

RAPID TRANSIT NETWORK PLANNING

The government has signalled a fundamental change to the planning and delivery of Rapid Transit Networks (RTN), of particular interest to urban centres. These high capacity public transport projects can combine with urban regeneration initiatives to result in city-shaping outcomes. Auckland Transport and the NZ Transport Agency will present on the changes that have been made and what these mean for the transportation environment, progress to date and the way ahead for both agencies. Reference will be made to the Auckland Light Rail project and wider RTN planning.

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INTRODUCTION

Rapid transit forms the backbone of any public transport network, providing fast, frequent and high capacity services along corridors separated from general traffic and therefore unaffected by road congestion.

Auckland's geography presents several major transport challenges. Large trip volumes are funnelled into a small number of connections between major parts of the urban area (e.g. the Auckland Harbour Bridge, Northwestern Motorway causeway, etc.) while limited access points to key destinations like the city centre and the Airport create further bottlenecks.

Auckland's motorway network is now largely complete and there are few easy opportunities for adding new or widened road links. There is increasing competition for street space between different transport modes (private vehicles, public transport, walking, cycling), on-street parking and a growing need for streets to form important public open spaces as Auckland intensifies. This means existing transport corridors need to be used far more efficiently and a major shift towards public transport, alongside active modes, is required.

THE CURRENT RAPID TRANSIT NETWORK

Auckland's rapid transit network will need to play a central role in meeting the travel needs of a fast-growing region, as well as supporting and shaping Auckland's growth and urban form.

In particular, only rapid transit can:

- Efficiently move large numbers of people to intensely developed places like the city centre and other major centres
- Dramatically increase the number of people able to travel between major parts of Auckland (north, central, west and south), especially at peak times
- Provide a fast and reliable travel option that encourages people out of their cars for longer-distance journeys
- Deliver long-lasting access improvements to areas near rapid transit stations, which improves their attractiveness for redevelopment.

Rapid transit will become an increasingly important part of Auckland's transport system in the future. This is due to the extremely high people-moving capacity of rapid transit vehicles.

Compared to private vehicles, rapid transit vehicles (bus, light rail or heavy rail) can shift extremely high volumes of people along relatively narrow corridors. Furthermore, rapid transit can ease pressure on overloaded parts of the public transport network by increasing the system's capacity and efficiency.

Auckland's current rapid transit network comprises the electrified heavy rail network between Swanson and Papakura, as well as the Northern Busway. It carries over 26 million passengers a year, with use continuing to grow strongly (see Figure 1 below).

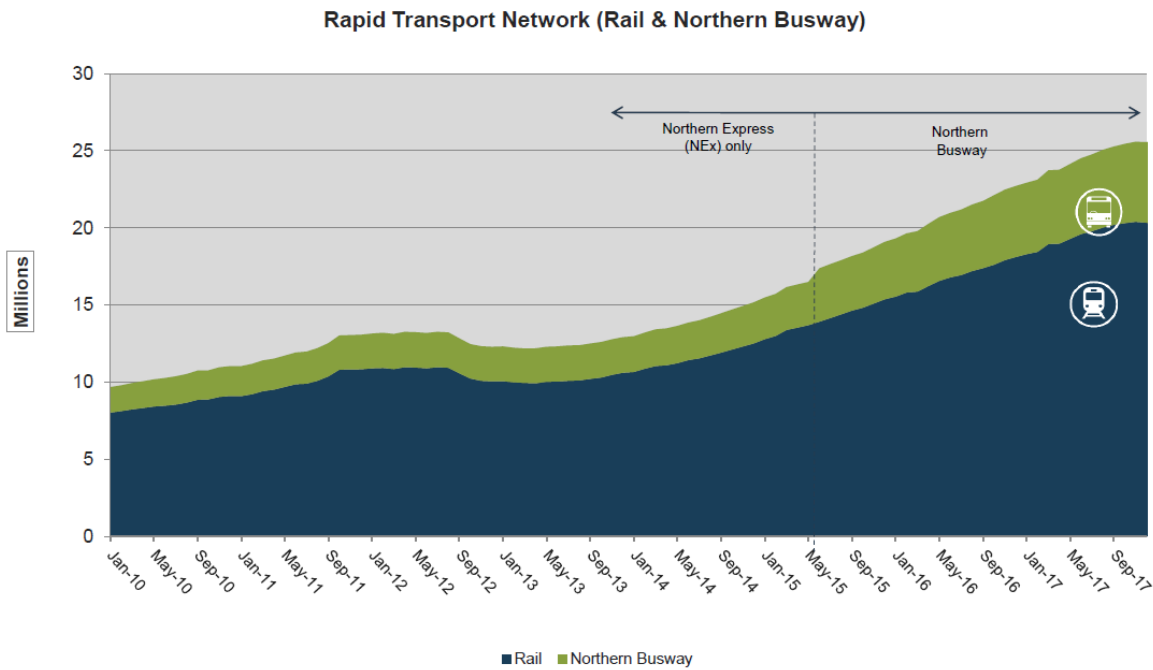


Figure 1: Rapid Transit Network patronage

The Northern Busway was opened in 2008 and serves several bus routes, including core Northern Express services that also use the Auckland Harbour Bridge and local roads to the south of the busway, and bus shoulder lanes between Constellation and Albany stations.

The rail network has provided passenger services for well over a century, but has been substantially upgraded over the past decade to enable more frequent and reliable services. Electric train services were progressively implemented from 2014 to 2015.

Auckland’s rapid transit network remains fairly undeveloped and there are major plans to expand and upgrade this network over time. The map below shows in red the parts of Auckland’s future rapid transit network that exist today. In most cases, those incomplete parts of the network still have services operating (such as Northern Express bus services to Orewa despite the Northern Busway stopping at Constellation Drive station).



Figure 2: Auckland's Rapid Transit Network in summary (red lines represent right of way, e.g. rail and dedicated busway, see Figure 4 for more detail)

PLANNING FOR RAPID TRANSIT

The growing importance of developing Auckland's rapid transit system is emphasised in recent strategic documents, including the Government Policy Statement on Land Transport 2018, the Auckland Transport Alignment Project and the Auckland Plan.

Auckland's ongoing population growth, combined with the challenges of meeting growing travel demand through additional road capacity and the need for transport to play a greater role in shaping urban form, has highlighted the need for major expansions and upgrades of the rapid transit network.

There are two key drivers underpinning planned upgrades and expansions of the rapid transit network:

1. Upgrading key public transport routes to a higher capacity mode, to relieve current and forecast capacity constraints.
2. Expanding the rapid transit network to support a more efficient overall transport system.

ROLES AND RESPONSIBILITIES

Transport is a partnership between central and local government and this partnership approach must form the basis of developing the rapid transit network. This is illustrated by the following:

- Rapid transit is nationally significant infrastructure, like the state highway network which is owned and operated by the New Zealand Transport Agency (NZTA) or the rail network which is owned and operated by KiwiRail.
- It is essential that rapid transit services are integrated with the wider public transport network, which is operated by Auckland Transport (AT).
- An optimal rapid transit corridor may be located in its own right-of-way (i.e. like the rail network or adjacent to a state highway) or might be located on roads managed by AT, with absolute

priority at intersections, or some combination of the two.

The overlap of roles and responsibilities for rapid transit between central and local government means joint network planning is essential, and that a 'best for Auckland and New Zealand' principle must apply throughout the different phases of project development, implementation and operation.

CHANGES IN CONTEXT

A variety of changes to organisational responsibilities for rapid transit have been made recently to help accelerate Auckland's rapid transit network.

In May 2018, the Minister of Transport confirmed that it is now a NZTA's responsibility "*to plan, fund, design, supervise, construct and maintain rapid transit networks and/or projects, including light rail.*" This overlaps with AT's unchanged role in this area (see further commentary on this in the Roles and Responsibilities section above). NZTA is now leading the Business Case for the city centre to Mangere and North-west light rail corridors, in partnership with AT, Auckland Council and the government development agency HLC.

The 2018 Government Policy Statement also includes a new rapid transit activity class, which enables 100% NZTA funding of rapid transit projects. Previously, AT was required to apply for funding from the public transport activity class. Although the activity class is nationally available, most future rapid transit investment is likely to be in Auckland.

The 2018 Government Policy Statement also established the 'transitional rail' activity class to assist with the ongoing redevelopment of the heavy rail part of Auckland's rapid transit network.

INTRODUCTION OF LIGHT RAIL

Light rail is a key component of Auckland's future rapid transit plans. AT and NZTA Board decisions in early 2017 confirmed the long-term mode for the Dominion Rd corridor as light rail.

The aim of the light rail project is to:

- *Alleviate current and forecast bus capacity constraints in the city centre.* A substantial increase in public transport capacity and efficiency is required. Without this, increased travel times to and around the city centre will negatively impact Auckland's productivity.
- *Improve access to growing employment areas, particularly at and around Auckland Airport.* Without a major increase in the number of people accessing the airport by public transport, the road network will not be able to function effectively and the success of this critical employment area will be placed at risk.
- *Unlock significant growth potential along the corridor, especially around Mangere, Onehunga and Mt Roskill.* Providing a step-change in improved access along this corridor will encourage redevelopment, particularly of major public landholdings, and assist in addressing Auckland's housing challenges.

Delivery of light rail took a significant leap forward following the Minister's direction to NZTA to plan, fund, design, and construct rapid transit projects, including light rail. AT is playing a key role in the development of this programme as the service provider and integrator of the Auckland public transport network.

UPCOMING RAPID TRANSIT PLANS

Plans to develop Auckland's rapid transit network over the next decade are detailed in the Auckland Transport Alignment Project (ATAP) and the Regional Land Transport Plan (RLTP). Full implementation of these plans will see a substantial expansion of Auckland's current network through the additional of several rail, light rail and bus rapid transit improvements.



Figure 3: Auckland's Rapid Transit Network first decade improvements

Significant plans to expand and upgrade Auckland's rapid transit network are being progressed. City Rail Link, an extension of the Northern Busway to Albany and the first stage of the AMETI Eastern Busway between Panmure and Pakuranga are all under construction.

As well as introducing light rail on two corridors, there are also plans to extend rail electrification to Pukekohe (to allow direct and more frequent services).

CHALLENGES FOR RAPID TRANSIT PLANNING

Planning, funding, delivery and operational arrangements for rapid transit in Auckland are currently complex and inconsistent. This creates several risks that may lead to project delays, inefficient investment and poor customer outcomes over time.

Currently many issues which should be addressed at a network level are being tackled on a 'project by project' basis. This can be seen through examples such as:

- the need to establish City Rail Link Limited for the completion of that project
- legal complexities for delivering the light rail project, in terms of roles
- a different lead agency for the Eastern Busway compared with the Northern Busway
- the Supporting Growth Alliance leading planning of greenfield rapid transit networks

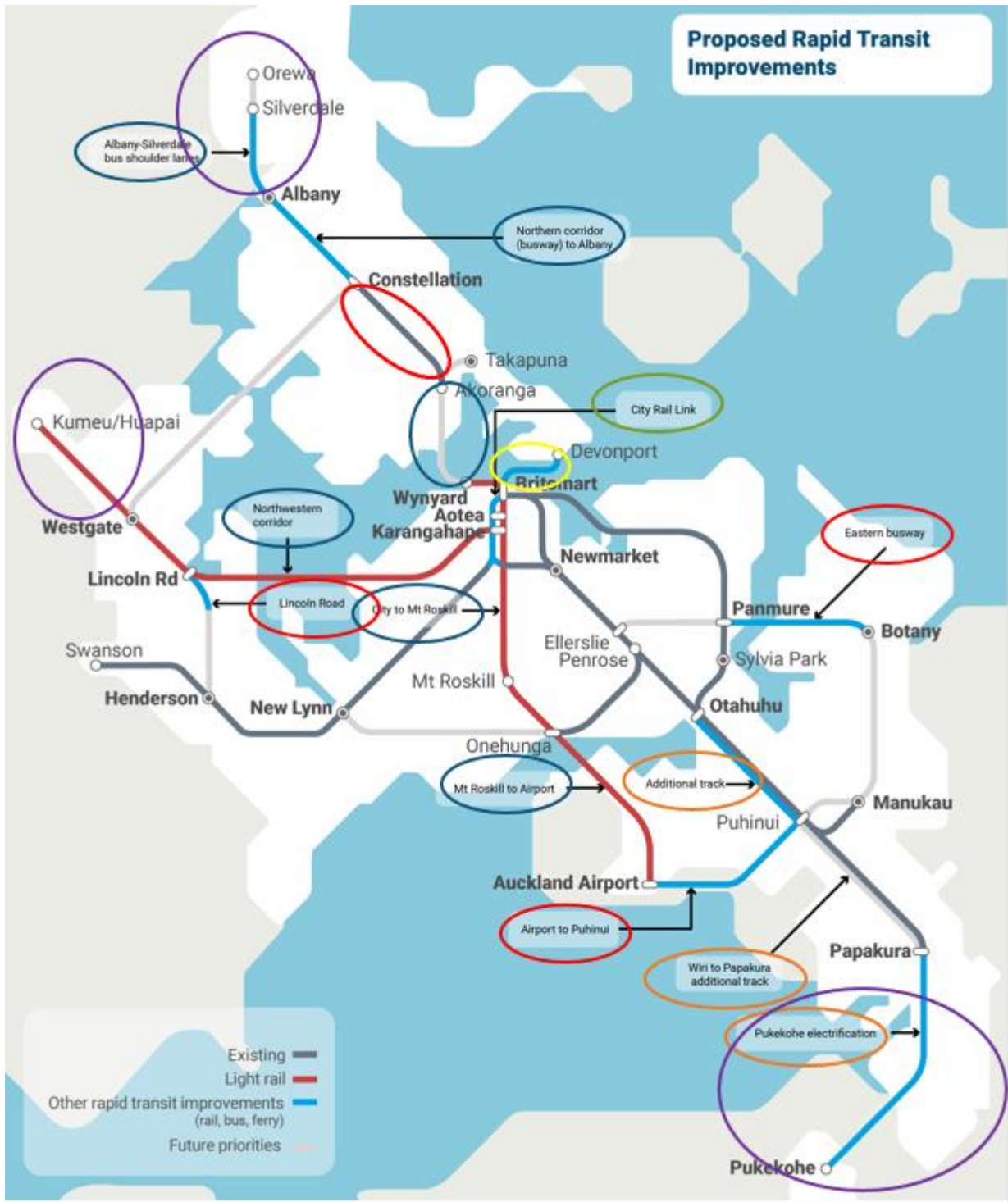
Several projects to expand or upgrade the rapid transit network are currently either under construction or have well advanced planning. As highlighted in the table below, there is significant variety in the delivery and funding approaches of these projects:

Project	Delivery Phase	Delivery Lead	Funding arrangements
City Rail Link	Early works under construction. Main project in procurement.	City Rail Link Limited	50% Auckland Council, 50% Crown
Northern Busway Extension (Constellation to Albany)	Under construction	NZTA (mainline busway) Auckland Transport (Rosedale station)	Mainline busway: 100% NZTA. Rosedale station: Approx. 50% Auckland Council/NZTA
AMETI Eastern Busway	Panmure-Pakuranga under construction Pakuranga-Botany consenting/land acquisition	Auckland Transport	50% Auckland Council 50% NZTA
City Centre to Mangere Light Rail	Business case	NZTA	100% NZTA (seed funding in NLTP)
Northwest Light Rail	Business case	NZTA	100% NZTA (seed funding in NLTP,)
Pukekohe rail electrification	To be determined	KiwiRail	100% NZTA (transitional rail activity class)
North Shore Rapid Transit	Business case	To be determined	To be determined
Greenfield rapid transit networks	Business case	Joint AT/NZTA	75% NZTA 25% Auckland Council (investigation costs only)

Table 1: Rapid transit network project roles and stages

There is generally more consistency in how the rapid transit network is operated (services contracted by AT to operators), although Fullers' 'exempt service' status in the Land Transport Management Act means that AT have little ability to influence ferry services, including on the important Downtown-Devonport route.

A full picture of current lead organisations for different parts of the rapid transit network is shown below:



Key: Current Organisation Lead:

- ▶ AT ○
- ▶ AT-NZTA Alliance ○
- ▶ NZTA ○
- ▶ KiwiRail ○
- ▶ CRL ○
- ▶ Fullers ○

Figure 4: Lead roles for rapid transit planning

AT and NZTA are working together to provide clarity on the roles and responsibilities for rapid

transit across the different phases of implementing and operating a rapid transit corridor, and also outline a clear long term rapid transit plan for Auckland (building on what is identified in ATAP).

Collectively, AT and NZTA will identify key next steps, including changes necessary to give effect to the recommended roles and responsibilities, and more detailed business case and planning work to enable delivery of the rapid transit network.

FUTURE NETWORK PLANNING

ATAP provided strong direction around how the rapid transit network should be developed over the next decade, and also an indication of Auckland's longer-term rapid transit network, noting that exact routes and modes will need confirmation over time through more detailed analysis.

As the network needs to operate as an integrated whole, and also as part of the broader public transport system, getting clarity on long-term planning is key. A map of the longer-term rapid transit network is included below:



Figure 4: Future rapid transit network

The map above is considered the starting point for network planning and project development work. The key issues that need to be addressed in detailed planning and design work for future rapid transit projects will include:

- The key tasks in Auckland's overall transport system that rapid transit needs to perform
- The impacts of developing transport technology on rapid transit planning and implementation.

- Incorporating recent work that has been undertaken since ATAP's completion (e.g. City Centre to Mangere light rail business case development, greenfield network planning, Auckland-Hamilton corridor study, Future of Rail study, etc.)
- Testing the likely rapid transit mode for the different corridors identified in ATAP (noting that further mode analysis will be undertaken in project-specific business cases).
- Understanding the trigger-points and therefore likely timing and sequencing of different parts of the rapid transit network.

A 'network-wide' approach to planning rapid transit in Auckland is essential. There are significant interactions between different corridors while the scale of required investment means it is essential to consider long-term implications.

Developing Auckland's rapid transit network will require very significant investment over time. To maximise the benefits from this investment, future growth must be focused around rapid transit corridors – through both enabling planning provisions and a careful focus to council and government led redevelopment plans. Route protection should be done in a way that is flexible for different modes, while mode choice must be undertaken in a way that avoids creating major future capacity problems and the need for multiple changes over time.

MODE CHOICE

Although the overall rapid transit network has been set out, with assumed modes (as shown in Figure 4), there are still significant decisions to be made about whether these are correct and how these should be rolled out.

The choice of mode (i.e. type of vehicle and infrastructure) is a critical part of developing a rapid transit project. There is an increasingly wide variety of different rapid transit modes, from standard buses right through to 200m+ long heavy rail trains.

Higher capacity modes tend to have the greatest investment requirements, so finding the right balance between meeting projected demand and achieving value for money will always be the core challenge in selecting the right mode.

Other considerations, such as amenity, integrating with existing networks, supporting growth and urban development and minimising environmental impacts are also critical elements of mode choice. This section provides an overview of the likely range of rapid transit modes in Auckland's future rapid transit network – building on the indication provided in ATAP.

The overall capacity of a rapid transit line is the combination of how many passengers can travel in each vehicle, multiplied by the maximum frequency of vehicles that can be operated efficiently per hour. As shown below, vehicle capacity varies from around 50 (for a standard bus) up to well over 1000 (for a 9-car train).

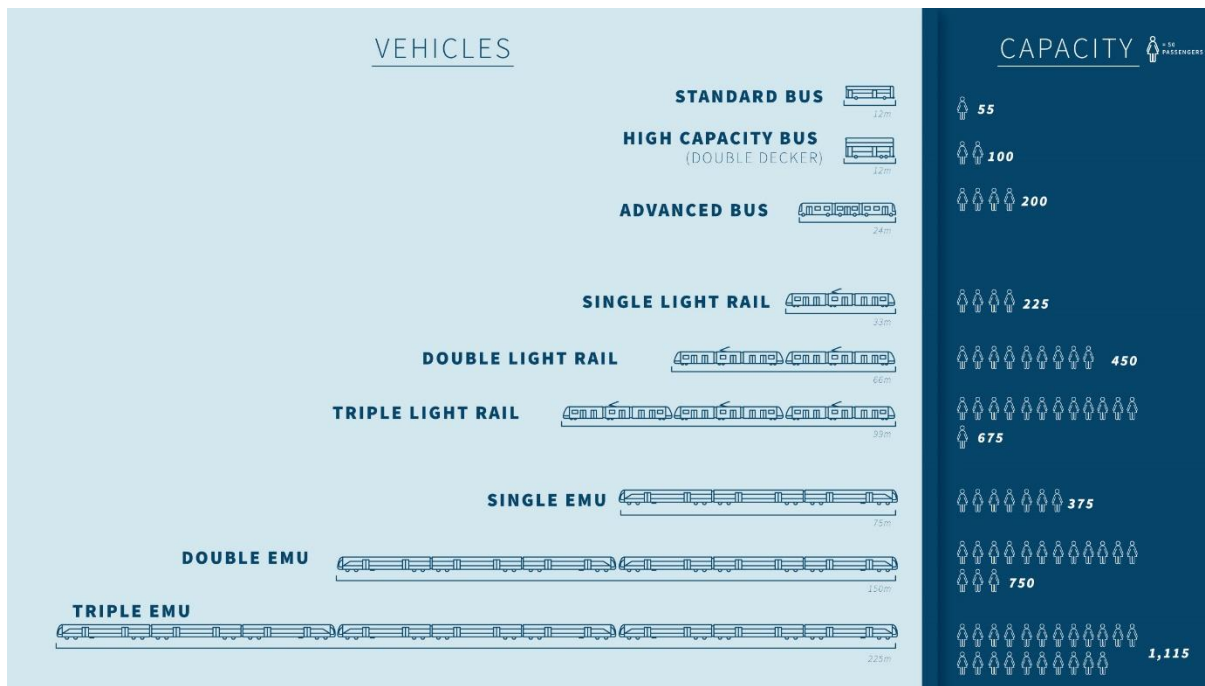


Figure 5: Public transport vehicle typical carrying capacity

The number of public transport vehicles that can be efficiently operated along a corridor is typically determined by points of constraint at stations, intersections/junctions and terminals rather than the running way between station and intersections. While low frequencies can result in long wait times, especially where headways drop below ten to fifteen minutes between vehicles, very high frequencies also create their own set of problems.

These include:

- Congestion between vehicles at stops and stations, with some vehicles blocking space for others while passengers board and alight.
- Signal priority systems (e.g. providing an automatic green light at intersections for public transport) become overwhelmed, leading to long delays for other traffic.
- Many vehicles arriving and departing at the same time creates confusion for passengers.

Larger, rail-based vehicles generally operate at lower frequencies than bus-based modes. Operating more than 30 rail-based services per hour is unusual internationally and generally requires fully separate lines, automation and complex signalling systems. Higher bus frequencies are more common, although as bus frequencies increase beyond a service every 1-2 minutes, increasingly substantial infrastructure is required – especially at route terminus points.

The variety of projected demand levels across different parts of Auckland's future rapid transit network highlights why a selection of different modes will be necessary. The figure below shows the overlapping carrying capacity of the various modes.

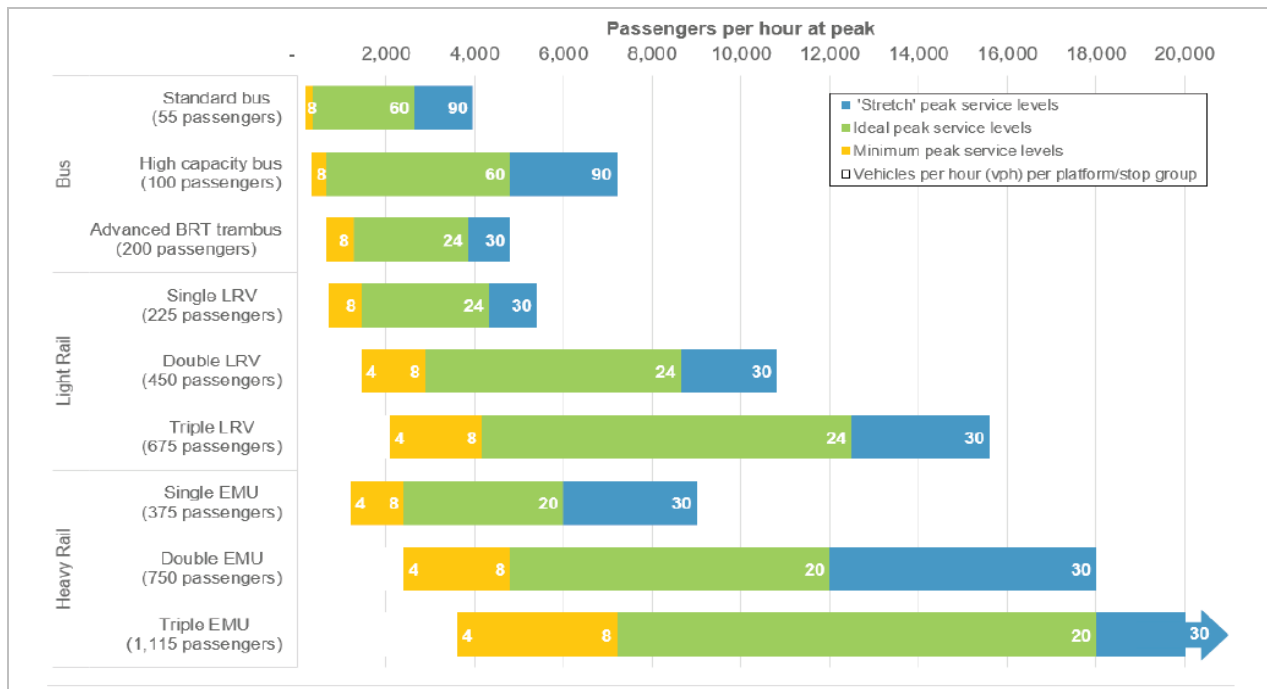


Figure 6: Carrying capacity of various rapid transit modes

Rapid transit’s great strength is its ability to move very high levels of passenger demand quickly and reliably. In order to do so, rapid transit requires significant investment into infrastructure and services. Rapid transit corridors are generally fully grade-separated from other transport networks, or in some cases delivered ‘on street’ with absolute priority at intersections and other interactions with traffic (i.e. services are automatically provided with a green light at signalised intersections).

The work by AT and NZTA to develop and refine the rapid network will be challenging and complex, but it is hoped that the collaboration and shared direction will see progress and consensus in the near future.

CONCLUSION

The recent changes in government direction have signalled a fundamental shift in the planning and delivery of the rapid transit network.

Rapid transit projects can result in city-shaping outcomes and AT and NZTA are working together to provide clarity on the roles and responsibilities for rapid transit across the different phases of implementing and operating a rapid transit corridor, and also outline a clear long term rapid transit plan for Auckland (building on what is identified in ATAP).

Collectively, AT and NZTA will identify key next steps, including changes necessary to give effect to the recommended roles and responsibilities, and more detailed business case and planning work to enable delivery of the rapid transit network.

REFERENCES

Auckland Plan – Auckland Council, 2018
 Auckland Transport Alignment Project - Auckland Transport, Ministry of Transport, NZ Transport Agency, et al, 2018
 Government Policy Statement on Land Transport 2018 – NZ Government, 2018
 Regional Land Transport Plan – Auckland Transport, 2018