Sprucing up the Shop Window: Improving the Bus Stop Environment for Passengers, Pedestrians and Property Owners

Chris Harris
chris.harris@northshorecity.govt.nz

Abstract
Most public transport journeys begin at the local bus stop, yet this "shop window" of the passenger transport system has long been an unattractive, neglected and dirty one. Even the most detailed public transport textbooks contain little positive advice on the design of bus stops and shelters, other than their spacing. The threat to the health of old people imposed by requiring them to wait at poorly sheltered bus stops, for sporadic off peak services, attracts little attention. Nor is the possibility of integrating bus stops with traffic calming and pedestrian crossings often considered. The inappropriateness of internal-combustion engines for buses, given that heavy acceleration must occur near the bus stop, attracts little attention. Much time is also wasted in dealing with property owner objections, which largely derive from the substandard character of real world bus stops, and in finding safe locations for bus stops on roads without traffic calming. In this presentation, I will discuss North Shore City's experience with its bus shelter improvement programme and will also enlarge upon recent developments in electric bus transit and in the possibility of integrating bus stops with local pedestrian crossings and traffic calming, even on arterial roads.

Note: This paper is a practice review based on experience and ongoing innovation, and thus not fully academic in form.

Introduction

Anyone who has lived in Auckland over the last ten years is likely to have noticed an improvement in the appearance of bus shelters. Ten years ago, a shelter not much better than a chipboard packing crate was commonplace even on the side of a main road (Figure 1). More recently, however, attractive metal-and-glass shelters have appeared. These upgrades were pioneered by a firm that uses bus shelters to display advertising; however, many attractive shelters without advertising have also appeared.

It is perhaps surprising that bus shelters have been neglected for so long. Nothing, it would seem, could be more contrived to put people off using public transport than an unpleasant waiting environment. Economic surveys consistently reveal that time spent waiting by the roadside is resented several times more highly than time spent on a train or bus, and, that the most powerful driver of increased bus use is higher bus frequencies (and therefore shorter wait times).

Although we should strive to minimise waiting times as far as possible by higher frequencies and greater reliability of services, waiting will never be eliminated. Nor can we entirely eliminate the hazards and insult inherent in the experience of being a pedestrian in the road environment. For this reason, we must do what we can to ensure that all avoidable hazards and insults are minimised. Until recently, as I have suggested, relatively little has been done to address this issue. The reasons for this lie with the susceptibility of the bus shelter to vandalism; with local objections to bus shelters from property owners, largely driven by vandalism concerns; and with a failure to collate all the technical knowledge relevant to reduction of hazards and insults in one place. This paper, based on recent practice, is a rough summary of a relevant body of knowledge for the improvement of what is after all the shop window of a large part of the public transport system. The bus stop serves as the shop window not only of the entire bus system but also of the railway system insofar as it is served by bus feeders.

1. Design Quality Shelters

Appearance is important. But in fact the first and most fundamental requirement is that the shelter should, in fact, provide shelter. In Victor Papanek's phrase, they should be designed for the real world (Papanek, 1985). This is not always the case with many designs, which are now designed to look attractive but often too open at the front or at the roof. Many such shelters are completely wet inside after rain; a photograph published in the Herald a couple of years ago shows a person standing in one with an umbrella! Perhaps for this reason, an award winning survey conducted in 1999 and 2000 on Auckland's North Shore found a clear preference for shelters with front panels. Shelters provided by North Shore City do have front panels and two entrances, to avoid entrapment. The roof is also a snug fit with no gaps underneath, and storm grilles are installed under the barrel vaulting (Figure 2).

Dark frames, wooden seats with an anti-graffiti coating and decorative glazing patterns all improve appearance while at the same time discouraging vandalism (Figures 3, 4). From the point of view of a graffiti artist or scratcher, the decorative pattern is also a disruptive pattern. This philosophy, whereby the appearance is of the shelter is improved while at the same time denying vandals a ‘blank canvas’, has also been adopted by the main supplier of advertising shelters in Auckland and by some other territorial authorities that have gone down the decorative-glass route as well. Current designs in the greater Auckland area range from stylised geometric shapes to elaborate artwork depicting historical scenes.

As regards materials, it seems that that the ideal glazing system may consist of laminated glass with a toughened plastic film, which absorbs impacts and can carry the decorative pattern. The film has a nanoparticle surface similar to what is now used on plastic car headlights; this is nearly as scratchproof as glass. One might therefore ask why we do not go to solid sheets of a strong plastic, such as polycarbonate. The answer to this is that a toughened or laminated glass base remains desirable as it is much more rigid than plastic and is therefore easier to mount. Glass is also much cheaper than thick plastic and resists damage by cigarette lighters.

Within the next year North Shore City should be in a position to assess a number of these design hypotheses with more quantitative field data. In the meantime, it is surprising how much more attractive the streets of North Shore City and other municipalities are starting to appear, as ‘eyesore’ public transport shelters are replaced with high quality ones. In other words, the benefits of quality shelters extend beyond the public transport sector, into civic beautification and urban design more generally.

2. Integrate Bus Stops with Traffic Calming and Greenways

Going beyond such architectural and functional basics, a larger opportunity exists to reconceptualise bus stops and shelters as key nodes in a multimodal transport system. To be more precise, the node in question is a bus stop pair. It is well known that bus stops should be located on opposite sides of a safe location to cross the road. An interesting question is whether it might be possible to use the bus stops to create a safe location, by means of a traffic-calming effect caused by the bus stops themselves. The idea would be a type of chicane or road narrowing, in which the bus stop projects out from the kerb in a manner made visible by the presence of bus shelters and planter boxes. This would lead to a more general traffic calming effect. The advantage of such a system of safe crossings is multiplied if the crossings exist where preferred walking and cycle paths ('greenways') cross main roads. The greenways can be used by some to access the bus on the main road, and the bus stop crossings can be used to help other cyclists and pedestrians get across the main road and continue on their way.

Actually, the integration of walking, cycling and public transport modes isn't a new idea. Figure 5 shows a system of pedestrian/cyclist greenways and bus-serviced main roads from an official 1940s Auckland plan, for a new town to be built after World War II adjacent to a new commuter railway line in the Tamaki area. These designs were abandoned in the 1950s in favour of a more car-oriented city, in which it was tacitly assumed that public transport, walking and cycling would die out. Technologies change, but the basic principles of planning either for the motorist, or for a variety of modes, remain the same!

3. Provide Shelter at All Stops Where People Board

A potential bonus of more attractive, vandal-proof designs and integration with traffic calming and greenways is that it may permit a move to a higher standard of provision, in which most bus stops have a shelter as of right.

At present shelters tend to be rationed, in the face of local objections, to the stops that have the most buses going past and the most people waiting. As such, only a minority of bus stops have shelters. However, if a bus stop is only lightly used or serviced, this also tends to imply that some people will be waiting for a long time. This is obviously unpleasant if it is raining. Indeed, long waits for the bus create a documented and somewhat unique risk of hypothermia and serious health consequences; as two leading researchers note in a letter to the *British Medical Journal,*

> Despite considerable evidence, reduction of outdoor cold stress has been largely ignored in official campaigns to control winter mortality. Heating of waiting areas for public transport, and at least windproof shelters on bus routes subject to unscheduled delays, are obvious measures that would help. (Keatinge and Donaldson, 2004)

These problems are as much due to wind chill as to absolute temperatures; this fact helps to explain why the annual 'winter crisis' of health and hospital admissions and excess mortality is just as bad in New Zealand as in Britain.

Although this is as yet undocumented, it is highly likely that avoided health problems, administration costs associated with case-by-case justification of each shelter (often proceeding to formal hearings), and encouragement of additional patronage, may outweigh the costs of providing additional shelters. Given that high quality bus shelters cost about $10,000 each, and given that there are 5,000 bus stops in Auckland with perhaps half of these having shelters, to install high quality shelters at 3,500 of these stops (some 1,500 being dropoffs only) would cost $35 million. To put this in perspective, this is one per cent of the officially-proposed spending of $3.5 billion on motorway construction over the next ten years in Auckland.

4. Apply New Information and Lighting Technologies

The technology of low-energy, updatable 'electronic paper' is now reaching maturity. It is now increasingly feasible to install radio-updatable timetable and passenger information displays in every bus shelter and indeed at every bus stop. These displays, and the shelters, can also now be illuminated white LEDs. A particularly important advantage of the latter is that they have a lifetime of 100,000 hours; in other words, it will not be necessary to keep replacing bulbs or fluorescent tubes in order to keep high quality displays in working order. Figure 2 shows systems that in the future will be integrated into the shelter itself.

5. Improve Bus Quality in Parallel

Also to be addressed is the contribution of the the bus itself to the bus stop experience. The most important issue here is the bus propulsion system. A paradox of bus operation is that the average power of a bus is only about 10 kW, but it has a 150 or 200 kW engine for acceleration away from bus stops. The resulting noise, smoke and odour—but most fundamentally, the noise—is the single most important cause of property-owner objections to bus stops, shelters, and any other measure designed to increase bus use. Much of the public transport-planning effort in Auckland actually consists of battles with local objectors; anything that will reduce this is to be highly prized.

It therefore pays to look seriously at bus propulsion systems. Recently, engineers at Auckland University have devised an almost ideal system whereby all-electric buses can be charged using inductive power transfer (IPT) from a traffic island at the end of their run. Five minutes' charging is enough to power the bus for half an hour's operation on city streets. A new and unconventional battery technology with a lifespan similar to the bus itself is also being employed. The cost of such a bus in mass production is expected to be much less than a hybrid bus and about the same as a Diesel bus, with substantial savings over either in annual maintenance. The ability to do without overhead trolley wires also means that there are good prospects for such buses to enter shopping malls and other such indoor areas. Under these conditions, it is quite likely that mall owners will pay for the installation of charging facilities and bus stations themselves.

Short of such ideal systems, there is still much that can be done. Although it does not fully address the noise issue, the use of clean fuels can at least eliminate smoke and odours. This has always been one of the advantages of running buses on compressed natural gas (CNG). Modern Diesel engines running on low sulphur fuel with smoke traps are as attractive as CNG. Perhaps even more promising though still experimental is dimethyl ether (DME), a physically butane-like substance that is made by reacting coal or biomass with steam in the presence of a catalyst. DME can be transported under low pressure as a liquid and this makes it somewhat more practical than CNG. DME also has a number of other desirable properties, including a much lower greenhouse potential than methane, the main constituent of CNG. However, interest in DME arises mainly out of the recent (1995) discovery that it can be used as a liquid fuel in Diesel engines. Before that date it was a rule of thumb that Diesel engines had to run on heavy, smoky oils while cleaner-burning fuels could only propel the less efficient petrol engine. This is usually true but it turns out that DME is the exception. The DME molecule lacks a carbon-carbon bond so, as with methane or for that matter methanol, DME does not contribute directly to soot formation. In many ways DME looks like the Diesel fuel of the future, not only for environmental and practical reasons but also because it does not need to be made from oil.

To summarise, there is chain of improvements that lead from conventional Diesel buses through more modern Diesels and alternative fuels like CNG and DME, to an all-electric system. Ironically, this reverses the trend of the past few decades. In several New Zealand cities trolley buses predominated in the 1950s and 1960s; CNG buses in the 1970s and 1980s when alternatives to oil were being devised by agencies like the Liquid Fuels Trust Board and DSIR; and conventional Diesels in the 1990s when cheapness ruled and public-sector experimentation was frowned upon!

Although the propulsion system is the most important single quality feature of the bus, almost as important are its general appearance and its suspension system. As we move up the propulsion value chain, we can expect to see more attractive buses also, and the gradual disappearance of 'rattly' suspensions. In effect, buses will be catching up to fifty years of automobile improvements, relative to which the buses often appear to have stood still. An example of the future look and quality of buses is shown in Figure 6.

6. Implement Faster Ticketing

Lastly, anything that speeds up boarding times will improve the bus user's experience. People will queue less at the bus stop; buses will travel faster and arrive more predictably; and more subtly perhaps, faster boarding will facilitate footpath-widening and traffic calming. This is because, if buses board rapidly, the bus stop can be designed in such a way as to make it difficult or impossible to overtake the bus. Conversely, if boarding takes about a minute, there will be much greater pressure for a narrow footpath and a wide road carriageway, favouring the motorist, because drivers will be impatient to get past. The fastest possible boarding system is free boarding; a contactless smartcard comes a close second.

Conclusion: From the Details to the Big Picture

Altogether, there is a strong case to take the bus stop and its environs seriously, as an essential component of the urban transport system. It should not be an afterthought, something left over on the side of the road. However, to design better bus stops in detailed terms, we have to break down traditional barriers of fragmentation that exist between road engineering, public transport operations, public health, the award of grants for technological innovation, and even between public transport and traffic calming. We also have to overcome a widespread lack of technical knowledge and design experience over what makes a good bus stop or shelter in the first place. These problems are exemplified by the currently limited understanding of the synergistic interactions between ticketing system performance and possibilities for bus stop design; between bus stop design and possibilities for traffic calming; between bus shelter provision and public health outcomes; and between provision of bus stop infrastructure and avoided roading costs; and between the quality of bus stop street furniture and buses and the level of property-owner objections to bus stops and shelters.

However, as we have seen, the basic principles of pedestrian-, cyclist- and transit-oriented planning are much the same today as they were sixty years ago. Neglect of the issues and interactions described in the previous paragraph is to some extent a reflection of an actual social choice to put the automobile first and forget about the rest. It is the 'big picture' that ultimately pulls the details together, or allows them to scatter, as the case may be. In this sense, the shelter of Figure 1 also symbolises a city that has favoured the motorist as a norm while tending to treat the public transport user and the pedestrian as social anachronisms. Conversely, the designs of Figures 2 to 6 symbolise cities that have normalised a mixture of bus use and walking, and that also invite the disembarked pedestrian to linger and look about. Details change but the choice remains the same.

References

Papanek, V. (1985) *Design for the Real World: Human Ecology and Social Change* (2^{nd} edn) (London: Thames and Hudson)

Keatinge, W. R., and Donaldson, G. C. (2004) Action on outdoor cold stress is needed to reduce winter mortality, *British Medical Journal* 329, 23 Oct., p. 976.

Figures Follow Overleaf

Figure 1: Typical 1970s Bus Shelter (Auckland Region, 2001)

Figure 2: Current Standard North Shore City Bus Shelter
This photograph also shows experimental solar lighting and illuminated timetable installations.

Figure 3: Standard North Shore City Bus Shelter with Planned Glazing Improvements
The purpose of these is to improve the aesthetics further and reduce vandalism. They build on the basic, weatherproof design.

Figure 4: Glazing Details at Northcote Bus Station (North Shore City), 2006

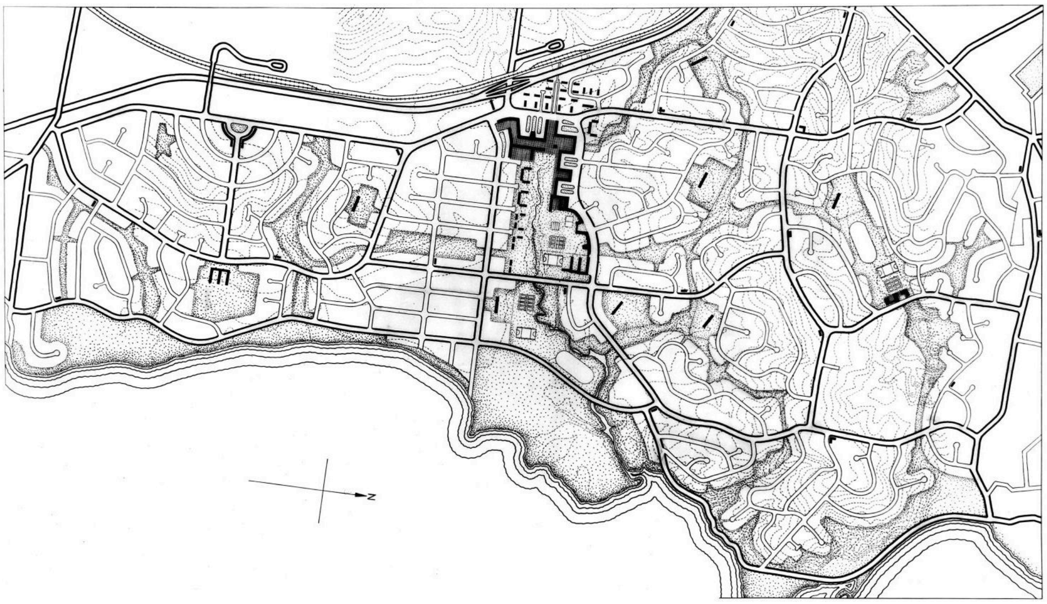

Figure 5: Greenway Network Intersecting Main Roads circa 1945 – *Le Plus ca Change?*
Plan by Ernst Plischke, reproduced in *State Housing in New Zealand* (Ministry of Works, 1949). Reproduced by permission of the Housing New Zealand Corporation.

Figure 6: Electric Bus (Christchurch City, Jan 2007)
This is a hybrid-type bus. The main advantage is the quietness of the bus but the aesthetics are also worthy of note.