MODULAR BUS SHELTERS-
NEW DESIGN and NEW TECHNOLOGY with INNOVATION

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ABSTRACT

Due to differences in legacy Council operations and a history of incremental design changes, Auckland has well over 30 different bus shelter designs creating a myriad of problems from maintenance costs through to very varied customer experience.

With the phased rollout of the new Public Transport Network there will be significant changes to how bus passengers travel across the city. Shorter, more frequent trips and a greater need to interchange between routes and/or modes will require a number of changes to infrastructure to ensure the New Network is successfully implemented.

Auckland Transport's Modular Bus Shelter project aimed to develop a consistent suite of shelter designs and parts to fit 90% of locations requiring a bus shelter. Developing a design that not only meets the requirements of the New Network but is also adaptable to changing technology (e.g. smart screens), fits local context (e.g. art) and environmental sensitivities (e.g. solar power), as well as the needs of a diverse community (e.g. shelter configurator tool) has been a challenge.

This practice paper provides an overview of the innovative processes used, the lessons learnt, and the future of bus shelters in Auckland.

INTRODUCTION

In response to the changes and transformation of the bus route and network design (New Network) initiated through the Regional Public Transport Plan (RPTP) and a focus on the 'whole of journey' experience, a new suite of bus shelter designs has been developed by Auckland Transport (AT) to roll out across the Auckland region. The new shelter design has been developed via a comprehensive process, including public tender, a physical trial of three of the designs at two locations in 2014, a stakeholder engagement process, and detailed post-trial design evaluation.

The intention is to replace the more than 32 existing shelter designs (with the exception of Adshel shelters in the short-medium term) with the new design and implement in line with budget availability. They will be installed where existing assets are approaching the end of their life and also targeted initially around the New Network rollout. For key corridor upgrade projects the new shelters may be installed along the entire route.

Key features of the new design include:

a) Enhanced wet weather and wind protection
b) Improved safety features
c) An overall more consistent and legible user experience
d) Sensor activated solar powered lighting
e) The ability to incorporate local identity via art
f) Integration of an enhanced real-time system and (trial of) enhanced customer interface into the shelters
g) Potential to incorporate other facilities (e.g. retail, cycle racks etc)
h) The smart shelter concept
i) Way-finding and information

Standard designs for 3 different size shelters (minor, intermediate and major) have been developed and the common parts can be used to design bespoke and much larger Neighbourhood Interchanges.

The design has been completely revamped from previous designs with the intention to set a line under previous designs- many of which were perfectly functional but not necessarily reflective of where AT wanted the look and feel of shelters to head.

Innovation was a critical consideration and has been embedded throughout the project in the following processes and design elements:

- Procurement of the design team
- Shelter evaluation process
- The prototype shelter trial process
- The modular design and materials used in the shelter
- Shelter design configurator

Key themes of adaptability and modularity have helped shaped the final outcome and been a powerful influence in making decisions about the parameters of the design and to what degree it should or could develop to.

From a technology perspective, the shelter is a 'connected shelter' and the trial shelters can host interactive screens, wifi, metrocell, and surveillance cameras. Electronic advertising signage can also be incorporated in appropriate locations.

The shelters are solar powered, and have sensor controlled LED lighting. They can be mains connected if necessary- especially if all the additional technology is included.

Design Brand from Wellington were the successful design team.

NEW DESIGN

Look and Feel

One of the key themes in developing a new shelter design was to create a new and unique design for Auckland that had the right look and feel to suit a range of different locations across the City. It was intended that the shelter parts could be used in 4 different shelter types. The types and sizes of shelter are:

- Minor Shelters (3.6m internal length with 600mm eave at both ends)
- Intermediate Shelters (2 x minor shelters)
- Major Shelters (3 – 5 x minor shelters)
- Neighbourhood Interchanges (bespoke)

Each of the core 3 shelter sizes is available in 3 depths of 800mm (slimline), 1300mm (existing standard shelter width), and 1500mm (desirable if space allows). The design has focussed on refining designs for the first 3 shelter types and ensuring that the parts can be used in the more complex, location specific, and much larger Neighbourhood Interchanges.

The 3 designs are shown in Fig 1: Minor Shelter; Fig 2: Intermediate Shelter; Fig 3: Major Shelter

Fig 1: Minor Shelter

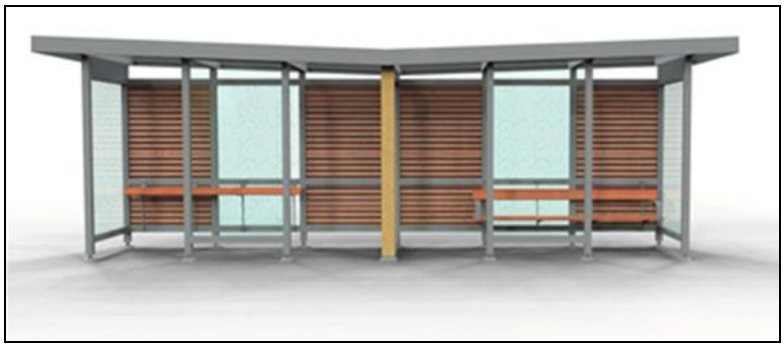

Fig 2: Intermediate Shelter

Fig 3: Major Shelter

Key design features

- Front panels- For weather protection, these will generally be centrally located with entry/exit possible on either side. In highly weather exposed locations or because of an existing design, the front panels can be located at either side or side by side with one entry/exit point.
- Aluminium frame- A Design Brand designed product this provides the ability for adaptable design solutions in constrained locations and flexibility around bespoke design. All ducting, lighting and services are contained within the frame system.
- Portal- A design feature, this is made from either timber or powder coated steel. The main portal is evident on the left had side of Figure 3, but it is also repeatable in the vertical column where the lowest parts of the roof line meet.
- Timber- Sydney Blue Gum used in panels and seating. Pine used in timber portal feature.
- Sensor activated solar powered lighting- sensors located in entrance ways to shelters. Each solar panel provides 50 watts with each Minor shelter having 3 panels. This is enough to service lighting requirements and provide a 3 day minimum redundancy via batteries.
- Foundation- Concrete pad with bolted in foot. The portal feature on the major shelter requires a footing and it is likely with the larger Neighbourhood Interchanges that more of this will be required.
- Cost- This has been benchmarked against the predecessor shelters and is close to those costs despite the base set of additional technology such as solar lighting. We anticipate efficiencies through bulk orders and further refinement of the design over time.
- Accessibility- The design was reviewed by people with accessibility needs (the blind community, wheelchair users, hearing impaired, and the elderly) and some elements of the design were changed for example, a darker colour was used to increase contrast for the blind, smaller gaps were introduced at the bottom of the shelters for cane users and the outdoor seating orientation was changed in the major shelter. This input was a direct result of the prototype trial.
- Personal Safety- There has been some concern about the use of timber slats and that people could hide behind the shelters increasing safety and crime. This is possible, but with the adaptable nature of the design, the range of materials available in the suite of parts, and the ability to design for specific locations, it is considered that this risk has been minimised as much as possible.

Adaptability and Modularity

The design works in different contexts and concepts have been developed for sloping locations and where a double sided shelter might be appropriate. Concept designs that can incorporate retail facilities and bicycle storage have also been developed.

Local character

One of the key areas of stakeholder feedback especially that from Mana Whenua and Local Boards was the interest in being able to demonstrate local character/context into the design. This needs to be balanced with the ongoing maintenance of the shelters and the objective to create a legible network and hierarchy of shelters.

Keeping that in mind, the shelters can incorporate art via the vinyl laminate that is applied to the glass and also in the timber (or steel) portal which is a feature in every shelter size. It is noted that there are some heritage shelters in parts of the city that there is no intention to replace.

Building Consent

PS1's have been issued for the 3 main shelter sizes and the 3 depths within each of those. The Neighbourhood Interchanges are bespoke and will require a new building consent every time.

Resource Consent

Resource Consent is generally not required but the larger of the major shelter sizes and city centre locations do require resource consent approval.

Implementation

The new shelters will be gradually rolled out on the New Network as required. The cost negatives of a complete shelter rollout outweigh the network legibility and user experience benefits and there is no need to remove perfectly functioning assets just because of the new design. It is anticipated that it will take 15-20 years to replace the existing shelter asset base by which stage AT will be in a much better position around maintenance and delivering an enhanced whole of journey customer experience.

NEW TECHNOLOGY

Shelter features

- LED lighting in shelters- This is a first for Auckland Transport and builds on a wider shift to the use of LED's in street lighting. Their operational level is around 37 lux which is an increase from around 27 lux in the prototype design. The LED strips sit in a channel in the framing and can be designed to produce different colours. At present the lighting is bright white. The sensors are designed to dim down the lighting when the shelter is not in use but not so much that they create a personal safety issue. Whilst the prototype met standards the design team felt the level of lighting was still not high enough. We have also been mindful that the level of interior light is appropriately balanced with any external lighting sources such as from buildings and street lights.

- Solar panels- Solar panels are provided as standard in all new shelters. In some locations it may not be possible due to shading or geography and these locations will be provided with mains power. Larger shelters will also be mains power connected, especially where there is additional technology such as the VPID interactive screens and advertising signage. As noted earlier, the solar panels are sufficient to power the LED lighting,

Smart Shelters

Strategically, AT are looking at bus shelters to provide a wider service offering to the travelling public and at the same time make them more cost effective. The opportunity to trial some options for how this could occur has been tested on the successful design and one of the other designs.

There are two key areas of work taking place in this area:

1) The Smart Screen Concept

   This concept provides an interactive display on the inside of the shelter, nominally located at the departure end of the shelter. The Smart Screen is intended to provide the following data via a touchscreen user interface:

   - Real time information of the next 5 buses arriving, including bus passenger capacity and minutes from the stop
   - Interactive map showing the next buses arriving.
   - Journey Planner
   - Local landmarks and services near bus stops (points of interest)
   - News and weather updates
   - AT information and special traffic updates
   - Survey links

2) The Connected Bus Shelter

   The basis for this is to make shelters a self-sufficient revenue generating asset by using the shelter real estate to co-locate paying third party tenants, e.g. e-ticketing and bus management, advertising, mobile operator/s, utilities (Smart metering), Security cameras.

At the time of writing this aspect of the shelter is still under development. It is not impacting on the ability of the shelters to be rolled out as they have been future proofed to be able to accommodate additional features.

INNOVATION

There are 5 key areas of innovation applicable to this project. Some of these relate to the processes used and others relate directly to the design of the shelters. Some of the new technology discussed in the previous section that is being introduced is cutting edge- certainly for use in a New Zealand bus shelter. The 5 key areas of innovation are:

- Procurement process
- Prototype shelter evaluation process
- Prototype shelter trial process
- The modular design and materials
- Shelter configurator

Procurement process

The procurement process involved the standard practice of releasing a Request for Tender (RFT) with a detailed brief and the requirement for tenderers to provide written responses to criteria covering Methodology (20%), Track Record (10%), Relevant Skills (20%), Relevant Experience (20%) and Innovation (30%). The inclusion of Innovation as both an assessment criteria and one with a high weighting was in direct relation to the emphasis that the project team wanted to place on the importance of the design being innovative. Within this criteria we also required tenderers to submit concept designs. We required a Minor shelter design, a Major shelter design and a Neighbourhood Interchange design. Tenderers could submit up to 2 sets of concept designs.

This was a huge success and there were some very interesting designs submitted. It also showed that some consultant firms were very good at the written requirements but not necessarily as accomplished in the design space. Feedback from consultant teams was that whilst it cost them a bit more to undertake, it was a great opportunity to demonstrate their design skills upfront rather than post appointment. It ensured the project had a shortlist of three very high calibre design

teams.

Innovation criteria

A set of elements was developed against the Innovation criteria prior to RFT release and was used throughout the various stages of decision making. For example, it was used to formally assess the initial RFT responses, it was used as a consideration when deciding whether to take all 3 shortlisted designs to the onsite prototype trial, and again when formally assessing all 3 trial shelters to determine the preferred design. The criteria are listed in Figure 4 'Shelter Innovation Criteria' and comprise 5 key heading areas: Look and Feel, Functionality, Adaptability, Materiality and Cost Effectiveness. Each of these criteria were equally weighted at 20% and each criteria had secondary and tertiary layers of detail under each heading.

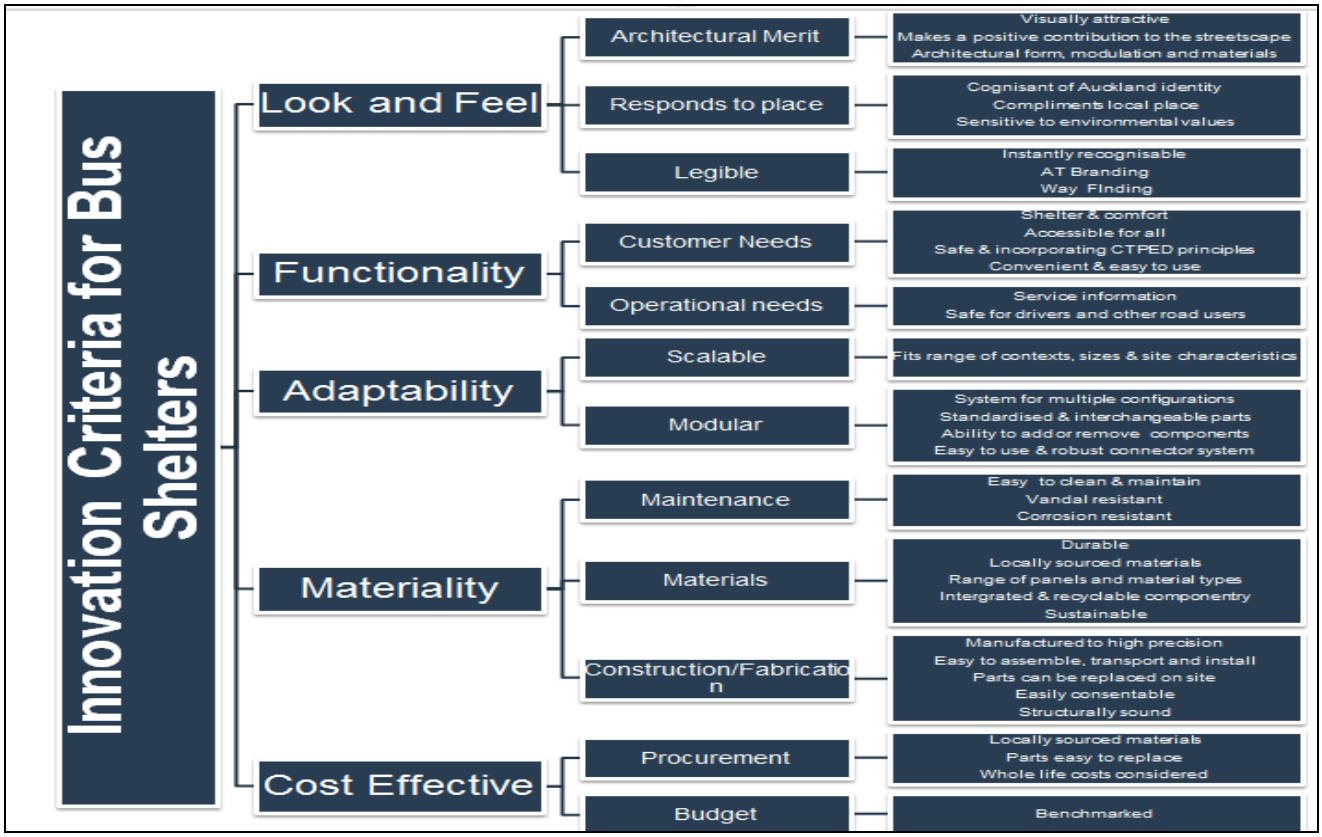

Fig 4: Shelter Innovation Criteria

Prototype Shelter Trial Process

As noted earlier, the decision was made prior to RFT release to take up to 3 concept designs to a physical prototype trial. Each of the design teams were paid for their design work from the point of contract award as well as all relevant construction costs. The designs are all still in place and have been used to trial some of the new technologies being proposed for the bus shelters.

We chose a site that required 3 shelters and was reasonably equal in terms of geographic considerations, patronage levels and the ability to evaluate each shelter fairly and equitably. We also had an existing shelter to compare the new designs to. We selected a site on Symonds Street at the edge of the City Centre. It is a busy bus location, has considerable foot traffic, is exposed to the south westerly winds and there is a lot of traffic noise. Early on the decision was made to trial the larger Major shelters to ensure we properly understood the impacts of the larger shelter size. It was felt that the complexity of the larger shelters was a potential risk and we wanted to understand any issues that might emerge. Any learnings could be translated to the smaller shelters and up to

the Neighbourhood Interchanges. Fig 5: Symonds Street Major Shelter, shows the shelter just after completion on site.

Fig 5: Symonds Street Major Shelter

Notwithstanding the decision to trial only the Major Shelter, an opportunity arose to test the minor shelter trial as a part of a separate project in Silverdale that needed 4 new Minor Shelters. We took the same approach as for the Major Shelter with the 3 new designs being tested together with a standard existing shelter. As the project progressed, the team became acutely aware of possible risks and with Minor shelters making up around 90% of shelter installs the decision was made to test them. Fig 6: Silverdale Minor Shelter, shows the shelter as completed on site.

Fig 6. Silverdale Minor Shelter

The trial ran for 3 months through a fairly typical wet Auckland winter and was a very effective way to test how the shelters operated in a real-world context. Sometimes designs can look great on paper but less so once fabricated and vice versa. One of the challenges for the team in terms of evaluation was determining fatal flaws from fixable flaws. We discussed these issues with the design teams and asked for a report from each design team identifying how they thought their shelter performed and how they would improve them. This report contributed to our overall

evaluation of the trial shelters.

The prototyping exercise was the most important part of the process and gave confidence to the project team and decision makers that a rollout of the new design would be cost effective and add value for the travelling public.

Modular Design and Materials

The shelter is constructed from 80% recycled aluminium. Timber slats and seating is locally sourced sustainably grown Sydney Blue Gum and the timber portal feature is pine. Stainless steel connectors are standard. It is possible to swap out the timber portal for a powder coated steel portal which may be more appropriate in locations susceptible to vandalism. It is interesting to note that the trial shelters were all vandalised to some extent but this was within normal operational expectations.

All materials can be swapped out with relative ease and replaced like with like or a stronger material, for example, glass or timber slats can be replaced with aluminium sheets or perforated steel. The installation assumption is that timber and glass will be provided in all new shelters but if vandalism is at an unacceptable level then these will be removed and replaced with a more robust material.

The roof is usually Bondor but can be glass if the location suits it. Bondor is a commonly used proprietary product made of expanded polystyrene sandwiched between two layers of powder-coated aluminium. A combination of both glass and Bondor can also be used in different roofing sections.

Configurator

An online based design tool called the ‘Shelter Configurator’ has been developed to enable the quick and easy design of shelters by project managers and/or designers. The Configurator allows the designer to select each element of the shelter design to construct a visual representation of the shelter they are designing. This image can then be used for consultation/communication and uploaded to an order form with other details for off-site fabrication. This tool will be further demonstrated at the conference.

LEARNINGS

As always, there are learnings that can be taken from any process and applied to subsequent projects. Overall, the outcome has exceeded expectations and the process enabled the team to be very informed about the design and to address any risks in the final design stage. Inevitably things some things work well and some things could be done differently. Some of the learnings from this project - both things to retain and things to change- are as follows:

Process

The process was somewhat convoluted in places and despite the Innovation criteria being comprehensive, the evaluation process was complex and time consuming. It would require minor tweaks only to make it simpler but still effective, for example by removing the final layer of elements and considering them as a part of the higher layer/s.

Prototype trial

The prototype trial was a very useful way to test the designs in a real world context. It also provided the opportunity to test the fabrication skills of the 3 companies involved. Careful consideration is needed when considering how many trials are appropriate to ensure a cap on

overall costs. The other benefit is that the prototypes have remained in place and have been used to trial other related elements such as the Smart Screen technology.

Public Engagement

The level of engagement was encouraging and we received over 850 submissions in response to the new designs. We also engaged with key stakeholders such as Mana Whenua, Disability Groups and Bus Operators. Separately, we undertook a very detailed level of engagement that interrogated the design but didn't add much value to the overall assessment. At the time we considered there was a reasonable level of risk to the project if we didn't undertake a comprehensive level of engagement. It was useful but not necessarily critical to the outcome.

Future Procurement

Whilst we resolved this through the process and now have a plan in place, we needed to have thought more about how we might procure the shelters once we had a final design approved.

Intellectual Property

This is a significant consideration in relation to the design. It means that AT own the design and the ability to control who makes the shelter in the future, whilst noting that the external design team retain the right to use their componentry in other projects.

Ongoing design refinement

We have acknowledged the design is a living design and can change as implementation progresses. As shelters are fabricated and installed it is expected that there will need to be minor changes to the design. Certainly after 12-18 months we will need to review progress and where any consistent issues may be emerging. To date, the main issues have been around trying to get the design installation process working consistently. Overall it is considered that the prototype trial process has been critical to refining the design to where it is and enabling the design to be more progressed that where it would have been without the trial.

CONCLUSION

Overall, the project has been a very positive experience and with an outcome that will over time create a positive experience for the travelling public across Auckland. Through both the processes used and outcome achieved the design is innovative and marks a positive change in direction for the provision of bus shelters. The ability to deliver a range of ready-designed shelters for a large range of locations will reduce the need for bespoke designs in difficult locations. Together with the new online configurator tool both these will also help with the standard of site specific design rollout.

The design also future proofs the provision of new technology and ticks several areas of sustainability such as the use of recycled aluminium, locally supplied sustainably grown logged timber, and the use of solar panels. The ability to incorporate local character via art will also assist with meeting the needs of local communities.