or right turn markings have been painted.

However, it should be noted that at accident investigation sites it is rare that a single treatment will be chosen in isolation. Rather, a package of measures will be chosen to address the accident problem and it is often not possible to precisely isolate the effect of any one of the measures.

To reduce the potential dominating effect of major changes at a site, those sites which had any of the following measures were excluded from the sample:

- traffic signals
- changes to kerbs, traffic islands, etc.
- road lighting
- changes of priority
- changes to the geometric alignment

In all, there were 37 sites selected which met these criteria, where right turn treatment was applied.

The five most frequent other actions at those sites were:

- Install signs (10 sites)
- Paint edgeline (7 sites)
- Move sign (5 sites)
- Paint continuity line (5 sites)

There were an average of 3 actions implemented at each of these sites.

## 3. Control

Accident trends in New Zealand overall will have some effect on the accident changes resulting at the treated sites. A method was devised to take account of these trends.

Accidents at all intersections in New Zealand was used as the control.

For each site (x) a control is calculated which is the ratio of the average number of intersection accidents for a similar after period to the average number of intersection accidents in a similar before period to that site.

For example, a site with a before period of 1980-84 and an after period of 1986-93 had a control of the ratio of the average number of accidents at intersections in the period 1986-93 to the average number of accidents at intersections in the period of 1980-84.

Eg:

	Before		After
80	4197	86	5417
81	4362	87	5257
82	4635	88	5093
83	4743	89	4873
84	<u>5130</u>	90	4956
Total	23067	91	4686
		92	4456
		93	<u>4069</u>
		Total	38807

$$\text{Before (x)} = 23067/5 = 4613.4$$

$$\text{After (x)} = 38807/8 = 4850.9$$

The control for that particular site (x) would then be the ratio of the control after (x) rate for that site, to the control before (x) rate for that site.

$$\text{Control (x)} = \frac{\text{after (x)}}{\text{before (x)}}$$

$$= \frac{4850.9}{4613.4}$$

$$= 1.052$$

Because the control factor uses all intersection sites in New Zealand, and this includes treated

intersection sites, there is a possibility that the after accidents in the control factor are smaller than they would be had these sites been excluded. This then decreases the control factor, and Expected After, which then may result in a lower reduction being calculated at the sites. However, it is expected that this effect overall would be small.

The numbers in Appendix A show the reduction at individual sites, which have been calculated using the control as above.

#### 4. Analysis:

The overall accident change at each site was calculated as:

$$E(x) \text{ After} = \text{before} \times \text{control} \times \frac{\text{after years}}{\text{before years}}$$

*After* = after accidents

$$\text{Change} = - \frac{(\text{sum } E(x) \text{ after} - \text{sum after})}{\text{sum } E(x) \text{ after}} \times 100$$

where

*E(x) After* is the expected number of after accidents, assuming the treatment had no effect.

*Before ax* is the actual number of before accidents.

*Control* is the number calculated as shown.

*After* is the actual number of after accidents which occurred.

*Before years* is the number of years in the before period.

*After years* is the number of years in the after period (after implementation).

Note that a negative *Change* is a reduction in accidents.

Figure 2 shows the overall change in accidents.

#### 5. Regression-to-Mean:

Regression-to-Mean is a recognised phenomena inherent in before and after studies. There is no definitive method for coping with these effects and it is not in the scope of this report to determine those effects. As more research is done on the subject, later reports may incorporate some of those findings.

#### 6. Accident / Crash Reduction:

##### a) Overall:

The mean accident reduction at these sites was 33%. The first quartile accident reduction was 100% and the third quartile accident reduction was 18.3%. Therefore, at 75% of the sites which had right turn treatment, there was an accident reduction of at least 18.3%. The median reduction was 90%. Figure 3 shows the range of accident reduction at the sites.

At seven of the 37 sites there was an increase in accident numbers.

**Before/After Comparison**  
Right Turn Treatment

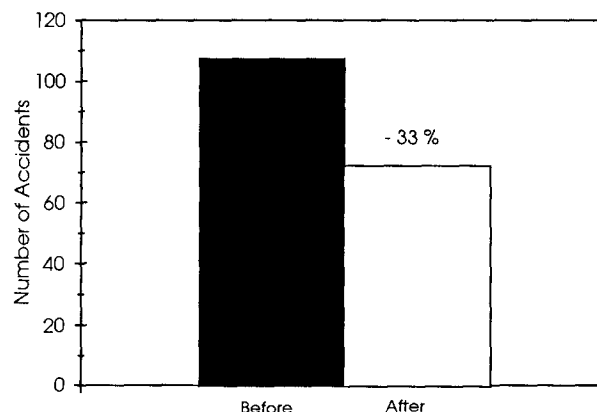


Figure 2

**b) By movement type:**

The accident movement types were grouped into the twelve "problem categories" used in the Accident Investigation Monitoring System Coding Manual, Version 2.0. These problem categories are:

- all / general
- overtaking
- head-on (bend)
- head-on (straight)
- lost control (bend)
- lost control (straight)
- rear-end/obstruction
- crossing
- turning - 'J-type' movements
- 'L-type' movements
- merging
- pedestrian
- other

Not all these accident types were represented at the sites which had right turn treatment.

The most common accident types at the sites in the "before" period accidents were: turning accidents - 'J-type' accidents (22 accidents), turning accidents - 'L-type' accidents (45 accidents), rear-end/ obstruction accidents (51 accidents), and overtaking accidents (27 accidents).

The changes in those three accident types were:

Accident type	Before	Expected After	After	Change	Accident Savings
'J-type'	22	14.1	12	-15.2%	2
'L-type'	45	20.9	12	-42.6%	9
rear-end	51	25.0	9	-64.0%	16
overtaking	27	13.7	4	-70.8%	10

Figure 1 shows the change in the number of accidents of each movement group represented at the sites with right turn treatment.

Appendix B contains the data relevant to that figure.

**7. Recommendation**

It is recommended that right turn treatment be considered at intersections which have a high proportion of:

- rear-end accidents due to right turning vehicles
- overtaking accidents due to right turning vehicles
- right turning accidents, especially 'L-type' movements

**Accident Reduction at Treated Sites**

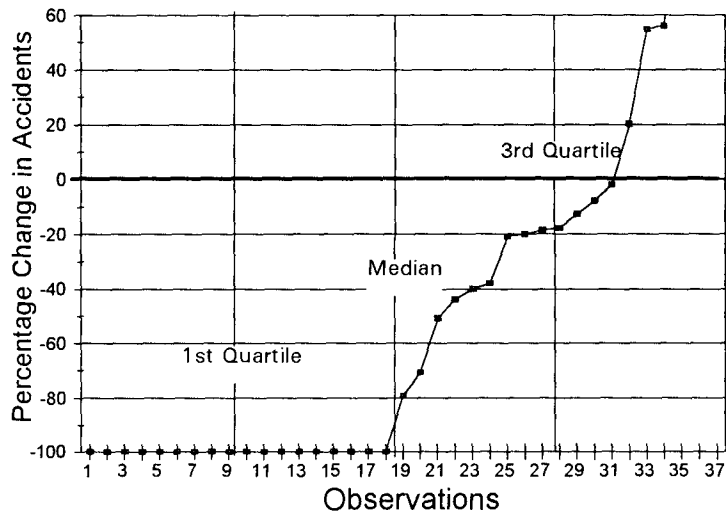


Figure 3

## APPENDIX A Data at Sites with Right Turn Treatment

OBS	IDNO	TYPE	ROADCNTL	BEFORE	DURING	AFTER	EXPAFTER	BYEARS	DYEARS	AYEARS	SITEREDU
1	125	I	2	5	.	0	2.787	5	1.7500	3.250	-100.000
2	404	I	2	5	8	3	5.352	5	2.4165	5.583	-43.949
3	516	I	1	7	.	11	10.871	5	0.0000	8.000	1.185
4	904	I	1	3	1	0	2.757	5	2.0000	5.000	-100.000
5	1202	I	1	4	2	0	2.491	5	2.4165	3.583	-100.000
6	1404	I	1	6	5	12	4.118	6	1.4165	4.583	191.375
7	1408	I	1	11	1	5	5.006	6	2.9165	3.083	-0.123
8	1422	I	1	10	.	5	6.239	6	1.8333	4.166	-19.865
9	3112	I	2	4	.	0	2.143	5	2.9165	3.083	-100.000
10	3605	I	1	3	.	1	1.264	5	3.5000	2.500	-20.878
11	3715	I	1	5	1	0	2.387	5	3.1665	2.833	-100.000
12	3824	I	1	5	2	1	0.833	5	2.0000	1.000	20.099
13	3916	I	1	5	.	0	3.001	5	1.5000	3.500	-100.000
14	5003	I	1	3	.	2	1.290	5	0.5000	2.500	54.998
15	5201	I	1	7	3	1	1.612	5	2.5830	1.417	-37.951
16	41228	I	1	6	1	1	4.805	5	3.7500	4.250	-79.188
17	41607	I	1	3	.	0	1.886	5	1.3333	3.667	-100.000
18	41618	I	1	3	.	0	1.801	5	1.5000	3.500	-100.000
19	41754	I	1	4	1	3	3.056	5	1.6665	4.333	-1.841
20	41802	I	2	4	.	3	3.432	5	2.2500	4.750	-12.589
21	41804	I	2	5	.	2	4.064	5	2.5000	4.500	-50.791
22	41906	I	1	7	.	0	4.937	5	2.0000	4.000	-100.000
23	42309	I	1	7	.	0	4.562	5	2.2500	3.750	-100.000
24	42316	I	1	5	1	2	3.331	5	2.1665	3.833	-39.956
25	42904	I	1	7	3	6	3.007	5	2.4165	2.583	99.556
26	43020	I	1	5	3	3	3.673	5	1.8333	4.166	-18.325
27	43104	I	1	3	2	0	0.269	5	4.4160	0.583	-100.000
28	43602	I	1	2	.	2	0.672	5	2.0000	2.000	197.763
29	44106	I	2	3	1	0	0.874	5	1.2500	1.750	-100.000
30	44112	I	2	6	.	1	1.082	5	1.9165	1.083	-7.610
31	44206	I	1	7	1	0	0.742	5	2.3330	0.667	-100.000
32	45405	I	1	6	.	0	2.739	6	0.0000	3.000	-100.000
33	47911	I	2	3	.	0	0.380	5	0.2500	0.750	-100.000
34	47912	I	2	4	.	0	1.464	5	0.0000	2.000	-100.000
35	70302	I	1	4	2	7	4.488	5	1.0000	6.000	55.984
36	71006	I	2	5	1	1	3.412	5	3.1665	3.833	-70.693
37	73607	I	2	15	9	0	0.596	5	2.7500	0.250	-100.000
				=====	=====	=====	=====	=====	=====	=====	
				197	48	72	107.426	189	73.6633	119.328	

- OBS** = observation number  
**IDNO** = monitoring system identification number  
  
**TYPE "I"** = Intersection Site  
**ROADCNTL** = Road Controlling Authority  
 1 = Local Authority  
 2 = Transit New Zealand  
  
**BEFORE** = actual number of before accidents  
**DURING** = actual number of during accidents  
**AFTER** = actual number of after accidents  
**EXPAFTER** = expected after accidents, calculated using the control method described  
  
**BYEARS** = number of before years (ie study period)  
**DYEARS** = number of during years. Note that where dyears is negative actions have been implemented in the study period (ie not as part of the Accident Investigation study)  
**AYEARS** = number of after years (ie after implementation)  
  
**SITEREDU** = accident change for site

## APPENDIX B Accident Change by Movement Type

OBS	MVMT	BEFORE	EXPECTED AFTER	AFTER	CHANGE
1	Crossing	11	7.6995	12	+ 55.9
2	Head-on (bend)	4	2.9185	2	- 31.5
4	Head-on (straight)	1	1.5530	0	-100.0
3	Lost control (bend)	11	8.3918	12	+ 43.0
4	Lost control (straight)	3	1.1859	5	+321.6
5	Merging	6	4.4980	2	- 55.5
6	Overtaking	27	13.7204	4	- 70.8
7	Pedestrian	11	4.3324	2	- 53.8
8	Rear-end obstruction	51	24.9999	9	- 64.0
9	Turning 'J'-type	22	14.1428	12	- 15.2
10	Turning 'L'-type	45	20.8954	12	- 42.6

**MVMT** = Accident movement type  
**BEFORE** = total number of before accidents  
**EXPECTED AFTER** = total number of expected after accidents  
**AFTER** = total number of after accidents  
**CHANGE** = change in accidents numbers (ie difference between expected after and after accidents.

## APPENDIX C Movement Codes

Movement type	Associated Movement Codes
OVERTAKING	AA, AB, AC, AD, AE, AF, AG, GE, GB
HEAD-ON (bend)	BB, BC, BD
HEAD-ON (straight)	BA
LOST CONTROL (bend)	DA, DB, DC, BE (curve)
LOST CONTROL (straight)	CA, CB, CC, BE (straight)
REAR-END/OBSTRUCTION	EA, EB, EC, ED, FA, FB, FC, FD, FE, FF, GA, GC, GD, GF, MA, MB, MC, MD, ME
CROSSING	HA, HB, HC
TURNING - 'J-type'	JA, JB, JC, JD, JE
- 'L-type'	LA, LB
MERGING	KA, KB, KC
PEDESTRIAN	NA, NB, NC, ND, NE, NF, NG, PA, PB, PC, PD, PE, PF
OTHER	QA, QB, QC, QD, QE, QF, QG

See the Accident Investigation Monitoring System Coding Manual, Version 2.0, Appendix A for a more complete description of the above movement codes.