LAND transportsafety AUTHORITY

INSTALL PEDESTRIAN REFUGE AND/OR BULBOUS KERBS

December 1994

Executive Summary

Pedestrian refuges (also known as central islands) and bulbous kerbs (also known as kerb extensions) are usually installed to reduce pedestrian accidents. They provide a crossing point which is visible to drivers, and where pedestrians can wait for an interruption in traffic flow before continuing across the road.

The following paper analyses the effect of installing pedestrian refuges and bulbous kerbs on pedestrian accidents. Overall, use of either or both of these treatments can be expected to reduce pedestrian accidents by about **32 %.** The range of the reduction varies from **18 %** to **37 %,** depending on the combination of treatments installed. (see Figure 1)

Other works may have been implemented at the treated sites, in addition to the installation of pedestrian refuges and/or bulbous kerbs. The reduction calculations do not attempt to account for the contribution of any other treatment.

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 becomes available.

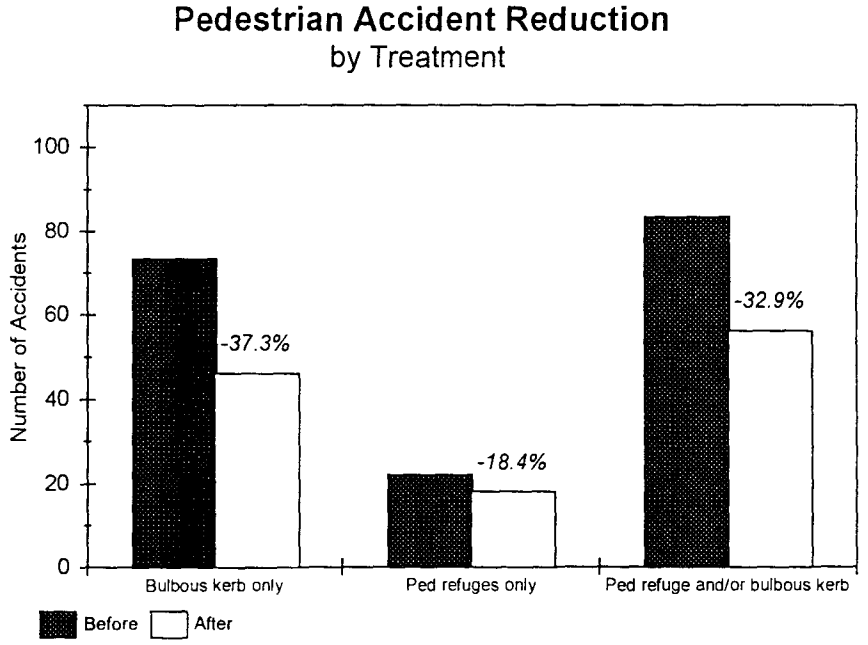

Figure 1

Introduction

In 1985, the government approved a programme of systematic accident investigation. The Land Transport Safety Authority (formerly the Ministry of Transport) developed an Accident Investigation Monitoring System in 1989, which contains data on sites which have had works implemented as part of the joint accident investigation programme. The "after" data on this database is now sufficient to allow analysis of the effects of specific "actions" or treatments at sites.

Site Selection

This report is on analysis of the effect of pedestrian refuges and bulbous kerbs in reducing pedestrian accidents. Separate reductions were found for each of these treatments as well as an overall reduction for sites where either or both treatments were implemented.

The criteria for selection were:

1. site fully implemented
2. pedestrian refuge installed and/or bulbous kerbs installed; and
3. there were pedestrian accidents in the before period at the site

Sites were excluded where changes to or installation of traffic signals were implemented and/or changes to or installation of street lighting occurred. It was assumed that these actions might have a greater effect on accidents than the installation of a pedestrian refuge and/or bulbous kerb. Sites where pedestrian crossings were installed were also not included as these are a slightly different issue and need to be evaluated separately.

Using the criteria of installing either a pedestrian refuge and/or bulbous kerbs, there were 60 sites. At 9 of those sites both a pedestrian refuge and bulbous kerbs were installed.

There were 18 sites where only pedestrian refuges were installed, ie no bulbous kerbs. At 33 sites only bulbous kerbs were installed, ie no pedestrian refuges. At 4 of the sites there were pedestrian crossings already present.

At 40 of the 60 sites where pedestrian refuges and / or bulbous kerbs were installed, the road controlling authority was the local authority. TNZ was the road controlling authority for the other 20 sites.

Other works were also implemented at the sites where pedestrian refuges or bulbous kerbs were installed. There were an average of 5 actions implemented at each of the treated sites. The most common other action implemented were:

Install sign (29 sites)
Paint edgeline (15 sites)
Paint flush median (15 sites)
Paint lane makings - right turn (10 sites)
Install RRPMs (9 sites)

Control

Accident trends in New Zealand overall have some effect on the accident changes at the treated sites. The following method was devised to take account of accident trends and accident rates around the country.

Accidents in each region in New Zealand can be classed as having a high, medium or low growth rate. As well, the urban / rural location will affect the accident trend. A control factor is thus calculated for the urban and rural area of each region.

The control factor is applied to the number of before accidents at each site on the monitoring system, depending on the urban/ rural/regional location of that site. This gives the number of expected after accidents, assuming that the recommended treatments would have no effect.

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

Analysis

The overall accident change at each site was calculated as:

$$\text{Expected} = \text{before} \times \bullet \text{ control} \bullet \frac{\text{after years}}{\text{before years}}$$

After = after accidents

Multiplying by the ratio of after years to before years adjusts for the difference in before and after time periods.

$$\text{Change} = -\frac{(\text{sum Expected} - \text{sum after}) \bullet 100}{\text{sum Expected}}$$

where

Expected 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 factor calculated by accident rate and urban/rural /regional location.

After is the actual number of after accidents which occurred.

Before years is the number of years in the before period (study years).

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

Note that a negative Change is a reduction in accidents.

Regression-to-Mean

Regression-to-Mean is a recognised phenomenon inherent in before and after studies. There is no definitive method for coping with this effect 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.

Crash Reduction

a) Pedestrian accidents

The reduction in pedestrian accidents using the combined data (pedestrian refuge and /or bulbous kerb installed) was **32 %.**

At sites where pedestrian refuges were installed but no bulbous kerbs were installed, the reduction was **18.4 %.**

At sites where bulbous kerbs were installed but no pedestrian refuges, the accident reduction was **37.3 %.**

Table 1 summarises the reduction in pedestrian accidents by treatment type:

Therefore, the installation of pedestrian refuges and/or bulbous kerbs can be expected to reduce pedestrian accidents by around **32 %.**

b) Overall

The mean accident reduction (all accident types) at these sites was 23.0 %. However, as installation of pedestrian refuges and/or bulbous kerbs are mainly intended to reduce pedestrian accidents, it was not expected that these treatments would have as great an effect on other accidents.

At 14 of the 60 sites there was an increase in accident numbers.

Table 1. Accident Savings at Treated Sites

Treatment Type	No. Sites	Before (actual)	Expected (After)	After (actual)	Pedestrian Accident Reduction	Accident Savings (actual)
Bulbous kerb only	33	141	73.3	46	- 37.3 %	95
Pedestrian refuges only	18	36	22.1	18	- 18.4 %	18
Bulbous kerbs and/or pedestrian refuges	60	156	83.5	56	- 32.9 %	100

APPENDIX A Data at Sites with Pedestrian Refuges / Bulbous Kerbs Installed

OBS	IDNO	TYPE	ROADCNTL	BEFORE	DURING	AFTER	EXPECTED	BYEARS	DYEARS	AYEARS	SITEREDU
1	128	R	2	15	1	3	6.563	5	3.083	1.917	-54.290
2	131	R	2	11	8	1	1.235	5	2.500	0.500	-19.027
3	427	I	2	7	4	2	7.964	5	3.333	4.666	-74.887
4	509	I	1	4	.	5	6.604	5	0.500	6.500	-24.284
5	908	R	1	12	7	14	15.405	5	2.000	5.000	-9.122
6	1102	I	2	1	1	1	0.506	5	2.583	4.416	97.771
7	1106	I	2	11	5	3	5.038	5	3.000	4.000	-40.453
8	2905	R	1	27	25	0	1.677	5	4.500	0.500	-100.000
9	2906	R	1	19	13	2	1.180	5	4.500	0.500	69.467
10	2908	R	1	52	31	6	10.648	5	3.333	1.667	-43.653
11	2909	R	1	45	28	3	2.795	5	4.500	0.500	7.329
12	2912	R	1	44	15	7	9.462	5	3.250	1.750	-26.017
13	2914	R	1	77	17	33	31.523	5	1.750	3.250	4.687
14	3507	R	1	15	1	5	6.563	5	3.083	1.917	-23.817
15	3510	R	1	11	8	1	1.235	5	2.500	0.500	-19.027
16	3718	R	1	55	36	23	25.386	5	3.250	2.750	-9.400
17	3723	R	1	68	43	17	31.387	5	3.250	2.750	-45.837
18	3911	I	1	3	3	0	0.233	5	4.500	0.500	-100.000
19	40101	R	2	6	1	6	10.023	5	0.833	8.166	-40.136
20	40608	R	1	6	3	5	6.685	5	2.083	5.916	-25.206
21	40708	I	1	3	1	4	3.249	5	2.250	5.750	23.126
22	40713	R	1	5	2	2	5.749	5	2.000	6.000	-65.213
23	40723	I	1	4	3	0	4.268	5	2.333	5.666	-100.000
24	40908	R	2	24	12	25	21.848	5	2.000	5.000	14.426
25	41105	I	2	4	1	2	3.466	5	2.167	4.833	-42.292
26	41106	I	2	4	1	0	3.406	5	2.250	4.750	-100.000
27	41107	N	2	5	1	3	4.108	5	2.417	4.583	-26.973
28	41213	I	1	6	4	4	2.908	5	5.250	2.750	37.532
29	41233	I	1	6	6	6	5.377	5	3.167	4.833	11.579
30	41605	I	1	5	1	2	1.529	5	2.500	2.500	30.826
31	41720	R	1	39	11	17	30.295	5	2.667	4.333	-43.885
32	41807	I	2	4	1	0	3.286	5	2.417	4.583	-100.000
33	41911	I	1	4	1	0	1.655	5	2.417	3.583	-100.000
34	42013	I	2	5	.	1	4.615	5	2.333	3.667	-78.330
35	42014	I	2	3	.	2	2.769	5	2.333	3.667	-27.766
36	42326	I	1	6	1	4	3.922	5	2.250	3.750	1.996
37	42505	R	2	7	2	3	1.962	5	3.500	2.500	52.934
38	42513	N	2	5	3	0	2.238	5	3.333	2.667	-100.000
39	42711	I	1	9	4	1	2.548	5	4.250	1.750	-60.756
40	42910	I	1	5	.	2	1.335	5	3.333	1.667	49.807
41	42913	R	1	47	4	49	38.348	5	0.333	4.666	27.776
42	42917	R	1	70	22	32	33.934	5	2.083	2.917	-5.700
43	43004	I	1	8	3	0	4.880	5	2.500	3.500	-100.000
44	43107	I	1	3	.	1	1.205	5	2.583	2.417	-17.012
45	43701	I	1	6	.	2	2.917	5	0.167	2.833	-31.446
46	44210	R	1	32	24	4	2.570	5	2.500	0.500	55.666
47	45404	I	1	7	.	6	2.114	6	-0.083	2.083	183.870
48	46703	I	1	9	1	2	4.280	5	3.167	2.833	-53.266
49	46717	I	1	14	2	7	9.464	5	1.083	3.917	-26.039
50	46721	I	1	19	4	2	15.097	5	1.500	4.500	-86.753
51	46729	I	1	13	5	1	3.047	5	1.583	1.417	-67.176
52	70303	R	2	10	3	11	15.239	5	1.000	6.000	-27.818
53	70806	R	2	10	8	1	2.265	5	6.666	1.333	-55.856
54	70946	I	1	6	.	5	5.468	7	2.000	5.000	-8.561
55	70966	I	1	3	1	1	2.734	7	2.000	5.000	-63.424
56	70990	N	2	5	.	2	5.012	7	1.500	5.500	-60.099
57	70992	I	1	2	1	1	1.823	7	2.000	5.000	-45.136
58	71508	I	1	9	6	2	2.043	5	3.583	1.417	-2.085
59	71703	R	2	5	2	2	2.589	5	2.000	3.000	-22.755
60	71910	I	2	8	.	0	2.058	5	2.833	1.167	-100.000
				928	391	346	449.733	309	154.493	201.491	

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IDNO= monitoring system identification number

Type = site type
I = intersection
R = route
N = non-intersection

ROADCNTL = Road Controlling Authority
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BEFORE = actual number of before accidents
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5	908	R	1	12	7	14	15.405	5	2.000	5.000	-9.122
6	1102	I	2	1	1	1	0.506	5	2.583	4.416	97.771
7	1106	I	2	11	5	3	5.038	5	3.000	4.000	-40.453
8	2905	R	1	27	25	0	1.677	5	4.500	0.500	-100.000
9	2906	R	1	19	13	2	1.180	5	4.500	0.500	69.467
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54	70946	I	1	6	.	5	5.468	7	2.000	5.000	-8.561
55	70966	I	1	3	1	1	2.734	7	2.000	5.000	-63.424
56	70990	N	2	5	.	2	5.012	7	1.500	5.500	-60.099
57	70992	I	1	2	1	1	1.823	7	2.000	5.000	-45.136
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