LAND transportsafety AUTHORITY

INSTALL FLUSH MEDIAN

March 1995

Executive Summary

Flush medians (also referred to as painted or hatched medians) have been used sparingly for many years on New Zealand roads. Their purpose generally is to reduce conflict, encourage improved vehicle lateral placement, and lower speeds by reducing carriageway width on wide roads.

Flush medians are now also used on arterial and sub-arterial roads where property access needs to be maintained, and where removing turning vehicles from the through traffic streams will improve safety. They also provide pedestrians with a place to pause while crossing two traffic streams, and general separation for safety improvement.

The following paper analyses the effect of installing flush medians. The data used for analysis are from the Land Transport Safety Authority Accident Investigation Monitoring System.

Certain types of accidents are expected to be reduced by this treatment: turning accidents (LB) , G-type accidents (turning vs same direction), overtaking accidents and pedestrian accidents. From the sites studied, LB accidents were reduced by **19.5 %,** G-type accidents were reduced by **66.3 %,** overtaking accidents were reduced by **28.9 %,** and pedestrian accidents were reduced by **30.2 %.** Overall there was a **19 %** decrease in accidents at those sites.

Other works may have been implemented at the treated sites, in addition to the installation of flush medians. Sites where traffic lights were installed and/or changed or where street lighting was installed and/or changed were not included in the site selection. The reduction calculations do not attempt to account for the contribution of other treatments.

It is expected that this analysis will be repeated in the future as more data becomes available.

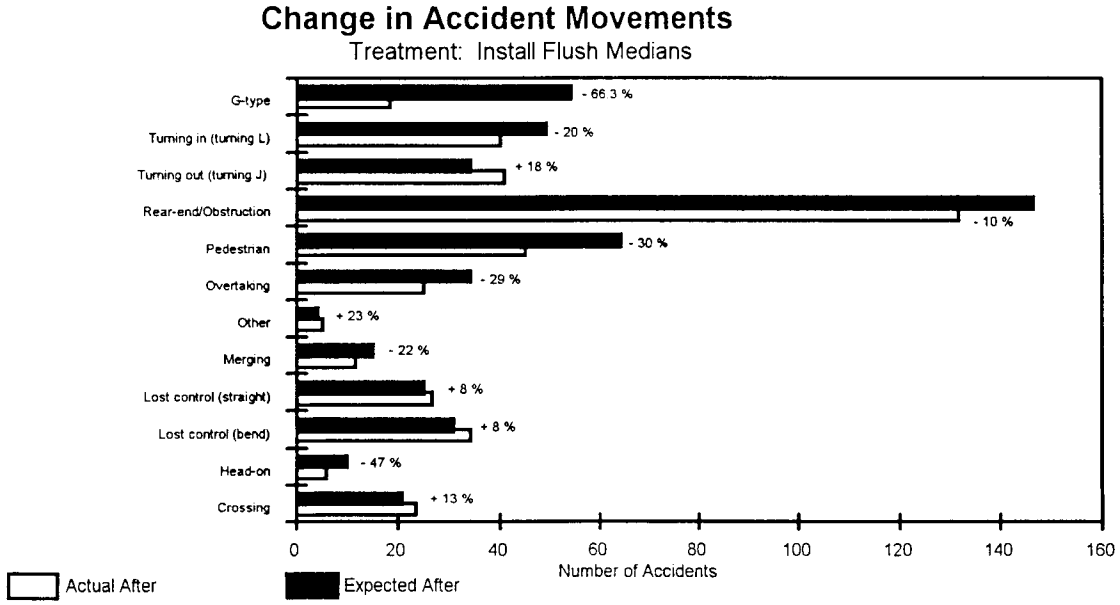

Figure 1

The following table summarises the reduction in accidents by Accident type:

Table 1: Reduction in Accident by Movement Codes

Accident Type	Includes Movements	Before (actual)	Expected After	Actual After	Accident Reduction
G-type	GA, GB, GC, GD, GE	123	53.4	18	- 66.3
Right turn in (turning L)	LB	105	48.4	39	- 19.6
Right turn out (turning J)	JA, JB, JC, JD, JE	86	33.8	40	+ 18.3
Rear-end/Obstruction	EA, EB, EC, ED, FA, FB, FC, FD, FE, FF, GA, GC, GD, GF, MA, MB, MC, MD, ME	342	146.1	131	- 10.4
Pedestrian	NA, NB, NC, ND, NE, NF, NG, PA, PB, PC, PD, PE, PF	126	63.0	44	- 30.2
Overtaking	AA, AB, AC, AD, AE, AF, AG, GE, GB	82	33.7	24	+ 28.9
Other	QA, QB, QC, QD, QE, QF, QG,	7	3.3	4	+ 22.6
Merging	KA, KB, KC	34	14.2	11	- 22.4
Lost Control (straight)	CA, CB, CC, BE	54	24.0	26	+ 8.4
Lost Control (bend)	DA, DB, DC	72	30.4	33	+ 8.5
Head-on	BA, BB, BC, BD	27	9.5	5	- 47.2
Head-on (bend)	BB, BC, BD	5	1.8	3	+ 67.8
Crossing	HA, HB, HC	49	10.4	23	+ 12.8

Note that although the G-type movements have been repeated in the "Rear-end/ obstruction category, analysis was done separately for each grouping to avoid double-counting of accidents

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 an analysis of the effect of installing flush medians on accidents, and specifically on turning accidents, G-type accidents, overtaking accidents, and pedestrian accidents.

The criteria for selection were:

1. site fully implemented
2. "route" site
3. flush median installed
4. no traffic signal changes; and
5. no lighting changes

Sites were excluded from the analysis where changes to or installation of traffic signals were implemented and/or changes to or installation of street lighting occurred. It was assumed that this may have a greater effect on accidents than the installation of a flush median.

Using the above criteria, 40 sites were selected. At 17 of those sites a pedestrian refuge and/or bulbous kerbs was also installed.

At 25 of the 40 sites the road controlling authority was the local authority. TNZ was the road controlling authority at the other 15 sites. Thirty sites were in 50 km/h speed limit areas, 5 sites were in 70 km/h speed limit areas, and 5 sites were in 100 km/h speed limit areas.

Other works were also implemented at the sites where flush medians were installed. There were an average of 5 actions implemented at each of the treated sites. The most common other actions implemented were:

Install signs (21 sites)
Install bulbous kerb (14 sites)
Paint edgeline (12 sites)
Paint/install right turn bay (12 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 each region, taking the urban / rural location into account.

The control factor is applied to the number of before accidents at each site on the monitoring system, depending on the urban/ rural/region 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. These reductions have been calculated using the control as described as above.

Analysis

The overall accident change at each site was calculated as:

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

After = after accidents

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

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

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.

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. However, research does show that as the number of years used for analysis are increased, regression-to-mean will have a lesser effect. Data used for analysis of the effects of installing flush medians have an average before period of 5.1 years and an average after period of 2.65 years. Therefore, regression-to-mean would not be considered to have a great effect on the results calculated.

Crash Reduction - All Data

a) Turning accidents (L-type)

The reduction in turning accidents was **19.5 %.**

LB accidents occurred at 29 sites in the before period. At 23 of these sites there was a reduction in LB accidents. There was only 1 site where an LA accident occurred.

b) Turning accidents (G-type - turning vs same direction) type Accidents

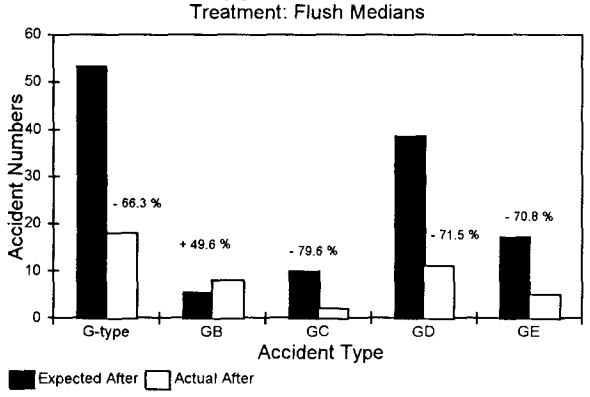

Figure 2

The reduction in G-type accidents was **66.3 %.**

G-type accidents occurred at 32 sites in the before period. At 29 of these sites there was a reduction in G-type accidents. GE accidents were present at 16 of the sites in the before period. These were reduced by 70.8 %. GD accidents were reduced by 71.5 %, GC accidents were reduced by 79.6 %, and GB accidents were increased by 49.6 %.

c) Overtaking Accidents

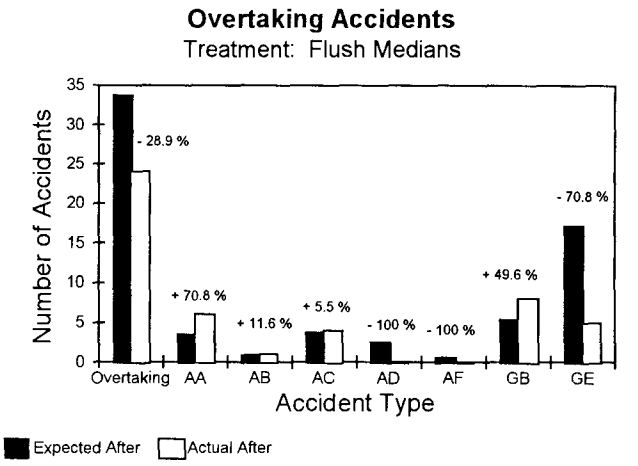

Figure 3

The reduction in overtaking accidents was **28.9 %.**

Overtaking accidents occurred at 21 sites in the before period. Overtaking accidents were reduced at 16 of those sites. At 2 sites the overtaking accidents increased, while at three sites the number of overtaking accidents remained the same.

d) Pedestrian accidents

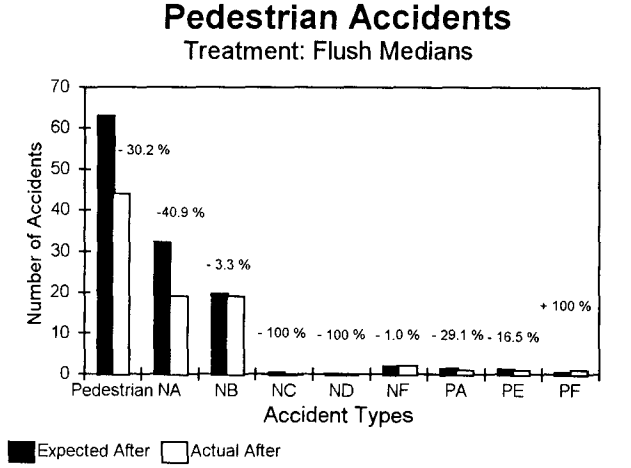

Figure 4

The reduction in pedestrian accidents was **30.0 %.**

Pedestrian accidents occurred at 30 sites in the before period. At 26 of those sites the pedestrian accidents were reduced, while at the other 4 sites the number of pedestrian accidents was unchanged.

There were 17 sites where either pedestiran refuges and/or bulbous kerbs were installed as well as flush medians. At 14 of those sites the number of pedestiran accidents was reduced, while at the remaining 3 sites the number of pedestrian accidents remained the same.

Crash Reduction - by Speed Limit

The data was split into sites with 50, 70, and 100 km/h speed limits. The overall accident reduction at sites with a 50 km/h speed limit was 19.8 %. Accidents were reduced by 7.7 % where the speed limit was 70 km/h and by 33.5 % where the speed limit was 100 km/h.

Table 2

Speed Limit	ExpAfter	After	Reduction
50 km/h	330.3	265	- 19.8 %
70 km/h	55.3	51	- 7.7 %
100 km/h	30.1	20	- 33.5 %

by Speed Limit and movement type

For each of the movement groups above, the data was again first split into 50, 70, and 100 km/h sites. This limits the number of each type of accident in each grouping, so the results must be read with caution. Small numbers of accidents may result in large reductions through very little change in the number of accidents.

a) L-type accidents

At the 60 km/h sites, L-type accidents were reduced by 19.2 %. These accidents were reduced by 1.5 % at 70 km/h sites, and by 100 % at 100 km/h sites.

Table 3 shows the number of before, expected, and after accidents for each of the speed limits, and accident reduction.

Table 3

Speed Limit	Before (actual)	Expected After	Actual After	Accident Reduction
50 km/h	88	42.1	34	- 19.2 %
70 km/h	11	5.1	5	- 1.5 %
100 km/h	7	1.9	0	- 100 %

b) Turning accidents (G-type - turning vs same direction)

G-type accidents were reduced by 57.7 % at 50 km/h sites, by 61.6 % at 70 km/h sites, and by 73.9 % at 100 km/h sites.

Table 4 shows the details for reductions in G-type accidents.

Table 4

Speed Limit	Before (actual)	Expected After	Actual After	Accident Reduction
50 km/h	141	59.1	25	- 57.7 %
70 km/h	28	13.0	5	- 61.6 %
100 km/h	10	3.8	1	- 73.9 %

c) Overtaking accidents

Overtaking accidents were reduced by 20.3 % at 50 km/h sites, by 44.4 % at 70 km/h sites, and by 69.7 % at 100 km/h sites.

Table 5 shows the details for reductions in G-type accidents

Table 5

Speed Limit	Before (actual)	Expected After	Actual After	Accident Reduction
50 km/h	61	25.1	20	- 20.3 %
70 km/h	11	5.4	3	- 44.4 %
100 km/h	10	3.3	1	- 69.7 $

d) Pedestrian Accidents

Pedestrian accidents were reduced by 30.9 % at 50 km/h sites, by 6.0 % at 70 km/h sites, and by 63.6 % at 100 km/h sites.

Table 6 shows the details for reductions in pedestrian accidents.

Table 6

Speed Limit	Before (actual)	Expected After	Actual After	Accident Reduction
50 km/h	105	55.0	38	- 30.7 %
70 km/h	13	5.3	5	- 6.0 %
100 km/h	8	2.8	1	- 63.6 %

APPENDIX A Data at Sites with Flush Medians Installed

speed limit=50

OBS	IDNO	STUDYNAM	SITENAME	ROADCNTL	SPEED	BEFORE	DURING	AFTER	EXPAFTER	BYEARS	DYEARS	AYEARS	SITEREDU
1	128	SH1 STUDY 2	89 R1: SH1: CENTREWAY - MOENUI	2	50	15	1	4	8.365	5	3.0830	2.4165	-52.181
2	131	SH1 STUDY 2	89 R3: SH1: NOEL - MOENUI	2	50	11	8	1	2.451	5	2.5000	1.0000	-59.193
3	731	SH1 STUDY 22	REGENT ST/ ELLERY ST	2	50	15	6	11	19.477	5	2.5000	5.0000	-43.522
4	1209	TAUPO BOROUGH	SPA RD - NUKUHAU ST - ROTOKAWA	1	50	22	9	10	14.643	5	2.6665	3.8330	-31.708
5	1213	TAUPO BOROUGH	RIFLE RANGE RD (WHAKAIPO)	1	50	13	5	3	8.653	5	2.6665	3.8330	-65.329
6	1403	HAMILTON CITY	GREY ST (GRIDGE ST - COBHAM DR	1	50	33	12	22	25.695	6	1.2500	5.2500	-14.382
7	1907	MT EDEN	R3:MT EDEN RD(LANDSCAPE-BALMORAL	1	50	27	6	16	23.744	5	1.5000	5.0000	-32.614
8	2801	TAMAKI	PILKINGTON: QUEENS-TAMAKI STATION	1	50	13	5	4	6.549	5	3.5000	3.0000	-38.925
9	2802	TAMAKI	JELLICOE: DUNLOP-DUNN	1	50	9	2	7	4.534	5	3.5000	3.0000	54.385
10	2814	TAMAKI	CARBINE: PANAMA-WAIPUNA	1	50	25	11	8	13.294	5	3.3330	3.1665	-39.822
11	2817	TAMAKI	MT WELLINGTON: HAMLIN-ARANUI	1	50	31	25	6	9.274	5	4.6660	1.8333	-35.300
12	2819	TAMAKI	MT WELLINGTON: MONAHAN-PORTAGE	1	50	26	18	11	13.461	5	3.4165	3.0830	-18.283
13	2905	ROTORUA URBAN	R1: CLAYTON ROAD	1	50	27	25	2	3.351	5	4.5000	1.0000	-40.308
14	2907	ROTORUA URBAN	R3: LAKE ROAD (EXCLUDING RANOLF ST	1	50	20	13	6	6.197	5	3.0000	2.5000	-3.178
15	2908	ROTORUA URBAN	R4: OLD TAUPO ROAD	1	50	52	31	7	13.931	5	3.3330	2.1665	-49.752
16	2909	ROTORUA URBAN	R5: MALFROY ROAD	1	50	45	28	3	5.584	5	4.5000	1.0000	-46.278
17	2912	ROTORUA URBAN	R8: FAIRY SPRINGS ROAD	1	50	44	15	10	12.242	5	3.2500	2.2500	-18.314
18	3124	SH1 STUDY 25/1	TIRAU	2	50	7	4	4	2.592	5	3.2500	3.2500	54.311
19	3723	TAURANGA PT1	R7: CAMERON RD (CHADWICK-16TH)	1	50	68	43	19	37.113	5	3.2500	3.2500	-48.805
20	3844	WAITAKERE CITY AIS 1991	RIMU ST (LYNWOOD - RATA)	1	50	22	8	5	7.014	5	2.0000	1.5000	-28.712
21	4611	SH16 AI STUDY	HUAPAI	2	50	14	12	0	0.812	5	4.2500	0.2500	-100.000
22	5009	TAURANGA PT2	R1: MAUNGANUI RD (PACIFIC-HEWL	1	50	35	5	11	12.163	5	1.4165	2.0830	-9.558
23	7506	SOUTH WAIKATO AI REPORT	R6: BRIDGE STREET (SH1-PAPANUI)	1	50	9	3	0	1.251	5	2.5830	0.9166	-100.000
24	41617	PORIRUA WEST	MAIN/DIMOCK	1	50	5	1	2	2.600	5	1.4165	4.0830	-23.088
25	42913	NELSON CITY	R1: MAIN RD STOKE (SH6)	1	50	47	4	54	42.287	5	0.3333	5.1660	27.699
26	43218	WANGANUI CITY	HEADS ROAD	1	50	7	.	0	3.686	5	2.3330	3.1665	-100.000
27	43223	WANGANUI CITY	R1: GLASGOW/SOMME	1	50	36	17	25	17.959	5	2.5000	3.0000	39.204
28	44210	NAPIER CITY PT2	R4: KENNEDY RD R1	1	50	32	24	11	5.265	5	2.5000	1.0000	108.922
29	70806	SH1 STUDY 10	AMBERLEY TOWNSHIP	2	50	10	8	1	3.144	5	6.6660	1.8333	-68.190
30	71703	SH6 94 99 STUDY 29	SH1 WINTON	2	50	5	2	2	3.009	5	2.0000	3.5000	-33.536
						725	351	265	330.338	151	87.6629	82.3302	

speed limit=70

OBS	IDNO	STUDYNAM	SITENAME	ROADCNTL	SPEED	BEFORE	DURING	AFTER	EXPAFTER	BYEARS	DYEARS	AYEARS	SITEREDU
31	207	SH3 STUDY 3	ARAWATA ST - TE AWAMUTU	2	70	8	7	2	2.8991	5	6.2500	3.2500	-31.013
32	2914	ROTORUA URBAN	R1: TE NGAE ROAD (SALA - ALFRED)	1	70	77	17	40	36.7794	5	1.7500	3.7500	8.756
33	42608	SH3 STUDY 28	NORMANBY	2	70	9	2	6	8.5476	5	2.7500	3.7500	-29.805
34	70506	SH1 STUDY 20	HAMILTON PARK - MATAURA RIVER	2	70	16	2	3	4.7911	8	2.4165	4.0830	-37.384
35	73620	CHCH CITY STATE HIGHWAY	SH1 NEAR RADCLIFFE	2	70	11	3	0	2.2624	5	2.2500	1.2500	-100.000
						121	31	51	55.2796	28	15.4165	16.0830	

speed limit=100

OBS	IDNO	STUDYNAM	SITENAME	ROADCNTL	SPEED	BEFORE	DURING	AFTER	EXPAFTER	BYEARS	DYEARS	AYEARS	SITEREDU
36	3110	SH1 STUDY 25/1	NTH & STH OF KELLY ROAD (S10&1	2	100	8	2	1	5.921	5	3.167	3.333	-83.112
37	6002	ROTORUA RURAL	HAMURANA RD/NGONGATAHA VILLAGE	1	100	48	15	14	18.747	5	1.583	1.917	-25.320
38	9602	SH3 RUKUHIA	R2: RUKUHIA STATION RD	2	100	12	1	0	0.198	5	1.417	0.083	-100.000
39	72906	CHCH SH1 JOHNS/RUSSLEY	JOHNS GARDINERS-WILKINSONS	2	100	10	1	2	3.492	6	0.417	2.083	-42.727
40	73605	CHCH CITY STATE HIGHWAY	SH1 FRASER-MCFADDENS	2	100	8	7	3	1.716	5	2.417	1.083	74.856
						86	26	20	30.073	26	8.999	8.499	