Walking School Bus Networks: A "Flaxroots" Approach to Cleaner Air

Dr Carolyn O'Fallon[1], Dr Charles Sullivan[2] and Paul Cottam[3]
[1] Pinnacle Research, PO Box 3058, Wellington, New Zealand
[2] Capital Research, 31 Gloucester Street, Wilton, Wellington, New Zealand
[3]Christchurch City Council, PO Box 237, Christchurch, New Zealand

Summary

A Walking School Bus (WSB) is an alternative method for children to travel to and from school. Adult volunteers walk a set route to school, collecting children from designated stops along the way. In 2000, we trialed WSB "networks" at 4 schools in Christchurch, New Zealand, to address the trend of increasing numbers of children being driven to school and the congestion, air pollution, and safety problems that go with it. Our evaluation shows that WSB networks are a clear success because nearly 10% of the children are regular users. Over 60% of these children had previously been driven to and from school. Furthermore, the WSB networks led to reduced petrol consumption and CO_2 emissions, saved parents time, and increased physical activity levels for everyone involved. They were self-sustaining even after a 2-month summer break. Our guidelines are being distributed by government organisations and have been used to establish new WSB networks in Christchurch and other New Zealand cities.

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1. Introduction

A significant and growing component of road network congestion before 9 a.m. is caused by parents / caregivers driving their children to school. Anecdotal New Zealand-based evidence suggests that as much as 20-40% of the early morning traffic stream is a result of this, and survey results from Victoria, Australia provide more concrete evidence that "at 8.50 in the morning in term time, cars chauffeuring children to schools make up in the order of 20% of all cars on urban roads" (Morris et al. 2001). Traffic congestion contributes to environmental degradation, increased vehicle operating costs including fuel consumption, increased driver stress and time spent travelling, and so on.

The 1997/98 New Zealand Household Travel Survey (LTSA 2000) confirms that 53% of the trips from home to school by primary school students are as car passengers. For the same trips by high school students, the figure is approximately 43%. The survey showed that around *twice as many* trips of this type were being made in 1997/98 as in the 1989/90 survey.

In 1999, Pinnacle Research, in collaboration with BRC Marketing and Social Research, conducted a survey of 128 Auckland and Wellington parents / caregivers who regularly drive their children to school but are not on their way to work.

The main purpose of the survey was to gauge parent / caregiver response to their child/ren using alternative methods, such as walking school buses, to the car for travelling to and from school. We described a walking school bus (WSB) as having an adult walking along a set route to school, collecting children from designated stops along the way. After school, they walk back the same route. The service is free and a co-ordinator helps to organise volunteers. Parents are not required to volunteer to "drive" the WSB. We also set a limit of 10 children per adult.[1]

The WSB concept attracted considerable interest: 33 of 69 families (48%) living within 2 km of the school said they would use a WSB at least three days per week. This prompted us to conclude that the WSB had the potential to make a significant impact on how children travel to and from school in New Zealand.

Internationally, there had not been any attempts to test how far the WSB concept could be taken to address the trend of increasing numbers of children being driven to school (and the congestion, air pollution, and safety problems that go with it). At the time, in New Zealand, there were three WSBs established in Christchurch,

[1] We later revised this figure to a maximum of 8 children per adult, based on international experience, particularly in the UK.

involving 3-5 families each and one much larger WSB, with about 30 children, in Auckland.

We designed a trial to establish WSB networks at four schools in Christchurch, New Zealand. A WSB "network" is similar to a regular motorised bus network. Based on family interest, several "routes" are established to and from school, (volunteer) "drivers" are organised, and children are taken on as "passengers" at designated "stops".

The remainder of this paper discusses, in brief, the Christchurch-based trial and evaluation. A more complete discussion and evaluation of the trial has been made available elsewhere (O'Fallon, 2001).

Section 2 addresses the setting up process, while section 3 discusses the evaluation. Section 4 offers the conclusions.

2. WSB Networks Trial

2.1. Initial Survey

The schools approached to participate in the trial were a reasonable cross-section of schools, both by socio-economic status (as indicated by a "decile rating" where 1 is the lowest socio-economic stratum and 10 the highest) and by size of school. The 4 schools are shown in Table 1 below.

Table 1 Schools in the WSB Trial

School	Decile Rating	School Roll (at Feb 2000)
Beckenham	6	430
Gilberthorpe	2	135
Paparoa Street	10	485
Wairekei	6	184
Total		1234

The self-completion survey distributed to families of all children attending the 4 schools had to be simple as well as to meet multiple needs (i.e. collect quantifiable data for our research, provide information for organising walking school bus routes and act as a potential model for WSB guidelines). The survey was distributed with a covering letter on each school's regular "newsletter day". Reminder notices were inserted in subsequent newsletters and completed questionnaires were returned to the school.

We achieved a response rate of 30% across the 4 schools and, not surprisingly, the returned surveys tended to have a favourable response to WSBs. In all, the positive response involved 231 of 1234 children (19%) in the 4 schools. Better initial responses may be achieved in the future, given that the WSB network concept is now proven rather than a novelty, and by using a shorter questionnaire (no longer needing the questions to estimate impact).

2.2. Establishing the WSB Networks

Our first task on receiving the surveys was to determine the potential to establish WSB networks at any or all of the schools surveyed.

The survey asked if the respondent was willing for their child/ren to participate in a WSB as well as if they or another adult in the household would volunteer to "drive" the WSB. If a positive response was given to either of these queries, further questions sought information as to when and in what conditions would their child/ren use the WSB and when and how often an adult would be willing to be a driver.

Nearly one-half (49%) of the parents who said their children would use the WSB also volunteered to help drive the WSB. If, at the time of the survey, parents drove more than one child to school / kindergarten or were on their way to work, they were much less likely to volunteer to be a WSB driver.

Using maps obtained from the city council, we mapped the location of each child and adult volunteer. We were then able to assess where there was sufficient interest to establish a WSB in a neighbourhood and what route the WSB might follow.

We created "WSB route groups" and documented the potential participants' details on a "route information form" which was distributed at meetings held with interested families at each school. The meetings served several purposes, but in particular allowed families to sort out how the WSB would operate in their area, thus creating a sense of "ownership" of "their" WSB. Each route group also nominated a contact person.

The meetings had two unexpected (positive) outcomes – they attracted parents who had not completed surveys but who were interested in becoming involved in the WSB network and additional volunteer drivers were recruited.

After the meetings, it became clear that WSB routes could be launched at 3 of the 4 schools in the trial. Christchurch City Council sponsored a kit for participants, including sashes for the adults and children using the WSBs, both to create visibility for the project and as a road safety measure.

The WSB networks were launched on 1 September 2000. Families who lived on nominated routes were sent a 2-page handout informing them of the WSB schedule, volunteer driver and children's details and a few basic rules for WSB operation.

By November 2000, there were a total of 13 routes in operation (including one established prior to our trial).

2.3 WSB Non-Users

The 13 routes established had the potential to accommodate 134 of the 231 children whose parents expressed in an interest in participating in a WSB. The

principal reasons for all of the potential users not actually joining a WSB were:

- not enough children in a given area to form a WSB
- children & drivers too geographically dispersed within an area,
- not enough volunteer drivers to operate a WSB.

We also had 93 families return the initial survey who did not want to join a WSB. Their primary reasons for not wanting to participate included a preference to take their children to school themselves, living too close to the school (<0.5 km), too much traffic or traffic moving too quickly (2 schools had over 1000 vehicles passing on the main road outside the school between 8 and 9 a.m.), and living too far from the school (>2.0 km). Other studies have found that once the distance from school is >2.4 km (1.5 miles), it was very unlikely that children would walk to school (Morris et al., 2001).

3. Evaluating the Trial

3.1 Structure of the Evaluation

The evaluation process was in four stages, as we wanted to have a full understanding of the impact of the WSB networks and therefore needed to contact both current WSB users and non-users:

- A survey of contact people for each WSB route
- A survey of current WSB-using families
- A survey of non-using families (who showed initial interest)
- An afternoon focus group of contact people.

As in the initial survey, we distributed and collected the family surveys through the schools' newsletter systems. We had a response rate of 66% from families using the WSBs and a 46% response rate from non-using families (who could have joined a WSB but chose not to).

3.2 General Characteristics of the WSBs and their Users

We found that 112 children were using the 13 WSBs – 11% of the population from the 3 schools. Table 2 provides a summary of the WSBs and their operating characteristics. Most of the WSBs operate 5 mornings a week and half of them operate 4-5 afternoons as well. The remainder operate 1-2 days per week, both in the morning and the afternoon. About one-half of the WSBs operate in any kind of weather, while the remainder cancel when it is raining (although carpooling sometimes occurs as an alternative to walking).

Table 2 Summary of WSBs and their Operating Characteristics

	No. of WSBs	No. of Users	No. of days in operation			
			Every a.m. & p.m.	a.m. only	1-2 a.m. & p.m.	Go rain & shine
Beckenham*	3	20	2	-	-	2
Paparoa*	9	71	4	2	2	5
Gilberthorpe	1	21	-	1	-	0
Total	13	112	6	3	2	7

*Two of the WSBs at these schools did not provide any "operating" details.

Many of the buses had made changes to their operation, such as increasing the number of days the bus ran or adjusting the departure times or drivers' roster. These changes were made to fit changing needs and circumstances of WSB users and drivers and occurred without any external assistance.

All of the families using the WSBs lived less than 2 km from their local school, with 63% of them living less than 1 km from school. Prior to September 2000, 62% of the families usually drove their child/ren to and from school, with a small proportion (11%) of these using a carpooling arrangement with another family.

We found that those families who initially commit to having child/ren use, and parents drive, the WSB are more likely to become and remain actively involved in their neighbourhood WSB.

We were unable to make any distinction in the overall WSB use levels between the different decile schools, given the small number of schools involved.

3.3 Impact of the WSBs at the Trial Schools

Based on the responses to the after survey, we were able to determine both qualitative and quantifiable benefits arising from the implementation of the WSB networks at the 3 trial schools. In particular, we assessed the impact of the WSBs on car use and operating costs, global and local air emissions, parents' time, physical activity levels, social cohesion, and road safety. Each of these areas is discussed separately below.

3.3.1 Car Use and Operating Costs

Since September 2000, 62% of the families found that they were using their car *less* before 9 a.m. because of the WSB, and 17% said their car use was the same. *On average*, the families were each saving around 20 minutes of driving per week. This represents 14 hours per year per family (based on a 40 week school year and taking into account the fact that some families experienced no change in car use).

We have estimated a saving in petrol, per family[2], per 40-week school year, of approximately 120 litres. Across the 70 Christchurch families involved in the 13 WSBs, this represents as savings of 8400 litres of petrol per year.

3.3.2 Impact of WSBs on Global and Local Air Quality

A reduction in petrol use of 8,400 litres per year in Christchurch would result in 19.3 tonnes less CO_2 emitted. Given the relatively small number of people involved in the trial (compared to the overall population in Christchurch), this is a significant savings.

Cars "cold-started" and driven for short trips also contribute a greater share of other pollutants to the atmosphere, particularly carbon monoxide, nitrogen oxides and unburnt hydrocarbons. These "local" air pollutants are more significant in locations, such as Christchurch, which often have still weather conditions (pollutants do not disperse), temperature inversions, and stop/start operations (as is generally found in front of schools during morning and afternoon drop-offs and pick-ups). Given the nature of these pollutants, we have been unable to estimate any changes to emissions, except to note that, logically, emissions will decrease with less driving and fewer cold-starts occurring.

3.3.3 Parents' Time

Fifty-six percent (56%) of parents said they were spending less time taking child/ren to and from school – ranging from 10 minutes to 2 hours per week. 30% stated they were spending the same amount of time, while a further 14% said they were spending more time (usually <30 minutes) per week getting their children to and from school.

Overall, parents saved 24 minutes per week on average (this is a net result, taking into account those losing as well as those saving time).

3.3.4 Physical Activity Levels

In its 1998/99 Sports and Physical Activity Survey, the Hillary Commission (2000) found that 31% of young people (aged 5 to 18 years) were "inactive" – doing less than 2.5 hours of sport or physical activity per week. Overseas studies have found that children who have daily physical education or other physical activity perform better academically than those who are not active (John and Wake, 1999). In addition, for up to 2 hours after the physical activity, the children have better concentration and problem-solving capability, improved creativity, enhanced memory and learning capabilities, and improved mood state (Hillary Commission 1998). Finally, childhood is considered the best time to become physically active, as active adults are far more likely to have been active children (Morris et al., 2001).

The Hillary Commission (1998), with the National Health Committee, recommends a minimum of 30 minutes of physical activity of moderate intensity (for example, brisk walking) on most, if not all, days of the week. This activity can be taken in small "snacks" of 10 minutes each. Clearly, the WSBs have the potential to contribute to improved physical activity levels in both the children and parents who use them.

The evidence from our survey suggests that WSBs may be making a difference. One in three (31%) of the families reported that their child/ren's overall level of activity was higher because of using the WSB. This perception also suggests that the higher activity ratings in Table 3 occurring after the introduction of WSBs are not purely due to warmer weather later in the year. We also asked respondents to rate their *oldest* child's activity level in November 2000 and prior to the start up of the WSBs in September 2000 using a categorisation adapted from Bickerstaff and Shaw (2000):

- **Sedentary** – gets very little exercise. For example: walks or runs less than 1 km per day; spends most of his/her free time sitting, watching TV, using the computer or reading.
- **Moderately active –** gets some exercise. For example: walks or runs 1-2½ km per day; when not in school he/she spends more of his her time in active play than he/she does reading or watching TV.
- **Active** – is involved with programmed exercise 2 or 3 times per week. For example: soccer, basketball, athletics or walks / runs 2½ km or more per day.

This comparison of physical activity levels before and after the implementation of the WSBs reveals that there has been a distinct shift in the level of activity by 10 of the 41 children (see Table 3 below). That as many as 10 of the 11 changes in rated activity level should be in the direction of greater activity is clearly significant statistically, $p < 0.01$, binomial test.

[2]Based on an average driving speed of 50 km / hour and fuel use of 8 litres per 100 km. This estimate assumes that most trips are cold-started and short-distance (less than 7 kilometres) but does not take into account any savings in wear and tear of running a vehicle on very short trips.

Table 3 Comparison of Level of Activity Before and After WSB Network[3] (n=41)

	With WSB (Nov. 2000)		
Before WSB (Sept. 2000)	Sedentary	Moderate	Active
Sedentary	-	**6**	
Moderate	1	19	**4**
Active	-	-	11

3.3.5 Social Cohesion

Putnam (2000) has stated that car commuting is "demonstrably bad for community life." He cites evidence showing that each additional 10 minutes in daily car commuting time reduces involvement in community life (such as volunteer committees, attending church, helping at school) by 10%. Putnam (2000) posits that, after education, car commuting is the most important demographic factor in influencing community involvement.

In addition, children need to explore and experience their environment in order to develop their "sense of place" (John and Wake, 1999). The Hillary Commission (1998) notes that this "physical activity also helps to strengthen family bonds and build stronger communities through increasing social networks and developing community identity" (p.10).

Establishing the WSB networks in Christchurch resulted in parents spending less time overall "commuting" their children to and from school each week. Furthermore, when we asked what the children and the volunteer drivers liked about the WSBs, they identified the following main reasons:

- The sense of community belonging - meeting other parents and children in the neighbourhood, getting to know them and having regular interactions with them
- Being with the children – chatting and having a "relaxing, pleasant time together"
- Contributing to the community - being part of the WSB network: "taking my turn."

Walking school buses have a distinctive contribution to the re-creation of social cohesion in our communities.

3.4. Road Safety

Genuine concerns could be raised about whether or not we are putting children at increased risk of road accidents by encouraging them to walk to school. Many studies highlight that children are the most at-risk group in the pedestrian environment (see for example, Morris et al., 2001 and National Pedestrian Project, 2000). Indeed, children are most at risk immediately before or after school opening time, that is, on the journey to or from school (Morris et al., 2001). Not surprisingly, parents may be choosing to drive their children to reduce the risk of accidents – although, at the same time, they will be contributing to the increased risk of accidents for remaining pedestrians.

Further examination of accident statistics for children in Auckland reveals that most accidents (>60%) occurred while crossing the road, either mid-block or at intersections without crossings (National Pedestrian Project, 2000). Around 13% were injured on pedestrian crossings. Most crashes occurred on roads with more than 2900 vehicles per day and where traffic was travelling over the legal speed limit. Walking on the footpath or along the side of a road, even "playing" on the road – the majority of any walking trip – was quite safe (<10% of pedestrian crashes).

Increasing use of WSB networks can only help to improve child-related pedestrian safety statistics. Firstly, reducing traffic around the school will create a safer environment for pedestrians (and cyclists) to travel in. The presence of adult "drivers" to assist with road crossings will ensure that children take full account of the road conditions before crossing and that children stay on the safer confines of a footpath for as much of the journey as possible.

Naturally, other actions would make the road environment even safer for pedestrians, such as lowering speed limits around school zones, installing more pedestrian crossings, preferably with pedestrian-controlled signals or crossing guards, and ensuring that there are safe and pleasant footpaths available for pedestrian use. Having more people walking will put greater pressure on road controlling agencies to improve the pedestrian environment.

4. Extrapolation of Trial Results

We have derived illustrative benefits if WSB networks were extended to schools in the Christchurch, Wellington and Auckland regions. The 4 schools approached for the WSB network trial in Christchurch had around 1200 children enrolled, compared with approximately 150,000 children aged 5-10 years in the three regions (1996 Census). A conservative extrapolation from our evaluation (assuming that only 5% of children in all schools in the three regions participate in WSBs as opposed to the 10% rate we had in Christchurch) to the greater numbers of the three regions, suggest that impacts of roughly the following size could be achieved:

- 3900 families and 6300 children using WSBs
- 33000 child trips per week using WSBs
- 9300 car arrivals at school per week saved
- 293,000 litres of petrol per year saved
- 673 tonnes less CO_2 emitted

[3] To avoid multiple ratings from one parent, they rated only the oldest child in each household using the WSB.

- 1500 hours saved per week by parents who do not have to make trips to and from school.
- The value of the travel time saving (for drivers) for one year would be $550,000.[4]
- 1920 children with a higher level of physical activity noticeable by parents
- 690 fewer 'sedentary' children

These are conservative estimates of the benefits to be gained from creating WSBs networks in the three most heavily populated regions in New Zealand. In Christchurch, with very little promotion and only one advocate, we achieved 10% participation rates. The subsequent development of support material, such as guidelines and a promotional kit and the greater awareness of people able to facilitate development of WSB networks such as road safety, active living, junior sports and WSB Regional coordinators should achieve even higher participation rates.

Furthermore, at the time of the Christchurch trial, the WSB network concept was unproven. Now we can point to lasting local success (and with networks of WSBs, not just isolated groups of parents doing this). Secondly, our original research approach was heavily dependent on an initial self-completion survey. In the WSB guidelines, the preliminary forms to complete are much shorter than those described here because they only need to gather information required to organise WSBs, not the extra information needed for evaluation and research. Thirdly, the guidelines will allow WSB networks to be set up much more easily in the future.

5. Conclusions

Based on the results from the Christchurch trial, we developed guidelines for setting up WSB networks. Because of New Zealand-wide interest in the project, the guidelines *The Walking School Bus – A Guide for Parents and Teachers* (www.pinnacleresearch.co.nz) are available to anyone interested in establishing one or a whole network of WSBs. Two central government agencies are distributing it nationwide. Furthermore, two agencies have sponsored the development of a support kit for schools and others interested in establishing WSB networks.

Our evaluation shows that the networks have been a clear success. Ten weeks after launch, 13 WSBs involving 112 children were operating at 3 schools. That is, our simple, community-based, approach using a then unproven concept resulted in nearly 10% of the children at the trial schools regularly using WSBs. Over 60% of these children had previously been driven to and from school. Parents and children alike were enthusiastic about the WSB, saying they enjoyed the friendships, sense of community, exercise and knowing that the children were getting safely to and from school.

Even following the 2-month summer break, all of the bus routes started in September 2000 continued to operate and some grew. Over 1 year later, in 2002, there were 20 WSBs operating in 7 schools in Christchurch and about 40 more operating in the rest of New Zealand. This is a huge increase from mid-2000 when there were 4 WSBs in the whole country.

The potential impacts of WSB networks are significant and varied, including measurable reductions in fuel consumption and CO_2 emissions, less congestion and accidents around schools, better physical fitness, mental well-being and learning ability of children (and adults) and improved social cohesion of communities.

WSB networks do not provide the "total solution" to providing a safe alternative to the car for children travelling to and from school. They are principally useful to those living less than 2 km from school and are reliant on volunteer adult drivers to make them work. However, we have demonstrated that the "flax-roots" approach can capture community interest and is potentially sustainable.

What is required now is further investigation into alternatives for those who are unwilling to use WSBs and/or who may live further than 2 km away from school.

[4]Calculated for a 40-week school year using the composite value of travel time for "urban other (<7000 vpd)" on a weekday in Appendix A4 of the Evaluation Procedures for Alternatives to Roading (1999). The value for congestion was not included.

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