

Slim ride

Arriving in New Zealand's capital from Berlin in 2007, Oliver Neuland was rapidly convinced of the benefits of a comfortable people-mover to ease Auckland's traffic woes

New Zealand is more renowned for its sheep and breathtaking scenery than for its public transport. Although one-third of all Kiwis live in Auckland, public transport provision for the 1.3 million inhabitants is still basic compared to cities of similar size in Europe or Australia. Many of Auckland's population do not use public transport, not only because it seems unattractive but also because it is not there.

The authorities have prioritised road development over rail, as in other cities that have experienced a rapid growth since 1945. Existing rail infrastructure was only sparingly extended or modernised during this period. Privately owned cars, SUVs and the boats that need to be pulled by them still have a high social value.

The confusing patchwork of individual bus lanes sharing the congested road corridors does not help make public transport more inviting. Its bad image is compounded by three unelectrified rail lines providing a slow and often unreliable service, predominantly to the lower-income areas in south and west Auckland.

Rubin, Moore and Lee conclude in their paper *Ten myths about US urban rail systems* that middle- and upper-income residents do not want to mix with public transport users on lower incomes. However, road capacities are reaching their maximum and energy prices have risen, so the increasing use of public transport seems probable.

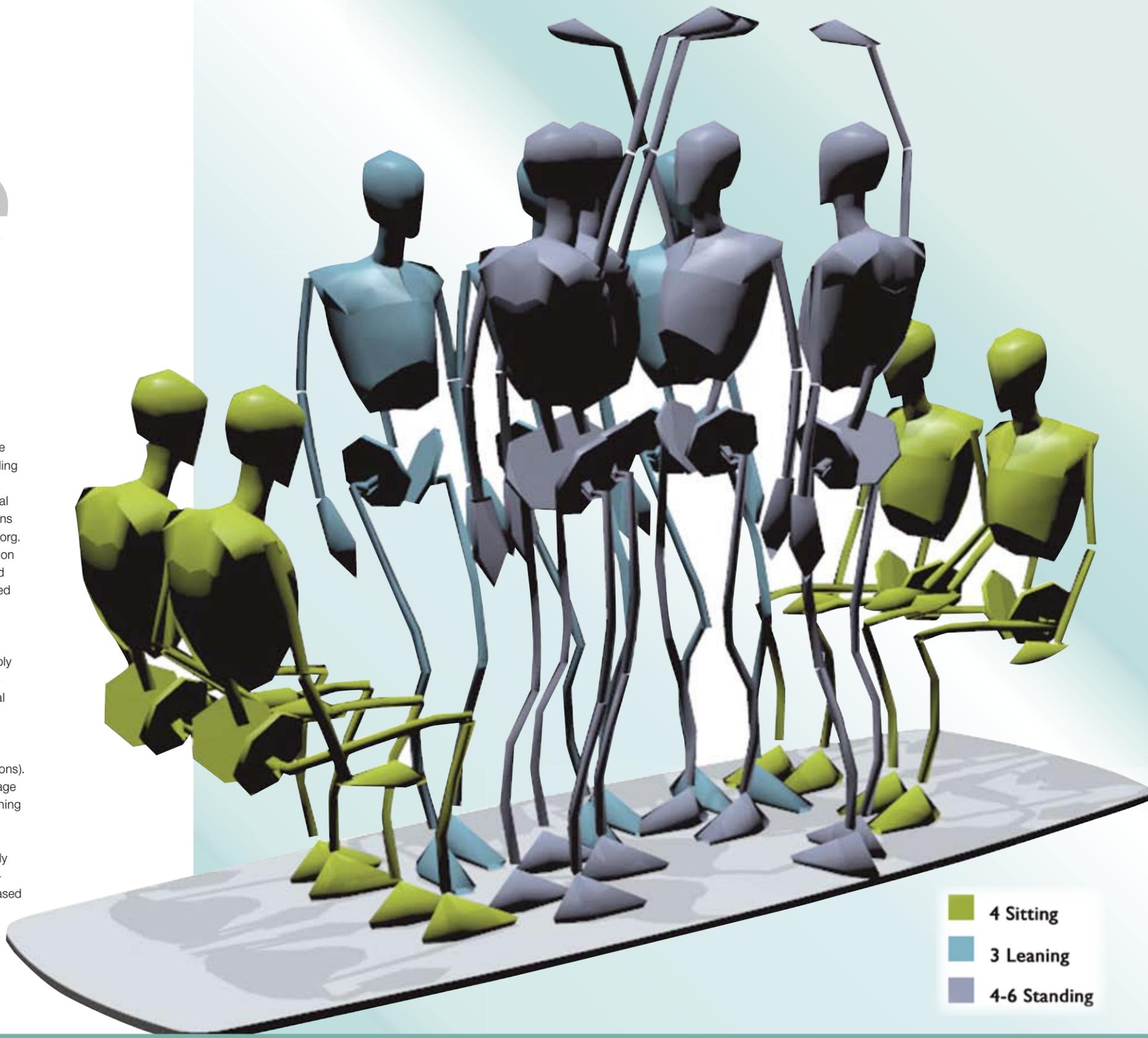
High investment costs and lack of available space are major issues and obstacles to building additional rail or bus infrastructure, and no light-rail system exists. There have been several initiatives bringing forward well-developed plans and public initiatives (such as bettertransport.org.nz). Although a decision has now been taken on rail electrification, completion is not scheduled until 2013 and, already, the proposals are mired in a funding controversy.

Grand designs

People have to be moved efficiently, sustainably and flexibly, using current infrastructure to the maximum and taking into account the minimal space available in the greater Auckland area. The solution proposed is a light-rail electric-powered track system (an on-off grid hybrid, carrying batteries for non-powered track sections).

Light-rail systems have a more positive image and seem easier to use in terms of route planning and way finding.

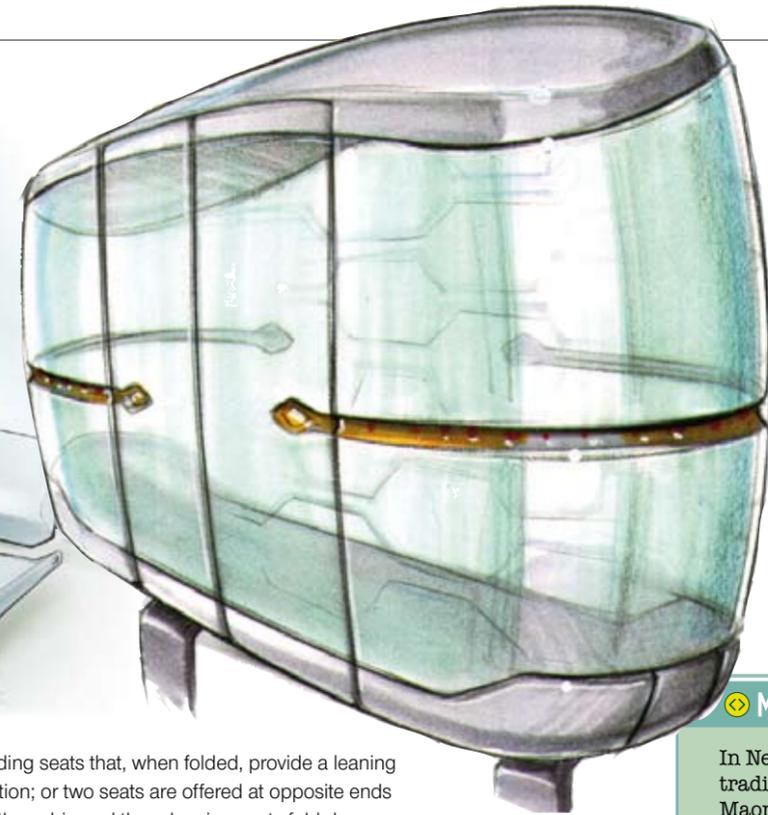
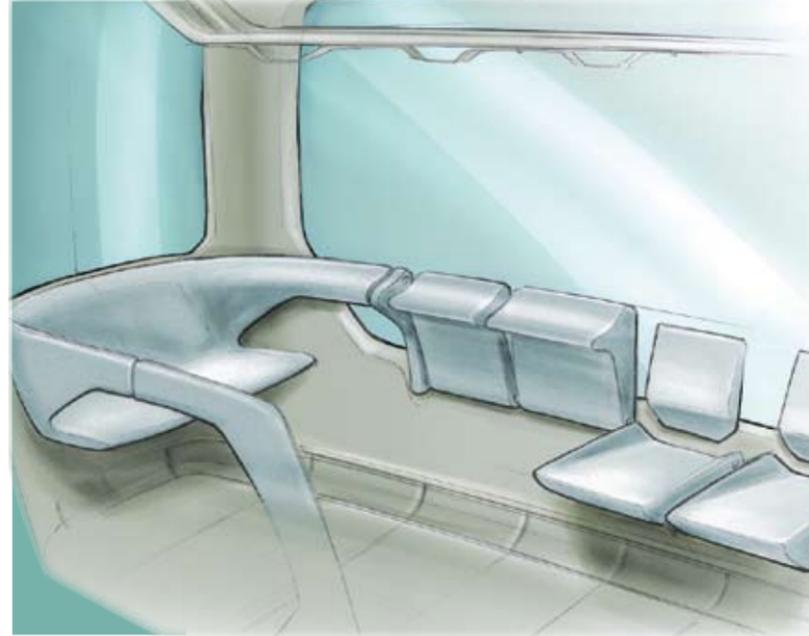
To operate in Auckland's infrastructure limitations, the track is planned to be extremely slim, a hybrid between ground and above-the-ground (around fence height) sections and based on an inline-rail layout. Two single rails made of standard tubes and profiles positioned above each other carry a light autonomous cabin situated above the pair of rails, offering pavement-level access.



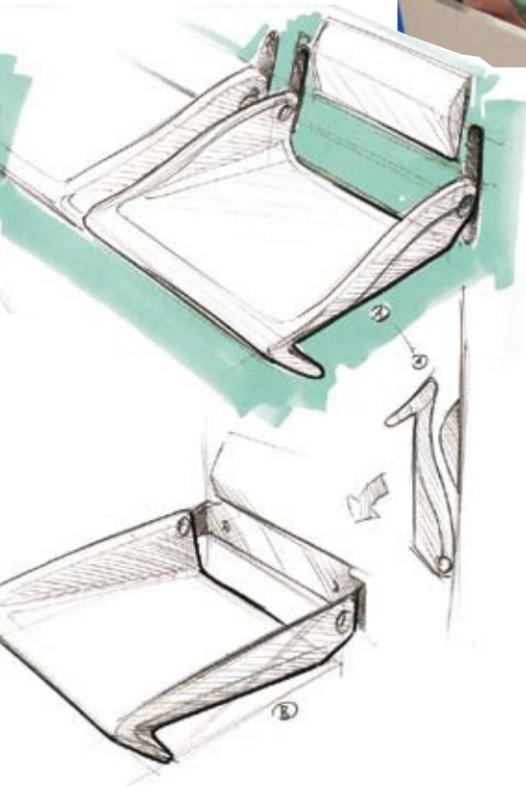
- 4 Sitting
- 3 Leaning
- 4-6 Standing

RIGHT: This is one of the current favourites for the interior lay out

The cabin layouts are tested separately in 2D and 3D before being merged and separated again for further development with the gained insight



“Instead of offering a cold, technical and vandal-proof interior, the design creates a ‘lounge’ atmosphere, clearly differentiating it from Auckland buses’ poor image”



Each cabin accommodates up to 15 passengers (seating, leaning and standing), a number reached by observations that most buses carry no more than 15 people at any one time throughout the day. The aim is to keep maximum loaded cabin weight around that of a mid-range car (1,300-1,500kg), making it possible to use more off-the-shelf components. The technology is more closely related to roller-coaster systems than to classic rail technology, making it an inexpensive, low-tech option that's easy to build, operate and maintain locally.

Cabin width and central door position was determined by the necessity to accommodate wheelchair access. Total width is 1,200mm – just over half usual railcar widths. A test rig showed that a cabin length of 3.3-3.5m would be enough to carry the maximum passenger load.

Each unit will operate individually and without a driver but would be able to link into a coupled train in peak times. The concept would be similar to London's DLR. The cabins will operate autonomously, running in loops, picking up passengers or parked and available on request.

With no driver or conductor, passenger space is increased but there is a potential impact on safety. In high-risk areas where there are pedestrians and other vehicles, the control centre

could take over and then release them again to automatic control once travelling on elevated tracks sections. The control centre would also provide passenger safety via cabin surveillance and two-way communication.

A gondola hanging underneath the cabin and connecting the two main structural chassis beams (Z-Bars) carries batteries, black boxes and other technical components. Only a thin floor and roof structure is specified, especially as Auckland's mild climate does not need air-conditioning.

Interior layout

Seating choice is crucial, and involved estimating total passenger numbers and deciding on the distribution of the options for sitting, leaning and standing. Research was done into the topology of the different options such as sitting front-facing, rear-facing, sideways and face-to-face, and how they relate to each other within the restricted space available.

Each viable solution was then used as a base for design sketches. Potential user and expert interviews helped to narrow down and modify the concepts. Layouts were tested in CAD to find the optimal relationship between passenger numbers and seating options. Two front-runner layouts have emerged: all passengers sit sideways on

folding seats that, when folded, provide a leaning option; or two seats are offered at opposite ends of the cabin and three leaning seats fold down to provide side seating options. Designing in wheelchair access reduces the options and make use of more folding seats necessary.

Instead of offering a cold, technical and vandal-proof interior, the design creates a 'lounge' atmosphere, clearly differentiating it from Auckland buses' poor image. Research suggests that appealing aesthetic design is less liable to be attacked by hooligans.

The initial intention was a system to serve a full network but currently the concept is that it should be a link, operating in low-density areas to feed rail hubs, provide inner-city transport and scenic routes for commuters and tourists, such as from the central business district (CBD) to Mission Bay. It could also work as a last-mile system for shopping malls, corporate centres, business parks and university campuses. The slim light-rail system is a holistic solution with the varying options weaving a tighter, more efficient and convenient network. ✕

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✦ MAORI ARTS

In New Zealand, Maori art continues to be a live cultural tradition that is visible every day, and wood carvings of Maori symbols, all with specific meanings, are traditional on Maori houses, boats and weapons. For New Zealand's capital, incorporating Maori carved symbols related to 'movement' and 'floating' provided an ethnic cultural dimension that is absent in the initial classic modern design sketches of interior and exterior cabin details.

The idea was discussed with a Maori artist who applauded it as a contribution to the Maori cultural heritage. It was then rendered in CAD, showing that it would work well. The next step is for a Maori carver to be consulted and to discuss casting in lightweight aluminium foam with production experts.

Currently three interior and exterior options are being merged with a final chassis solution to define the final option.

