

The Effect on Vehicle Speeds of Electronically-Signed Part-Time Speed Limits Outside Schools

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Abstract

In January 2000 the Christchurch City Council and Transit New Zealand installed trial "School Zones" outside five primary or intermediate schools in Christchurch. These zones had permanently-displayed fluoro warning signs and part-time 40 km/hr speed limits imposed by electronically-operated, illuminated signs.

As part of the evaluation of the trial, speeds of free-running vehicles travelling past the schools were measured at the school crossing point using a concealed laser gun.

The results showed that the permanent fluoro yellow-green warning signs had little or no lasting effect on speeds unless the school was not readily visible from the road. Good speed reductions (down to mean speeds around 40-42 km/hr) were achieved with the illuminated signs but these reductions were only sustained at times when there were children present on the roadside.

On two lane, two way roads with manned crossing points, mean vehicle speeds past the crossing point could be reduced to 40-42 km/hr using the illuminated speed limit signs if they were not already at that level.

1.0 Introduction

At the beginning of the school year in January 2000 the Christchurch City Council and Transit New Zealand installed "school zones" with part-time 40 km/hr speed limits outside five primary or intermediate schools in Christchurch. The main objective of the zones was to change peoples' perceptions of safety in the area of the schools to the extent that they would allow their children to walk or cycle to school rather than drive them to school.

The signs used for the school speed zones have a similar layout to that for a road works zone with signs at each end and warning signs for the crossing point in between. Most of the signs are permanently displayed fluoro yellow-green signs to indicate to motorists that there is a "School Zone" for up to 200 metres either side of the children's crossing point outside the school. There are also electronically-operated, illuminated 40 km/hr speed limit signs that are displayed only when children are travelling to and from school. This means that the signs are normally turned on between about 8:25 a.m. and 9:00 a.m. and then between about 2:50 p.m. and 3:15 p.m. These times are referred to as the "sign times" throughout this paper. Minor side roads intersecting with the main road within the school zones were signed with permanent signs indicating the times of the 40 km/hr speed limit.

As its part in the evaluation of the trial, the Land Transport Safety Authority carried out surveys to find out the effect of the "school zones" on vehicle speeds past the school crossing points. This paper provides a description of the results rather than an analysis.

2.0 Survey Method

Speed surveys were conducted at each of the schools with trial sites and at three control sites where no school zones had been installed. The characteristics of each of these sites are shown in Table 1.

Table 1. Characteristics of Trial Sites and Control Sites

	Road Classification	Road Type	Underlying Speed Limit	Crossing Point Type
<u>Trial Sites</u>				
Belfast School	Major Arterial	Four lane, median divided	60 km/hr	Kea Crossing
Bishopdale School	Major Arterial	Two lane, two way	50 km/hr	School patrol
Branston Intermediate	Collector	Two lane, two way	50 km/hr	One kerb bulge only
Halswell School	Minor Arterial	Two lane, two way	60 km/hr	Kea Crossing
Harewood School	Major Arterial	Two lane, two way	70 km/hr	Kerb bulges and school warden
<u>Control Sites</u>				
Breens Rd Intermediate	Collector	Two lane, two way	50 km/hr	One kerb bulge, school warden (a.m. only)
Redwood School	Minor Arterial	Two lane, two way	50 km/hr	Kea Crossing
Westburn School	Minor Arterial	Two lane, two way	50 km/hr	School Patrol

Speed surveys were carried out at each school using a concealed laser gun operated from a car parked on the roadside. Speeds of free-running vehicles travelling past the school were measured at, or as close as possible to, the school crossing point. Speeds were measured separately for light vehicles and heavy vehicles and for each traffic lane.

Three series of surveys were conducted:

- ?? “Before” surveys in November/December 1999,
- ?? “Interim After” surveys in March 2000, about one month after the zones were implemented, and
- ?? “After” surveys in November/December 2000.

For each school, the “Interim After” surveys and the “After” surveys were done on the same day of the week as the “Before” surveys. The “After” surveys were also done in approximately the same week of the year as the “Before” surveys. Five or six series of surveys were done at each school in each of the “Before”, “Interim After” and “After” periods.

Survey times were based around the operation of the school patrol or warden at the school crossing point and the “sign times” detailed above (when the illuminated speed limit signs were operating at the trial sites during the “Interim After” and the “After” surveys). Both morning and afternoon, the survey periods were split into:

- ?? a period of at least 20 minutes before the “sign times”,
- ?? where applicable, the period during the “sign times” when there was no patrol or warden operating,
- ?? the period during the “sign times” when the patrol or warden was operating, and
- ?? a period of at least 20 minutes after the “sign times”.

These surveys allowed evaluation of the effect on vehicle speeds of the following measures at each trial site:

- ?? the patrol or warden at the crossing point without any additional signs,
- ?? the permanent fluoro warning signs on their own,
- ?? the permanent warning signs with the electronic speed limit signs illuminated, and
- ?? the permanent warning signs, illuminated signs and patrol or warden all together.

3.0 Results

To provide a simplified picture of what happened to vehicle speeds at each trial site, the survey results have been aggregated in this paper. In particular:

- ?? heavy vehicle speeds have been included with light vehicle speeds,
- ?? speeds have been averaged for each series of surveys at each school, and
- ?? speeds for each lane and direction of traffic have been combined.

No statistical tests were performed on these aggregated results.

3.1 Effect of School Patrol or Wardens Alone

The effect on vehicle speeds of the school patrol, school warden or simply the congregation of a number of school children without any special signing can be demonstrated by the survey results from the “Before” period.

Table 2 uses speeds measured during the “sign times” at each school to evaluate this effect.

Table 2 Effects on Vehicle Speeds of Patrol, Warden or Children Alone.

	Mean Speeds (No Patrol) (km/hr)	Mean Speeds (with Patrol) (km/hr)	Reduction in Mean Speed with Patrol	85%ile Speeds (No Patrol)	85%ile Speeds (with Patrol)	Reduction in 85%ile Speed with Patrol
<u>Trial Sites</u>						
Belfast School	58.5	50.6	7.9	63.9	57.1	6.8
Bishopdale School	52.8	44.7	8.1	57.2	50.0	7.2
Branston Intermediate	55.5*	52.3	3.2	60.5*	57.8	2.7
Halswell School	54.9	45.4	9.5	60.5	51.8	8.7
Harewood School	61.5	48.3	13.2	67.5	56.7	10.8
<u>Control Sites</u>						
Breens Rd Intermediate	54.3*	46.7	7.6	60.4*	52.8	7.6
Redwood School	52.0	41.2	10.8	57.1	47.1	10.0
Westburn School	51.3*	41.7	9.6	56.2*	46.3	9.9

*- no “sign times” results are available for these schools so speeds measured immediately prior to the “sign times” are used instead.

Table 2 shows that reductions in mean speeds of around 8 – 10 km/hr were achieved when a patrol, warden or children were present on the roadside. Smaller reductions were evident in the 85th percentile speeds. Mean speeds showed a greater reduction at Harewood School where speeds were initially higher because of the higher underlying speed limit.

3.2 Effect of the Permanent Fluoro Yellow-Green Warning Signs

Table 3 uses speeds measured in each of the “Before”, “Interim After” and “After” periods prior to the “sign times” at each school to evaluate the effect on speeds of the permanent warning signs that were installed. The results from surveys immediately after the “sign times” show the same patterns.

Table 3 Effects on Vehicle Speeds of Permanent Warning Signs Alone

	Mean Speeds (Before) (km/hr)	Mean Speeds (Interim) (km/hr)	Mean Speeds (After) (km/hr)	85%ile Speeds (Before)	85%ile Speeds (Interim)	85%ile Speeds (After)
<u>Trial Sites</u>						
Belfast School	60.2	58.7	60.0	64.9	64.0	65.1
Bishopdale School	53.5	51.9	52.8	57.9	56.5	57.0
Branston Intermediate	55.5	52.4	53.0	60.5	57.8	58.7
Halswell School	54.8	54.4	56.7	61.4	60.3	62.2
Harewood School	65.6	60.7	59.9	74.0	67.9	68.2
<u>Control Sites</u>						
Breens Rd Intermediate	54.3	54.9	54.0	60.4	61.1	59.2
Redwood School	54.8	54.7	54.8	61.0	61.0	60.2
Westburn School	51.3	50.0	51.6**	56.2	54.7	56.7**

** - permanent fluoro yellow-green warning signs (but no electronic speed limit signs) were erected at Westburn School between the “Interim After” and the “After” surveys.

Table 3 shows that the permanent warning signs had a small initial effect, reducing mean and 85th percentile speeds slightly at most schools.

The speed reductions were not sustained except at Harewood School (where a reduction of around 6 km/hr was sustained) and Branston Intermediate (where there was still a slight reduction evident during the “After” surveys.)

This could be because Harewood School is in a semi-rural area (with a higher speed limit) and the school is not readily visible from the road. Branston Intermediate is also not readily visible but has a longer road frontage than Harewood School. Speeds actually increased at two schools where the signs were installed.

3.3 Effect of the Permanent Fluoro Yellow-Green Warning Signs plus Electronic Speed Limit Signs

Table 4 uses speeds measured during the “sign times” without patrols, wardens or groups of children present to evaluate the effects of all the school zone signs with the speed limit signs activated.

Table 4 Effects on Vehicle Speeds of Permanent Warning Signs plus Electronic Speed Limit Signs

	Mean Speeds (Before) (km/hr)	Mean Speeds (Interim) (km/hr)	Mean Speeds (After) (km/hr)	85%ile Speeds (Before)	85%ile Speeds (Interim)	85%ile Speeds (After)
<u>Trial Sites</u>						
Belfast School	58.5	44.9	46.9	63.9	51.3	53.6
Bishopdale School	52.8	42.1	46.1	57.2	46.5	52.8
Branston Intermediate	55.5*	43.2	45.2	60.5*	47.5	52.3
Halswell School	54.9	42.3	44.8	60.5	46.6	50.9
Harewood School	61.5	50.9	47.9	67.5	60.5	57.4
<u>Control Sites</u>						
Breens Rd Intermediate	54.3*	-	51.6	60.4*	-	59.0
Redwood School	52.0	49.2	50.2	57.1	56.0	56.7
Westburn School	51.3*	-	-	56.2*	-	-

Table 4 shows that an initial reduction of 10 – 14 km/hr in mean and 85th percentile speeds had not been sustained through to the “After” surveys, except at Harewood School again. At the other schools these reductions were only 7 – 12 km/hr at the time of the “After” surveys. However, speeds past Harewood School did remain higher than speeds past the other schools.

3.3 Effect of the Permanent Warning Signs, Electronic Signs and the Presence of Children

Table 5 **Effects on Vehicle Speeds of Permanent Warning Signs plus Electronic Speed Limit Signs plus Patrol, Warden or Children**

	Mean Speeds (Before) (km/hr)	Mean Speeds (Interim) (km/hr)	Mean Speeds (After) (km/hr)	85%ile Speeds (Before)	85%ile Speeds (Interim)	85%ile Speeds (After)
<u>Trial Sites</u>						
Belfast School	50.6	40.0	42.2	57.1	44.6	47.5
Bishopdale School	44.7	38.6	39.2	50.0	43.3	43.7
Branston Intermediate	52.3	41.5	42.1	57.8	48.5	48.0
Halswell School	45.4	39.7	40.4	51.8	44.1	44.6
Harewood School	48.3	41.3	41.2	56.7	47.5	47.6
<u>Control Sites</u>						
Breens Rd Intermediate	46.7	47.5	47.0	52.8	53.3	53.5
Redwood School	41.2	40.1	42.2	47.1	47.8	47.2
Westburn School	41.7	40.1	39.9	46.3	44.8	46.8

Table 5 compares speeds during “sign times” in the “Before” period (with patrols, wardens or other children present) with “sign times” speeds in the “Interim After” and “After” periods when all measures were present. It clearly shows that, at all trial sites, there was a cumulative effect on reducing speeds when all measures are used simultaneously. There were additional reductions of 6-12 km/hr in both mean and 85th percentile speeds that were largely sustained from the “Interim After” surveys until the “After” surveys, except for Belfast School.

It is worth noting that the mean speeds at the two control sites with school patrols or kea crossings (Redwood School and Westburn School) were very similar to those at the trial sites when the crossing point was operating. However, 85th percentile speeds were up to 4 km/hr less at the two comparable trial sites (Bishopdale School and Halswell School.)

4.0 Other Observations

In addition to measuring speeds at the survey sites there were two other subjective observations made by the surveyors:

- ?? With the electronic speed limit signs illuminated, vehicles slowed at the signs while they slowed much closer to the crossing point when there were no signs or the signs were not illuminated.
- ?? At busy two lane, two way sites with illuminated signs, traffic slowing at the signs often caused “bunching” which made it more difficult for the school patrol to find suitable gaps in the traffic.

5.0 Conclusions and Recommendations

This paper has not evaluated the extent to which the school speed zones met their major objective – to get children to change their mode of travel to school. However, based on the evaluation of their effect on vehicle speeds, the following conclusions can be reached:

- ?? Permanent fluoro yellow-green warning signs have little or no lasting effect on speeds unless the school is not readily visible from the road.
- ?? Speed reductions achieved with the electronic signs illuminated and no patrol, warden or children present were slightly higher than those achieved with a patrol, warden or children and no electronic signs.
- ?? When there were no children present, the speed reducing effect of the permanent signs plus the illuminated signs was not sustained over time.
- ?? The greatest speed reductions (to mean speeds of around 40-42 km/hr) were achieved with the combined effect of the permanent signs, electronic signs and children present. These reductions were largely sustained over time.
- ?? At schools with manned crossing points on two-lane two way roads, those with illuminated speed limit signs achieved slightly lower 85th percentile speeds than those without illuminated signs.

Again based on measurement of vehicle speeds alone it is recommended that:

- ?? Permanent fluoro yellow-green warning signs need to be used only outside schools that are not readily visible from the road. The signs would be more effective in alerting motorists if they were displayed only when children wanted to cross the road.
- ?? Part-time 40 km/hr speed limits implemented using illuminated electronic signs could be used to reduce speeds past schools without a manned crossing point (school patrol or kea crossing) and on roads with a speed limit of 60 km/hr or 70 km/hr.
- ?? At schools with manned crossing points on two lane, two way roads with a 50 km/hr speed limit, part-time 40 km/hr speed limits implemented using illuminated electronic signs could be used to achieve further speed reductions where the mean vehicle speed (with children present) is somewhat higher than 42 km/hr.
- ?? The times that the electronic signs are illuminated should be reviewed, especially if further indicator surveys show a continued increase in speeds when the signs are switched on but no children are present.
- ?? Following from the previous point, more work needs to be done to establish the minimum number of children crossing the road that is needed to make the part-time speed limits effective.

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