A Step-change for Auckland

Rail Development Plan 2006

Auckland Regional Transport Authority

August 2006

ARTA

Auckland Regional
Transport Authority

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Foreword

Efficient movement of people and freight within and through the Auckland region is essential for the lifestyle of the people who live here and for the New Zealand economy as a whole. The current Auckland transport system relies disproportionately on road transport by private car.

In April 2006, ARTA launched its Passenger Transport Network Plan (PTNP), a comprehensive and integrated programme designed to recognise the way Auckland is growing and to change the way Auckland moves. The aim of the PTNP is to provide Aucklanders with a viable public transport alternative to the car that will reduce traffic congestion and achieve the objectives of the Regional Growth and Regional Land Transport Strategies. As Auckland's population climbs toward 2 million, a car-based transport system is increasingly difficult to sustain.

Revitalising Auckland's rail assets is fundamental to the PTNP. South of the Waitemata Harbour, rail alone has the capability to rapidly move large numbers of people, and only by providing Auckland with a high-quality, high-frequency rail service will ARTA achieve the objective of freeing up motorways and intensifying urban development. The rail system has been long neglected, but it is of enormous strategic significance. The opening of the Britomart Transport Centre in 2003 together with relatively modest investment in upgraded trains, track and stations has resulted in dramatic growth in rail patronage – up from 2.5 million journeys in 2003 to 5 million at June 2006.

The Government's recent decision to invest $600 million over the next 3 years to upgrade track, stations and signalling is a welcome move to further expand the capacity of Auckland's rail infrastructure. However, on present rates of growth, the current Auckland train fleet will reach full capacity by 2008. New trains will, however, be required over the coming 10 years to improve service frequencies, maintain patronage growth and to replace life-expired trains. The processes to purchase these trains will need to commence in the coming months.

The purpose of this Rail Development Plan is to describe in more detail the steps needed to fully revitalise the Auckland rail system as part of a fully functioning world-class public transport system and in particular to document the issues that ARTA has addressed in developing its rolling stock procurement strategy. It provides a detailed and robust plan which will enable Auckland's rail system to make a significant contribution to economic development, to the way Auckland lives and moves, and to environmental sustainability.

As a region and as a country we have a responsibility to make far-sighted decisions. Rail assets cost a lot of money but they last a long time – 30 years or more. Only by taking a long-term view can we justify the investment required. Only by making choices today that are appropriate for Auckland in the future can we ensure we spend money wisely.

ARTA has undertaken an in-depth comparison of the options for new trains and has concluded that electrifying Auckland's rail system as soon as possible and purchasing electric trains provides the optimum solution. An electrified railway will achieve the challenging growth targets in the next 10 years but will also future-proof longer-term expansion of the Rapid Transit Network as Auckland's population continues to grow towards 2 million.

The plans outlined in this document are undoubtedly challenging and will require concerted ongoing collaboration between Central and Local Government and industry to realise. We need, however, to recognise that the cost of doing nothing may well be more than the cost of progressively implementing what is recommended. The costs associated with congestion and the impacts on the environment and health should not be underestimated.

Auckland has been identified as New Zealand's only city of international scale – now is an opportunity to reinforce that status and develop a public transport system we can be proud of.

The investment required to implement the Rail Development Plan is more than the funding that has currently been identified. If additional funding cannot be found, then tradeoffs will be required which may impact on patronage growth and service quality and reliability.

A decision on new rolling stock is required now to provide the planning certainty and efficient implementation of the investment and resources required to deliver a world-class rail system for Auckland.

In the opinion of ARTA, the challenge now is to find the collective will to see that this plan is fully implemented.

Brian Roche,
Chair, Auckland Regional Transport Authority

This document describes how we can revitalise Auckland's rail infrastructure.

Introduction

This is a plan to change forever the character of the Auckland region.

It is a plan to change the direction of Auckland's transport development. A plan to revitalise the region's rail infrastructure and make it possible for tens of thousands of commuters to reach the CBD every day without using the main arterial roads. This plan will make a real difference to traffic congestion.

It is a plan to change the shape of Auckland's urban development. As Passenger Transport using rail enables many people to move quickly and because the plan includes high-frequency, high-quality passenger train services that are linked to a bus service redeveloped to feed rail hubs in the suburbs, the development of Auckland will intensify around the transport hubs. International experience supports this. The plan will make a difference to urban sprawl.

The Rail Development Plan will be good for business, as it will encourage the economic growth of Auckland's CBD and other centres because it will make Auckland a more attractive place in which to live and work. It will deliver Auckland the kind of Passenger Transport service an international city should have. This plan, once implemented, will be good for the environment, because it will reduce greenhouse gas emissions, improve air quality and reduce noise pollution. This plan will be good for society: it will reduce the number of deaths and injuries from car accidents and it will make Auckland an easier region in which to move around.

This is a plan to take a long-neglected Auckland asset – its irreplaceable rail corridors that have untapped capacity – and put them to work again for the good of the region and the good of the country.

A new Regional Land Transport Strategy (RLTS) was adopted by the Auckland Regional Council (ARC) in 2005 and was developed in conjunction with Local Authorities and Central Government agencies. ARTA's Passenger Transport Network Plan (PTNP), published in April 2006, sets out an ambitious programme of improvements to bus, rail and ferry services over the next 10 years to deliver the Passenger Transport objectives of the RLTS. By 2016 Passenger Transport patronage will double from 50 million passenger trips per annum today to 100 million with rail carrying around 16% of the passenger boardings. Rail journeys will be mostly longer-distance trips, so when measured in passenger kilometres, rail's contribution to Passenger Transport will be around 35%.

This Rail Development Plan describes not only the work needed to upgrade the rail system in the next 10 years, but because trains and rail infrastructure are long-life assets, it takes a long-term view to 2030 and beyond. By 2030, by which time this Plan proposes an underground loop for the CBD and a rapid rail link to the airport, the number of rail trips will have increased to at least 30 million per annum.

This plan represents the opportunity to make a dramatic difference.

Auckland Strategic Alignment Project

At the time of preparation of this report a major review is being initiated to bring alignment between the Central Government and the Auckland region about Auckland's long-term transport view. Of great concern is:

- *A shortage of regional funding to pay for the "regional" component of the Regional Land Transport Strategy (RLTS) 2005. The principal impact of this shortfall is on proposed investments in Passenger Transport and Travel Demand Management activities.*
- *A major increase in the total cost estimates for the package of projects required to give effect to the new RLTS 2005. The package includes roading as well as Passenger Transport and Travel Demand Management.*

The review titled the Auckland Transport Strategic Alignment Project is expected to consider the information contained in this Rail Development Plan.

This plan is a step-change for the Auckland region and a step forward for New Zealand.

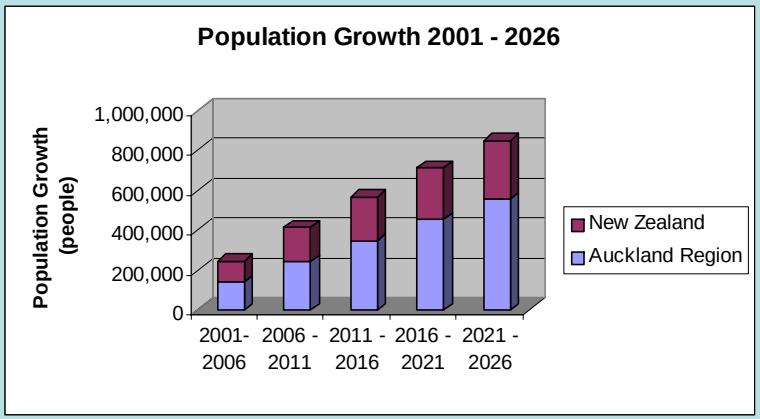
The challenge for the Auckland region

For 100 years, coping with Auckland's growth has been a relentless headache. By the 1940s the major arterial roads – the Great North and Great South Roads – were unable to cope with the traffic volumes. The advice was that things would only get worse: the local authorities were told that the burgeoning metropolis was likely to reach a maximum population of 600,000 people.

Today, the Auckland region has 1.3 million people – a third of New Zealand's population – a growth rate of more than 12% since 2001. In another 25 years, close to 40% of New Zealanders will be living in Auckland, and by 2050 Auckland is likely to be home to 2 million people.

The region's appetite for growth has always been underestimated. When the Harbour Bridge opened in 1959, it carried 4.9 million vehicles in its first year. By 1966 – just 7 years later – that number was 10.6 million, not far short of its capacity. The region didn't simply grow, it changed shape – the vast expansion on the North Shore that the bridge made possible had not been foreseen.

Auckland's Population Growth 2001 – 2026



Traffic congestion is a recurring consequence of Auckland's growth. Today, traffic congestion is costing the economy an estimated $1 billion a year (just under 1% of NZ GDP) and is a barrier to economic development. New Zealand cannot afford Auckland to be held back. Without an effective transport network, Auckland will not be able to realise its potential and New Zealand will not be able to maximise its economic performance.

As a result of this congestion, Aucklanders are increasingly turning to Passenger Transport. ARTA's experience is that whenever Rapid Transit service improvements to Passenger Transport are provided, the new capacity is quickly taken up by demand.

As the Prime Minister, the Rt Hon Helen Clark, said in her statement to Parliament in February 2006, *"We need to remove the infrastructure constraints which hold back world-class performance in Auckland, our only city of international scale."*

Quite simply, New Zealand needs Auckland to work, and for that to happen, Auckland needs to work differently.

An effective transport network will enable Auckland to realise its potential and New Zealand to achieve its economic goals.

The strategic context

Upgrading Auckland's rail system will achieve national and regional transport and wider strategic goals

New Zealand's Goals

A strong economy to deliver the living standards, the services, and the quality of life that the citizens of our first-world country expect, deserve, and are prepared to work for.

New Zealand Transport Strategy

Assist economic development.
Assist safety and personal security.
Improve access and mobility.
Protect and promote public health.
Ensure environmental sustainability.

The Regional Growth Strategy

Promoting quality, compact urban environments.
Encourage growth within the existing metropolitan area. Encourage urban growth focused around town centres and major transport routes to create higher-density communities and higher CBD employment.

The Passenger Transport Network Plan

A Rapid Transit Network. A Passenger Transport network based around a high-frequency, high-quality service operating on 'transport spines' that does not get caught up in road traffic congestion.

National Rail Strategy

Upgrade the national rail network.
Encourage more use of urban rail Passenger Transport.
Ensure public health benefits of rail are incorporated in transport planning.
Ensure transport choices take into account the environmental benefits of rail.

The Regional Land Transport Strategy

A transport system which supports and assists in instigating growth within the higher-density growth centres and corridors. A rapid Passenger Transport system which provides better linkages to and between those high-density centres.

The Rail Development Plan

Revitalising Auckland's rail infrastructure.

Building the capability for rail to become the primary mode for Passenger Transport travel between the CBD and regional centres. Patronage of around 15.7 million passengers by 2016 and 30 million passengers by 2030. This will equate to 40% of all Passenger Transport kilometres.

The Rail Development Plan is an essential component of achieving the strategic goals for Auckland and for New Zealand.

The importance of rail

Rail is the most efficient people-mover

Revitalising Auckland's rail infrastructure is critical to achieving the Rapid Transit Network proposed in ARTA's Passenger Transport Network Plan.

All successful first-world Passenger Transport (PT) systems utilise a series of high-speed spine routes supported by high-quality feeder services. In the case of Auckland, ARTA believes that these spine routes should initially comprise:

- The new Northern busway (partly in operation with further construction in progress)
- The three rail corridors south of Waitemata Harbour

Auckland's current PT system relies heavily on bus services: 85% of current PT trips are by bus. However, because buses share their routes with other traffic they are affected by the same congestion. There is limited potential for bus services to offer travellers significantly faster travel times and therefore any incentive to leave their car at home.

Rail, on the other hand, is extremely efficient at moving people. By 2030, 30,000 commuters could be travelling by rail to the CBD and across the region in the morning peak. Moving the same number of people by car would require around 120 kilometres of extra arterial road and motorway lanes costing at least $3.5 billion.

By the year 2016 it is envisaged that rail patronage should be around 15.7 million boardings per annum, and by the year 2030 it is envisaged that the rail system could be carrying some 30 million passengers p.a. (with the inclusion of the CBD loop tunnel), up from the current 5 million passengers p.a. These growth figures will obviously be impressive, but even more important is that these journeys will be mostly the long-distance journeys.

A high-capacity Rapid Transit Network is the key to reaching these goals. With current bus patronage accounting for 85% of all PT journeys, clearly bus services will continue to play a very important role in developing this network. However, the inter-modal PT approach adopted by ARTA will reconfigure bus services to provide integrated feeders to rail and ferry services.

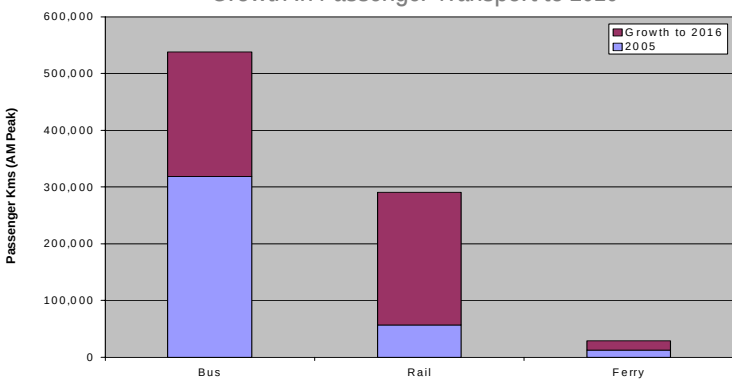
4 to 5 metre corridor width through city	Capacity per hour
An extra lane of motorway	2,400 people
Dedicated busway	12,000 people
Suburban heavy rail	20 – 25,000 people

Source: US Transit Study with factoring applied for NZ's narrow gauge

Rail as a Percentage of Total Passenger Transport

	Rail Journeys (million pa)	Percentage of Total PT Journeys	Percentage of Total PT Passenger Kilometres
2006	5.0	10%	19%
2016	15.7	16%	35%
2030	30	20%	40%

Growth in Passenger Transport to 2016



Rail is the essential backbone of the Rapid Transit Network. Rail can change where Aucklanders live and how they travel.

The importance of rail (continued)

Rail facilitates urban intensification

Given this ability to move large numbers of people quickly between centres, rail, and in particular electrified railways, encourages the development of higher-density communities as envisaged by the Regional Growth Strategy and now being incorporated into the Auckland Territorial Authorities' district plans. Good-quality public transport creates agglomeration benefits including more jobs and greater development in the CBD. Moreover, when the public transport is visibly "permanent" it begins to attract medium- and higher-density development and facilitates urban renewal. This phenomenon is highly visible along Sydney and Melbourne rail corridors and is beginning to occur in Brisbane.

Rail delivers the objectives of the New Zealand Transport Strategy

NZTS Objective	Upgrading Rail will
Assisting economic development	• Encourage intensification of development along rail corridors • Increase economic activity and labour productivity in the CBD • Reduce congestion, improving freight travel times and road user journey time reliability
Assisting safety & personal security	• Reduce road traffic accidents by replacing car trips by a much safer transport mode • Provide better-patronised well-lit stations, trains and car parks with CCTV security monitoring
Improving access & mobility	• Improve access to the Auckland CBD without increasing traffic congestion • Improve level of service for PT users • Provide better public transport options for people without private transport and mobility-impaired users
Protecting and promoting public health	• Improve local air quality by removing car trips and providing new, more efficient trains • Improve water quality due to less road runoff • Encourage walking and cycling to/from stations • Reduce dependency on private vehicles
Ensuring environmental sustainability	• Provide more energy-efficient transport mode than private vehicles • Reduce dependence on imported fossil fuels • Lead to more sustainable land-use patterns

Auckland's rail infrastructure is too valuable to waste

The Government repurchased the Auckland rail infrastructure in 2001 to help the region achieve a strategy to revitalise rail and enhance its ability to contribute to sustainable economic development. Auckland's rail corridors are an irreplaceable asset and the Rail Development Plan will ensure that they are used to maximum benefit. Furthermore, the rail corridors are at present significantly underutilised. In comparison, our motorway corridors are already congested and acquiring more land to dramatically expand them would be expensive, politically difficult and will disrupt local communities.

The "Exit Rail" option investigated in this report highlighted that if rail was abandoned an investment of over $1 billion would be required to build alternative high-capacity bus lanes and would take at least 5 years to implement and would only provide enough capacity until 2016. They would also require expensive land acquisitions involving politically contentious resource consents. The additional buses required to replace train services would add significantly to CBD traffic congestion.

By 2030, investing in Auckland's rail infrastructure will...

- *Ensure more than 30,000 train travellers each morning and afternoon peak. This is equivalent to some 24,000 fewer car journeys*
- *Save on road construction. Around 120 kilometres of arterial and motorway lanes costing around $3.5 billion in construction costs*
- *Increase health and quality of life. Reduce greenhouse gas emissions by 233,000 tonnes per annum. Achieve a 9% reduction in fatal road crashes per annum*
- *Reduce fuel consumption by 70 million litres per annum*

Rail: part of the integrated solution.

Auckland's rail network today

Rail patronage is growing strongly

Auckland's suburban rail system suffered from years of neglect from the 1950s and services almost ceased in the early 1990s. In recent years, as a result of both Central and Local Government investment into the rail system, rail patronage in Auckland has been growing strongly: up from just over a million trips per annum in 1992 to 5 million passengers in 2005/06. In March 2006, rail patronage reached a new monthly record of 545,000 – 39% up on the same month in the previous year. These investments have included the $204 million Britomart Transport Centre, remanufactured trains, track duplication and augmentation, station upgrades and more frequent services. These modest investments have driven significant patronage growth.

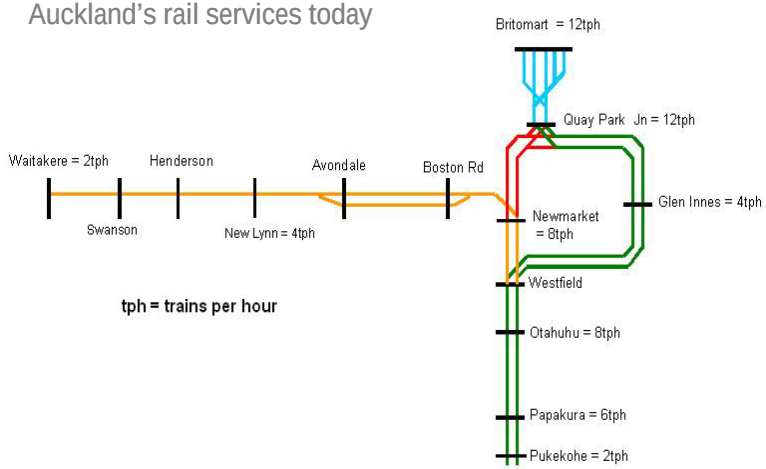
The system is almost at capacity

Currently, work is under way to complete double-tracking part of the Western Line to make possible more frequent services. However, without further investment, rail will not be able to make any further contribution to relieving Auckland's traffic congestion. The estimated capacity of the system without further improvements is around 8 million passengers per annum.

The limits on Auckland's rail network are:

- *The **capacity** of services is constrained by the number of trains available*
- *The **frequency** of services is constrained by the number of tracks and the signalling system capacity, and other improvements necessary if more and faster trains were utilised on the network*
- *The **extent** of services is constrained by the location of rail corridors and rolling stock*
- *The **quality** of service is constrained by old infrastructure and signalling, and the standard of stations and trains*

Auckland's rail services today



Without further investment, the Auckland rail network will soon reach its capacity of around 8 million passenger trips per annum.

Auckland's rail network tomorrow: 2006 to 2016

The Core Network Upgrade

Part one of the ARTA Rail Development Plan is what we call the Core Network Upgrade (CNU). The CNU is a package of enhancements to the system that, taken together, will make it possible for the system to be handling 15.7 million trips per annum by 2016 or earlier.

The components of the CNU are:

Trains

Over half of Auckland's train fleet is more than 25 years old with the oldest nearly 40 years old. New trains are required to replace these and also to provide more capacity. The plan is to have 28 trains in service by 2009 and 35 trains in service by 2011. Peak-period trains will have a minimum of 4 carriages, with some up to 6 carriages. Acquiring new rolling stock and electrifying the network will enable high-quality trains to provide more frequent services.

Track extensions

Completion of the Western Line double-tracking, redevelopment of Newmarket junction and construction of the Manukau City Spur line.

Station upgrades

Completion of station upgrading to provide improved, safer facilities for passengers. It also includes extensive redevelopment of Newmarket station to provide increased capacity and efficiency.

Other essential infrastructure

Upgrades to signalling to provide increased capacity and the reliability and safety standards required for an intensive urban passenger rail system.

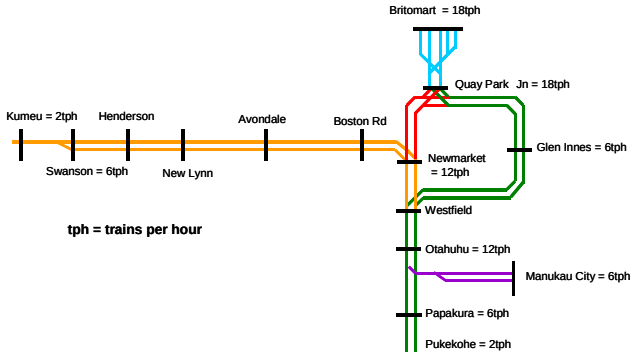
Provision of facilities to store and maintain the additional trains.

Potential electrification of the network.

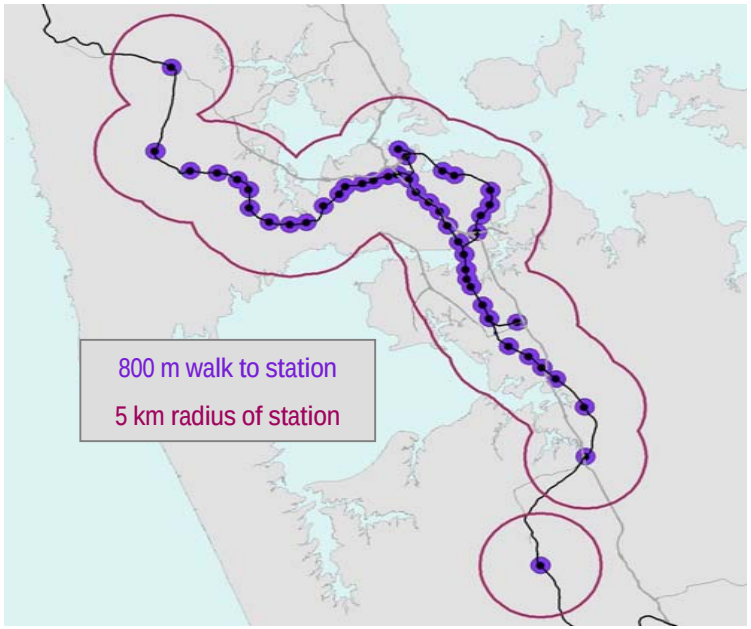
By 2016 Auckland's population is expected to be about 1.6 million people:

- *Around 440,000 (28%) will live within 800 metres' walk of a rail station*
- *Just over 1 million (62%) will be within a 5 km bus, car or ferry ride from a rail station*

Auckland's rail network in 2016



2016 core rail network catchments

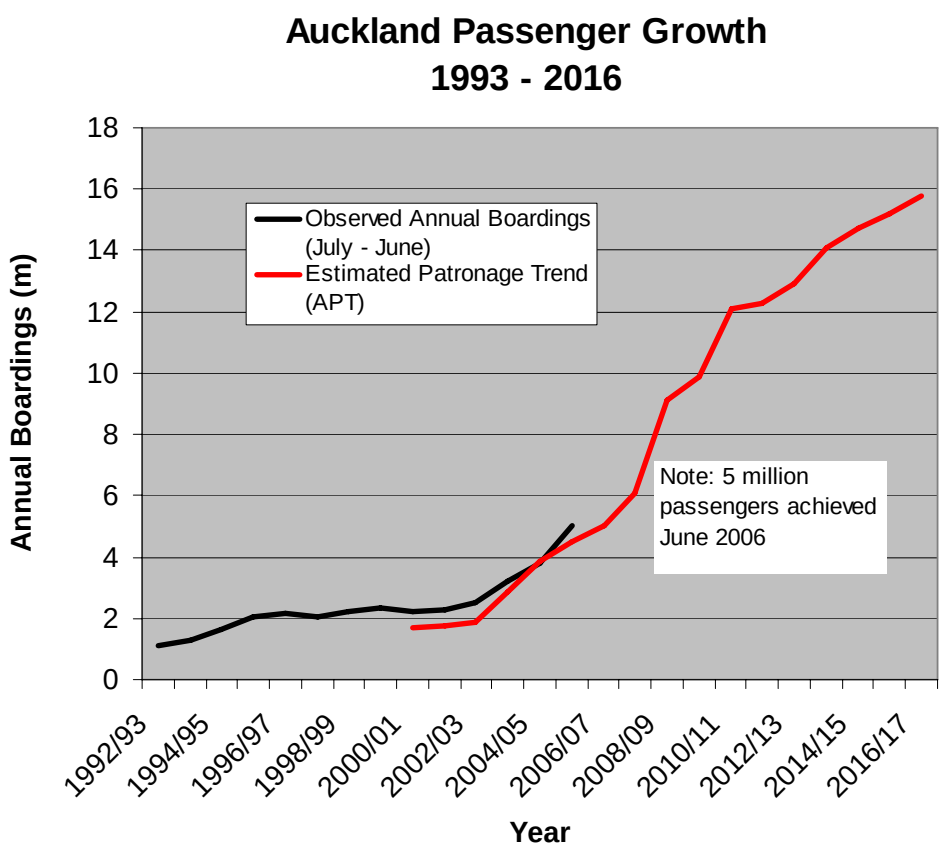


The Core Network Upgrade is the first step towards increasing rail patronage to 15.7 million trips p.a. by 2016.

Auckland's rail network tomorrow: Patronage

More Aucklanders than ever before are using rail.

The Core Network Upgrade and consequent service improvements will enable the current high rate of patronage growth to continue.



Auckland Passenger Transport Model

The patronage forecasts resulting from the rail upgrade have been generated using the Auckland Passenger Transport (APT) model. APT is a multi-modal Passenger Transport forecasting tool for the Auckland Region and utilises the EMME/2 software package used throughout the world for evaluating transport projects. APT was developed for and is maintained by the Auckland Regional Council. It was created in 2001 and calculates the incremental impact on bus, train and ferry patronage arising from specific service level scenarios, based on travel demand patterns that were developed by a comprehensive set of user surveys. It also draws upon current and projected land use information provided by the Territorial Local Authorities.

The APT model has been peer-reviewed and revised significantly since its introduction. It has been used extensively in the development of the RLTS and PTNP as well as projects such as the Northern busway.

There is a good correlation between the forecast and actual rail patronage for the last five years, with the APT forecasts being slightly conservative.

With further investment, the current high growth rates will continue.

Auckland's rail network tomorrow: 2016 to 2030

30 million rail trips per annum by 2030

The Core Network Upgrade will dramatically improve Auckland's rail network. By 2016, Auckland could have the Rapid Transit Network it needs to offer high-frequency, high-quality Passenger Transport services that will make a difference to road traffic congestion. But by then, Auckland's population will have reached at least 1.6 million people and so it makes sense to have a vision for Rail that looks beyond the immediate horizon.

Service intensification

The Business Case has considered two potential options for long-term service intensification that fully realise the benefits of the CNU. Over time both options could be implemented.

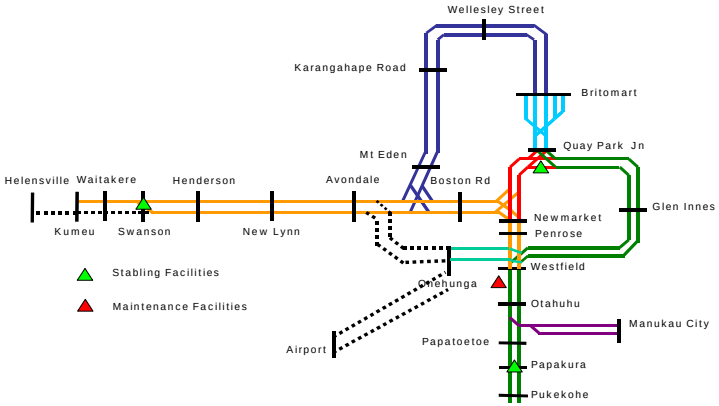
Option 1 – Suburban Services – Higher frequency and service extensions

A key way in which the capacity and utilisation of the rail network could be enhanced is to extend services to what will be high-density population centres, for example to Onehunga and Helensville, as well as higher frequency services on the existing network (including Pukekohe).

Option 2 – An underground CBD loop

With the Core Network Upgrade complete, an obvious shortcoming in the Auckland rail network will be the fact that services terminate at Britomart, at the bottom end of the CBD. Constructing an underground loop under the CBD, with stations at Wellesley Street and Karangahape Road, would have significant benefits to commuters and encourage even more people to use Passenger Transport. Furthermore, because Britomart would become a through station rather than a terminus, it would operate more efficiently, making it possible to increase the number of services. Overseas experience shows that significant increased economic activities occur in CBDs with high-capacity Rapid Transit systems.

Auckland's rail network in 2030



Further Expansion

New rail lines between Avondale and Southdown line paralleling State Highway 20 and to Auckland International Airport may also be completed by 2030. However, these projects have not been developed sufficiently for them to be included in the Rail Development Plan at present.

Start the planning now

Auckland will keep growing. Because of the lead times involved in the major projects required so that Passenger Transport can keep pace with that growth, ARTA intends to start work now on plans for the next generation of service and infrastructure improvements.

The Rail Development Plan looks beyond 2016 to consider the rail services Auckland will need for a population of 2 million.

The business case for rail

The Options

In order to decide that this Rail Development Plan is the right approach, ARTA analysed a variety of options using methodology prescribed by Land Transport NZ. The options considered were:

Do Minimum – Base case	Spend what is necessary to maintain current service levels, but nothing more
Exit Rail	No longer offer rail as a Passenger Transport option
15-minute peak frequency – Diesel	Compare the diesel and electric options, but with fewer trains
15-minute peak frequency – Electric	
10-minute peak frequency – Diesel	Compare the two options at the service levels considered necessary to achieve the objectives of the Regional Land Transport Strategy
10-minute peak frequency – Electric	
Service intensification – Suburban and CBD	Consider the benefits of the longer-term system enhancements

The "Exit Rail" option was eliminated early in the process when it became clear that it would involve considerable additional expense estimated at greater than $1 billion and would increase traffic congestion. Also, the "Exit Rail" option is inconsistent with the Regional Land Transport Strategy and Government strategies and so was not pursued.

The Benefits

The quantified economic benefits generated by the Rail Upgrade accrue from four main sources (as required by the Land Transport NZ Project Evaluation Manual):

Benefits to road users	Travel time and congestion costs savings to road users from fewer people using their cars especially in the peak periods
Benefits to Passenger Transport users	Savings in travel time, improved reliability, improved vehicle quality, benefits to new passengers to rail, increased rail revenue
Indirect transport benefits	Reductions in greenhouse gas emissions, reduced accidents, improved local air quality, reduced noise pollution, reduced urban sprawl and the "hidden" cost of motoring such as land used for roads and parking, severance and social costs of energy use
Agglomeration benefits	Benefits from intensification of economic activity in the Auckland CBD including deeper, more efficient labour markets, better links between suppliers and markets, and increased opportunities for knowledge sharing

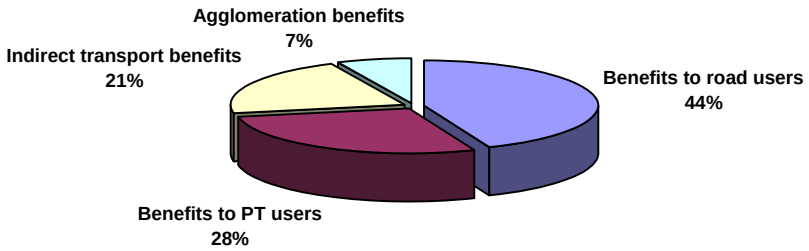
Implementing this Plan will provide significant benefits to rail users, road users, and communities.

The business case (continued)

The Analysis

Benefits

Travel time savings to road users make up the largest component of the benefits of the rail upgrade, demonstrating that an efficient rail system will not just benefit commuters but will help reduce congestion, especially at peak periods, for businesses and other road users.



Discount Rates

It has become clear that applying Land Transport NZ's standard project evaluation methodology to a major Passenger Transport investment such as this is too restrictive in its nature and does not allow for the full benefits to be realised. In particular, this is because of the long time periods involved with the rail upgrade – the time involved in establishing the assets and the far-reaching and enduring nature of the benefits.

Simply put, the Rail Development Plan compares favourably as an investment if all the benefits are considered more broadly and over a longer period reflecting the life of the assets and the ongoing generation of benefits, but not so well if a more narrow and short-term view is taken. Evaluation of the relative asset lifespan is consistent with international accepted practice. Many other countries adopt a methodology similar to that used by ARTA for long-term public infrastructure assets.

COUNTRY	DISCOUNT RATE
NEW ZEALAND	10% for 25 years
UK	3.5% for first 30 years then 3.0% for years 31 to 60
AUSTRALIA	
New South Wales	7%
Queensland	6%
CANADA	
Toronto	5%
British Columbia	6%
US	
Tennessee	3% and 7%
US Department of Transportation	5 – 7%
US Office of Manpower and Budget	6%
Iowa	6%
Washington	6.5%

Value of Time

There is a strong case for using the same value of time for car users and PT users, particularly for rail users in peak times. The Land Transport NZ Project Evaluation Methodology has historically used a lower value of time for PT users compared with car users.

A 40-year evaluation period is more appropriate and in line with international practice.

The business case (continued)

Benefit Cost Ratio: The Core Network Upgrade

The results of the economic evaluation for the Core Network Upgrade options are as follows:

10-minute peak frequency	BCR(G) at 10% Discount Rate over 25 years (Note 1)	BCR(G) at 7% Discount Rate over 40 years (Note 2)
Diesel	0.86	1.51
Electric	0.87	1.52
Diesel & Electric – Fuel cost increases – (Note 3)	0.95	1.66
Diesel & Electric – Fuel cost increases & Other economic benefits – (Note 4)	1.25	2.13
Diesel & Electric - Fuel cost increases & Other economic benefits & Equalised Value of Time – (Note 5)	1.37	2.34

Note 1: Evaluation conducted under the Land Transport NZ methodology.

Note 2: Evaluation conducted using internationally accepted methodology.

Note 3: If fuel costs continue to rise there will be a consequential increase in rail patronage (5%) and hence related benefits leading to improved BCRs.

Note 4: Other economic benefits relate to CBD (agglomeration) benefits (increased productivity per employee) – residential intensification – wider effects of car use – environmental benefits of new rolling stock.

Note 5: Equalised value of time – contrary to the Land Transport NZ Project Evaluation Methodology, rail users' time has been considered at the same value as car users'.

BCR(G) is the "Government" Benefit/Cost Ratio which includes additional revenue generated by the improved rail services. The other Benefit Cost Ratio measure used by Land Transport NZ, BCR(N) (N for national), excludes revenue and is around 20–25% below BCR(G).

Most of the BCRs are greater than 1.0 showing that the benefits are equal to or more than the costs.

Benefit Cost Ratio: Service Intensification

Looking long term, a preliminary evaluation of the post–2016 Service Intensification options (see page 12) shows that benefits exceed the costs.

	BCR(G) at 7% Discount Rate over 40 years (Note 2)
Service Intensification – Suburban	1.35
Service Intensification – CBD	1.03

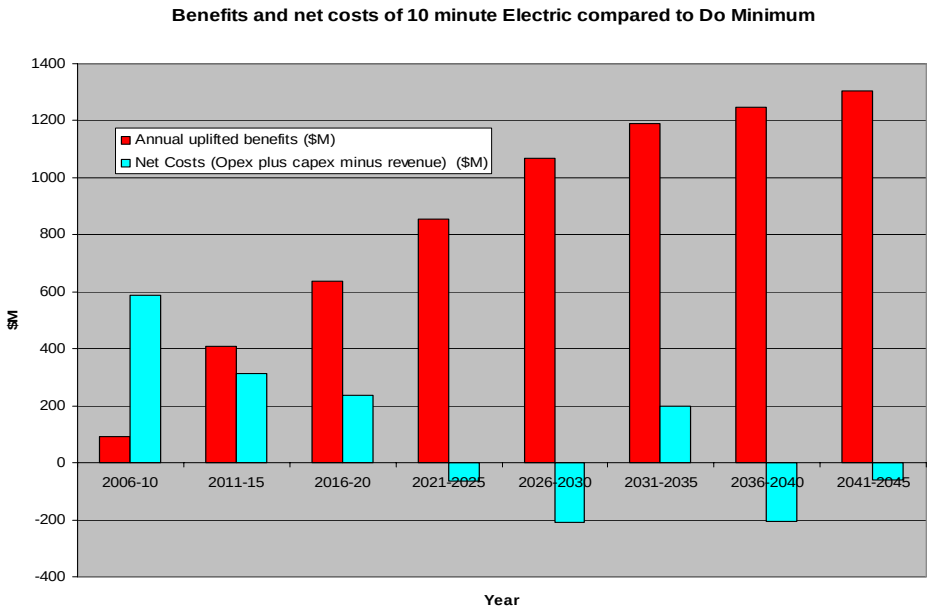
These are long-term 20–plus–year investments therefore 40 years is an appropriate minimum evaluation period.

Agglomeration benefits have not been included but initial analysis indicates that the BCR for the CBD option would rise by around one third.

The benefits of rail upgrades and electrification exceed the costs by a considerable margin.

The business case (continued)

The benefits of rail are sustainable and increase over time



The core network upgrade will provide a sustainable basis for future growth. Additional capacity can be added incrementally by running longer trains and upgrading signalling for higher frequencies. In contrast, the travel time savings created by most roading projects tend to diminish over time as traffic volumes grow. Further capacity can usually only be provided by adding extra lanes, which is expensive and can be contentious in urban areas.

The Conclusions

- Exit Rail is costly and does not provide a viable alternative to the rail upgrade.
- The BCRs for both diesel and electric are close to 1.0 under the standard Land Transport NZ procedures but comfortably exceed this when other sources of benefit and longer evaluation periods are used.
- Electric operation is cheaper than diesel over the long term.

Electrification: a key policy decision

Why is electrification ARTA's preferred option?

Begin with the end in mind

Trains are expensive and have long lives – 30 to 40 years. Therefore train procurement decisions have to take a long-term view of the future development of Auckland's rail network. Furthermore, because they are built to specific requirements (taking into account factors such as the gauge of the track, platform heights and tunnel dimensions), they have to be ordered between four to six years ahead. All of this means ARTA has to be very sure that the replacement trains it is about to order will be right for Auckland not just today, but for the future shape of Auckland.

The basic choice will be between modern diesel units and electric units with attributes illustrated in the table opposite.

ARTA undertook an in-depth electric traction technical evaluation study in 2005 which evaluated a number of possible electrification system types and then compared the preferred option (25 kV AC auto-transformer overhead electrification) to a diesel traction base case on a whole life cost basis over a 25-year period. The information from the study has formed the basis for this Rail Development Plan.

What does electrification mean for Auckland?

A modern electrified system has significant performance advantages over a diesel system for urban rail operations, including better acceleration between stations and the ability to operate high-frequency services through tunnels. In addition, electric trains provide environmental benefits such as improved local air quality and reduced noise and vibration so they are more compatible with the intensified development along rail corridors envisaged by the Regional Growth Strategy.

Moreover, train purchase costs, train operations and maintenance costs are lower for electric trains. Additionally, the risk of fuel price shocks is also lower and the system is much less dependent on imported fossil fuels.

However, the requirement to provide and maintain the overhead power supply system means that the initial capital and operating cost of the electrified railway will be higher than for a diesel system. In addition, the signalling system needs to be immunised against possible electrical interference from the power supply; there is a 10 to 15% cost uplift if compatible equipment is used when new signalling systems are installed to improve capacity and reliability but greater cost if immunisation modifications are carried out at a later date.

New trains: Diesel versus Electric: The Pros and Cons		
	DMU (Diesel Multiple Units)	EMU (Electric Multiple Units)
Infrastructure cost	Nothing additional	Power supplies, overhead wiring, signalling alterations and civil engineering (approx $180 m)
Noise and Vibration	Better than existing diesel but inferior to EMUs	Quieter and smoother for passengers and better for the railway "neighbourhood"
Power and Acceleration		Better performance
Reliability	More reliable than existing diesel units, but less reliable than EMUs	Most reliable
Capital costs (per car)	$4.55 million	$3.98 million
Maintenance costs (per car)	$0.80 per km	$0.50 per km
Energy costs	Determined by world oil prices	Ability to utilise local power supplies (hydro/wind/thermal)
Environmental and health impacts	Local and visible noise and fumes	Visual impact of overhead wires
Cost benefit analysis		Marginally favours electric

It makes sense to electrify the system now and start ordering EMUs.

Electrification: a key policy decision (continued)

The initial cost penalty of an electrified system is offset as more trains and services are operated. The current rail network has two major limitations: its total capacity is restrained by the limited capacity of the Britomart terminal station and the rail service does not run through the CBD, and only provides a station on the northern edge of the CBD.

ARTA's proposed rail network includes an Auckland CBD underground loop running from Britomart to Mount Eden, that will remove these limitations. The CBD loop would allow rail services to provide direct access to the heart of the CBD at between 3 and 5 minute intervals at peak periods. Similar projects overseas, such as the Melbourne city loop railway, have resulted in job creation and urban development and renewal over and around the new train stations within 10 years of the commencement of underground services. In addition, the "agglomeration" benefits (refer to page 13) to Auckland arising from the intensification of economic activity created by the CBD loop are conservatively estimated at around $0.5 billion over 40 years.

The CBD loop will be a major investment (estimated cost of around $1 billion and 12 to 16 years to plan and construct); however, the case for electrification does not depend on it being built. On the other hand, it will be hard to progress the planning for the CBD loop without a firm commitment to electrification of the Auckland rail network.

There is a desperate need to start acquiring new trains, but trains do have a long life – generally 30 to 40 years, so we need to be sure that the correct decisions are made. In practice, if electrification is deferred it will be very difficult to justify in say 10 years or 15 years due to the high capital investment – around $400 million – needed to buy diesel trains now and their low resale value – around 30% of initial cost- if replaced relatively early in their life.

An electric system will be better able to future-proof Auckland against fuel price shocks. There are major uncertainties as to the continuing supply of oil in an uncertain geopolitical environment. Electrifying the railway will provide the basis for the PT network needed for the long term.

Diesel today, electric tomorrow

Currently, Auckland uses diesel trains. They are either diesel-powered "multiple units" (DMUs) or carriages hauled by diesel locomotives. Diesel is adequate for Auckland's current rail network, but thinking ahead and taking into consideration the pros and cons, it makes more sense for Auckland to have an electric rail network, as Wellington does. Around the world, cities with high-frequency metropolitan passenger rail services use electric trains. Electric trains are quieter, faster between stations, and cheaper to maintain than diesel trains.

ARTA has therefore concluded that the right long-term decision for Auckland is to electrify the rail network and to purchase electric multiple unit trains (EMUs).

25-Year Capital Expenditure for 10-Minute Electric Option

Capital Expenditure Breakdown	Years 1-10	Years 11-25	% Total	Total Expenditure
Rolling Stock – EMUs + Further SAs	$386	$232	43	$618 million
Western Line Duplication & Newmarket Redevelopment	$295	0	20	$295 million
Electrification Construction Works	$152	0	10	$152 million
Resignalling and Train Control	$123	0	8	$123 million
Station Upgrades	$85	0	6	$85 million
Manukau Rail Link	$55	0	4	$55 million
Rolling Stock Maintenance Depot and Stabling	$68	0	5	$68 million
Various Infrastructure Upgrade Projects	$56	0	4	$56 million
Total CAPEX Expenditure	$1220	$232	100%	$1452 million

1) *Electrification construction works include the costs of raising bridges or lowering track to accommodate the overhead catenary system.*

2) *Approximately 75% of the resignalling and train control costs are needed to deliver to higher train frequencies required by the Core Network Upgrade. The balance of the costs are for provision of equipment compliable with electrification.*

3) *The CBD loop tunnel is estimated to cost up to $1 billion in addition to the base $1.45 billion.*

Electrification: a better outcome for Auckland's long-term requirements.

The transition...

Electric trains

Making the transition to electric trains will take time. Depending on the speed with which funding and approvals are provided, and the availability of manufacturing capacity for the trains, electrifying the network will take 5 to 6 years. Assuming that funding is approved immediately, the new electric trains have to be specified, tendered and ordered, which can take a minimum of one year by applying traditional procurement and contracting models. The programme on page 20 has been developed on this basis. Piggybacking on to existing overseas train orders and use of an alliance contract approach involving ONTRACK, ARTA and key suppliers may result in an earlier commissioning date. In the meantime, patronage demand will be greater than can be met by the current train fleet.

The introduction of electric trains will be phased in across the Auckland rail network, as the electrification infrastructure on the southern, western and eastern lines will be constructed and commissioned on a staged basis thus optimising resources and expenditure. ARTA considers that electrifying the whole system as one project, without significant gaps between completion of each line, will provide the most efficient method of implementation.

The capacity and robustness of Auckland's power supply will also influence the optimal time for starting electric operation. The electrical load caused by electric trains will be around 30MVA at peak periods, which is approximately the annual increase in Auckland's electricity demand assumed in Transpower's projections for the next 6–7 years. However, it is understood that several of the electricity-generating companies have well-advanced plans for constructing additional capacity within this period. In addition, Transpower has advised ARTA that, assuming that its proposals for upgrading the high-voltage electricity transmission network into and across Auckland are approved and completed by 2012 there will be sufficient transmission capacity to meet Auckland's future needs, including rail electrification. Furthermore, an early commitment to electrification will allow the additional electricity demand created to be incorporated into Transpower's planning for its transmission system upgrades.

SA trains

Within the existing fleet, Auckland has ten trains known as SA trains, with a further seven to be delivered by 2009. These are carriages hauled by diesel locomotives. Although based on imported second-hand carriages, the SAs have been completely remanufactured and are of higher quality than other trains in the fleet. However, when compared with modern trains, these SA trains have four major shortcomings. They are:

- lower performance characteristics (slower acceleration and deceleration) when compared with modern suburban trains;
- costly to operate because of high fuel costs and very high labour costs;
- the locomotives are noisier and have higher emissions than more modern equipment;
- less reliable than modern trains.

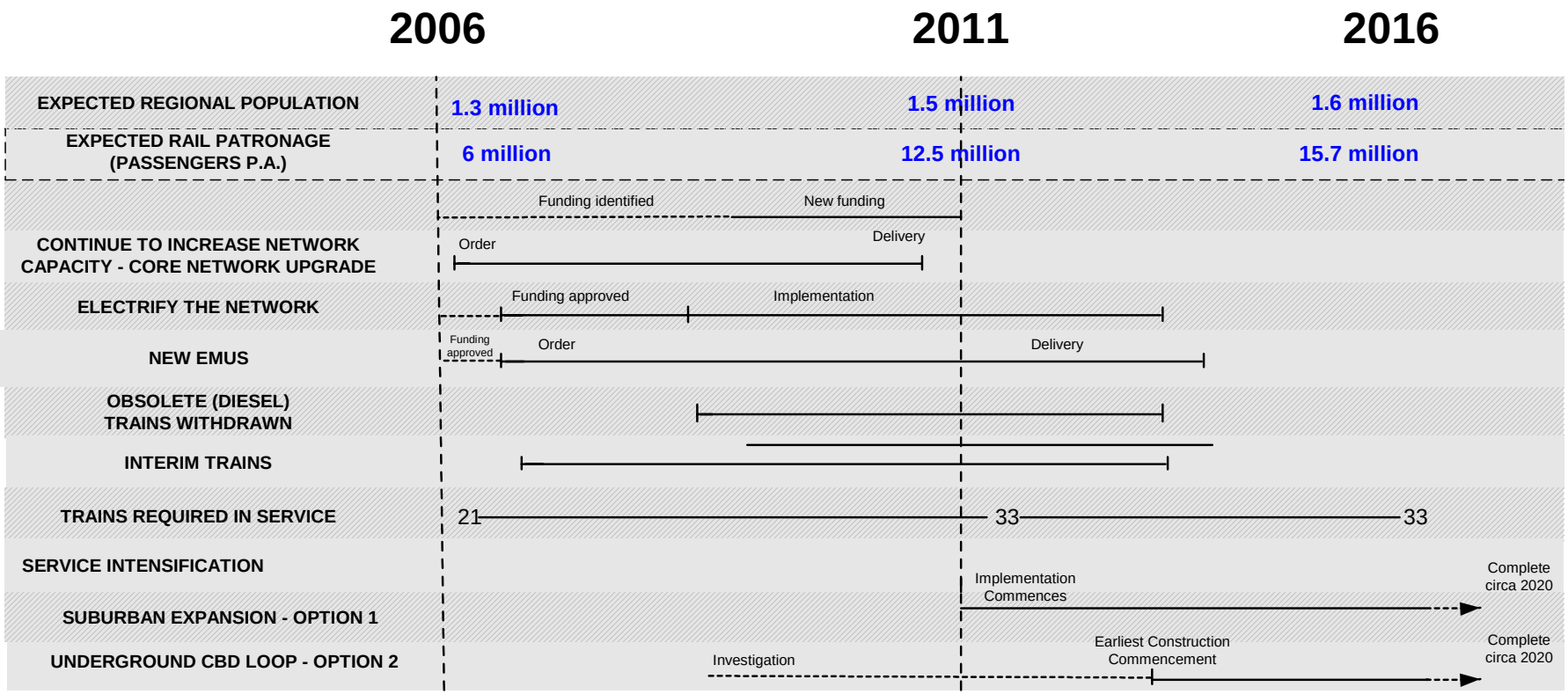
These constraints will make it very difficult to continue urban intensification unless we move to new, more efficient trains.

Today's trains are expected to provide service until at least 2030. An additional order of up to 13 more SA trains for delivery by 2011 will help cope with the continuous patronage growth. They can be hauled by leased diesel locomotives in the interim. Once the system is electrified, quieter electric locomotives can be used to haul most of these trains. SA trains provide a solution to the problem of meeting rising passenger demand while converting the rest of the train fleet from DMUs to EMUs.

More carriage sets, hauled by diesel or electric locomotives, will serve patronage growth during the transition.

Implementation: the first 10 years

This is the Rail Development Plan for the next ten years...



This programme could be accelerated through an innovative procurement process, e.g. an alliance contract incorporating a manufacturer

The Core Network Upgrade will transform Auckland's rail network, creating a platform for future expansion.

Funding

Current Funding Accountability

Central Government

ONTRACK is the Central Government agency that owns, manages and maintains the national rail network infrastructure and is now being funded directly by Central Government for capital works in Auckland totalling approximately $600 m over the 2006–2009 period, including the completion of the Western line duplication, redevelopment of Newmarket station and the construction of the Manukau City Spur line.

Local Government

"Above track" development of Auckland's rail network – stations, rolling stock etc – is funded by the Auckland Regional Council. In its latest 10 year Long Term Council Community plan (LTCCP), the ARC has allocated $545.6 million for capital expenditure on Passenger Transport. This, however, is not sufficient to purchase new trains and other above-ground infrastructure. In addition, Territorial Local Authorities contribute to the cost of Park and Ride and bus interchanges at stations.

Funding Challenges

Without doubt, funding is a challenge for the New Zealand land transport sector, including the activities normally funded by Central and Local Government.

The Auckland region has a history of decades of underinvestment in transport, as well as continued population growth, so the funding challenge for Auckland is particularly acute.

This report is being prepared at a time when:

a) The new RLTS proposes to double Passenger Transport patronage over the next 10 years.

b) The ARTA PTNP proposes to implement the RLTS by expanding bus and ferry services, and tripling rail patronage over the next 10 years.

c) ARTA's current estimate of costs to implement the first 10 years of the PTNP and associated Travel Demand Management is some $4.9 billion (including capital investment and operational subsidies). The component of this cost required to be funded by the region would be around $2.3 billion.

d) The ARC has assessed its ability to fund the expansion of services proposed by ARTA. The recent advice from the ARC is that it will be able to provide some $1.6 billion over the 10 year period, leaving a $700 million funding gap including a capital works funding gap of over $500 million. The ARC has made provision to raise finance to cover, inter alia, up to 50% of the capital cost of the staged electrification of the Auckland rail network, subject to it being able to access alternative additional sources of funding. If implemented, this would add around $250 to $300 million to the ARC's capital funding commitment for the 2006–16 period.

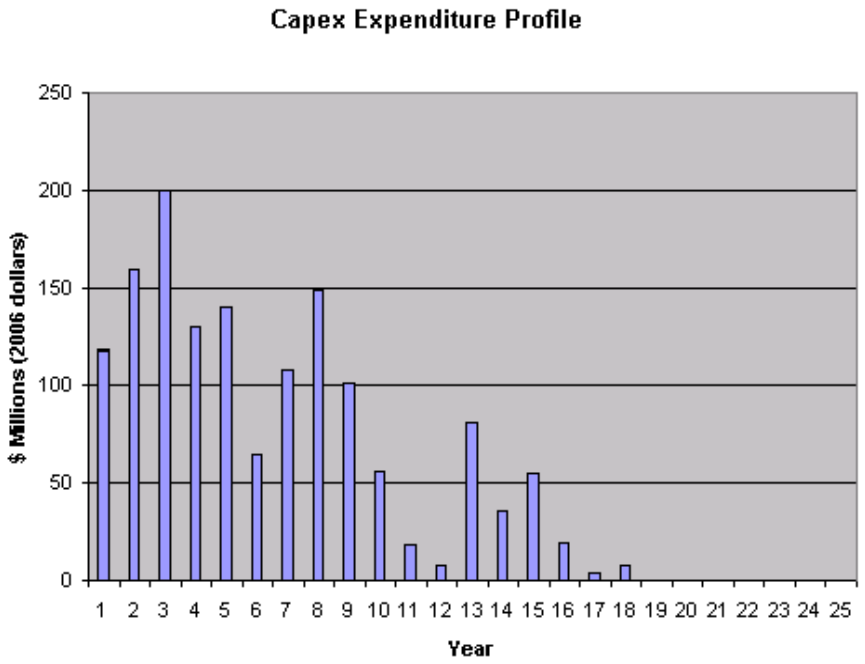
Funding (continued)

e) A recent Central Government and Local Government assessment of total transport costs for Auckland (including roading as well as Passenger Transport and Travel Demand Management) suggests the total funding gap is around $4.37 billion over the next 10 years. This figure includes the above regional funding shortfall of $700 million.

f) In response to the above issues, the Minister of Finance has now requested a comprehensive review of the Auckland transport issues, including some further assessment of priorities. This review, titled the Auckland Strategic Alignment project, is to be undertaken jointly by a taskforce of Central Government and Local Government officials, and is due to be completed by later this year.

ARTA is well aware of these funding challenges and wishes to ensure that its investment programme is extremely cost-effective. Nevertheless, we also believe that a major reinvestment is required to ensure that the region's transport infrastructure is restored to the quality and effectiveness required for a competitive first-world city. From this perspective, we believe that a major investment in rail infrastructure and electrification is well justified.

The capital expenditure profile over the 25 years evaluation period would be:



The capital expenditure beyond Year 10 is related to extra trains to support capacity demands

There is currently a $700 million gap between the funding that is available and the funding that is required.

Recommendations

ARTA recommends that Central Government and Local Government should:

a) Note that the Passenger Transport Network Plan envisages a doubling of Passenger Transport patronage over the next 10 years.

b) Endorse that objective as consistent with regional and national strategies.

c) Agree that the benefits of the rail upgrade outweigh the costs by a considerable margin when all the relevant factors are included in the analysis.

d) Note that electrification of the rail network and purchase of new electrical multiple units will best deliver the strategic objectives of the region and government.

e) Agree in principle to fund the electrification of the three corridors, the purchase of EMUs and the procurement of electric locomotives to haul the SA/SD trains as soon as practicable.

f) Note that ARTA is exploring innovative procurements and financing options which may assist in reducing the funding gap, improving affordability and speeding up implementation of the Rail Development Plan.

The sooner additional funding can be identified, the sooner Auckland can benefit from a revitalised rail network.

UPGRADING RAIL

Q1. How can we be sure that upgrading rail will be a success?

High patronage rail-based transit services are already operating in Perth in Western Australia, Portland in Oregon and Calgary in Alberta. These cities are about the same size as Auckland, and have low-density development (similar to Auckland).

City	Current population (millions)	Number of rail lines	Total route length of rail (km)	Current rail patronage (boardings pa)
Perth, WA	1.3	4	95	33 million and rising
Portland, Oregon	1.3	4	70	33 million and rising
Calgary, Alberta	1.1	4	32	52 million and rising
Auckland, NZ	1.3	3	94	5 million and rising

Over the past 25 years these other cities have invested in good-quality rail and bus services to relieve road congestion. The graph and table on this page clearly demonstrate the potential for Auckland rail to carry 6 to 10 times more people than currently.

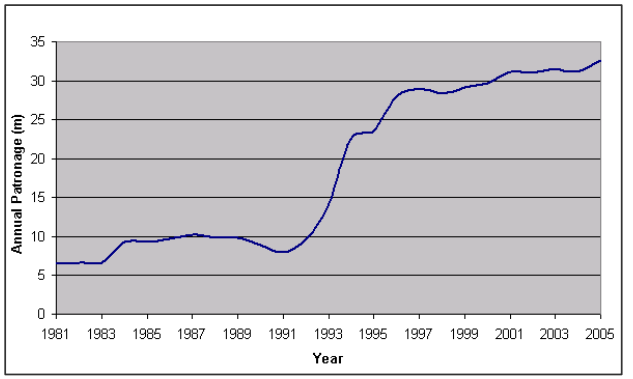
In Perth, Portland and Calgary the Rapid Transit rail spines are supported by:

- Major “park n ride” and “kiss n ride” stations, which are clean and safe
- Local bus services which shuttle to and from key rail stations

Furthermore, all three of these cities consider their rail services to be highly successful and are now initiating major expansions, of which the most advanced is in Perth.

The modelling for ARTA’s new Passenger Transport Network Plan predicts the same successful outcome.

Perth Rail Patronage Growth



By upgrading its network, Perth was able to increase train patronage from about 6 million p.a. up to 33 million in around 12 years

Q2. How can we accurately forecast the patronage increases? What is the APT model?

The forecasts of patronage increases resulting from the rail upgrade have been generated from the Auckland Passenger Transport (APT) model. The APT model is a multi-modal Passenger Transport forecasting tool for the Auckland region that was developed for and is maintained by the Auckland Regional Council. It was created in 2001 and calculates the incremental impact on bus, train and ferry patronage arising from specific service level scenarios, based on travel demand patterns that were developed by a comprehensive set of user surveys.

The APT model has been peer-reviewed and revised significantly since its introduction. When compared with actual rail patronage (see graph on page 10), the APT rail forecasts can be seen to be conservative.

Questions and answers (continued)

Q3. What makes up the economic benefits of the rail upgrade?

There are 4 categories of economic benefit arising from the upgrading of the rail system and electrification:

Benefits to Road Users:

Motorists who switch to using rail instead of their cars will lessen traffic congestion which will reduce journey times for other road users. This contributes 44 cents for every dollar of benefit generated by the rail upgrade.

Benefits to Passenger Transport Users:

Passenger Transport users will benefit from faster journey times, reduced waiting times and improved service reliability. This contributes 28 cents for every dollar of benefit when calculated using current Land Transport NZ values of time for PT users but would increase by around a third if the same value of time was used for both road and PT users.

Indirect Transport Benefits:

These are a group of indirect transport–related benefits to society, totalling 21 cents per dollar of benefit and comprising:

- Reduction in road traffic accidents – 2 cents
- Environmental benefits to local air quality and noise from fewer cars and quieter, more efficient trains – 9 cents
- Reduced residential sprawl from intensified land use along rail corridors will reduce car travel – 5 cents
- Hidden costs of car use, opportunity costs of land used for roads and parking, parking subsidies, social costs of energy use, severance effects – 5 cents

Agglomeration Benefits

Benefits arising from intensification of the CBD resulting from improved accessibility including deeper, more efficient labour markets, greater specialisation and competition, networking and knowledge transfer – 7 cents per dollar based upon a conservative preliminary estimate of $100 benefit per CBD employee per annum.

Questions and answers (continued)

Q4. What is the Benefit Cost Ratio of the 15 minute option?

The outcome of the evaluation for the four main options (diesel and electric traction, 4 and 6 trains per hour) when compared to Do Minimum Base Case is presented in the table below. All figures are in $ million Present Value at 10% discount rate over 25 years.

	Base Case	15-Min Peak (Diesel)	15-Min Peak (Electric)	10-Min Peak (Diesel)	10-Min Peak (Electric)
Cost Relative to Base	N/A	$511.29	$529.13	$793.44	$783.01
Revenue Relative to Base	N/A	$137.53	$136.64	$145.23	$144.22
Net Cost	N/A	$373.76	$392.50	$648.21	$638.80
Benefits to Road and PT Users	N/A	$505.97	$500.08	$560.30	$553.58
BCR(G)	N/A	1.35	1.27	0.86	0.87

Whilst the 15-minute service options have a better economic benefit cost ratio than the 10-minute service options, the 10-minute service options perform better in terms of achieving the patronage targets in ARTA's Passenger Transport Network Plan and delivering the objectives of the New Zealand Transport Strategy and the Auckland Regional Growth Strategy and Regional Land Transport Strategy. In addition, the indirect transport and agglomeration benefits (see Q3) would be expected to be less with 15-minute services, due to the rail services being potentially less attractive to customers.

Q5. With a Benefit Cost Ratio (BCR) of only 1 – 1.7 at best this really doesn't stack up as a compelling argument for upgrading rail – especially when other projects are 3 or 4! How can you argue this is a sustainable business case?

Roading projects can generate BCRs of 3 to 4 when travel time savings to existing road users form the majority of the benefits. However, the evidence in Auckland and internationally is that traffic tends to grow to fill the additional capacity created by new roads so that the travel time savings, which are the principal source of benefits, diminish over time although the current discount rate (10%) masks this effect. In addition, the cost of measures to mitigate the environmental and severance impacts of urban motorways can reduce the BCRs down to comparable levels to that of the rail upgrade.

The benefits of upgrading the rail system, as described in Q16, will, by contrast to a road, continue to be generated over the life of the system. In addition, additional capacity can be created on a double-track railway relatively cheaply by adding additional carriages to trains and/or upgrading the signalling to permit increased service frequencies. Once a motorway lane is at full occupancy, however, additional capacity can generally only be created by building additional lanes which can have high land acquisition and construction costs as well as being potentially controversial.

Questions and answers (continued)

Q6. What is the cost per passenger?

It is well known that the current subsidy per train passenger in Auckland is relatively high. This is largely because we are using very old equipment and manual systems for ticketing. As we acquire new trains and move to a modern ticketing system, it will be possible to reduce our overall cost per passenger.

Our current modelling suggests that by the year 2016 (when the system will be carrying some 15.7 million passengers) the total operating cost per passenger trip will be around $5–$6 and the subsidy per passenger will be $4; this subsidy is well below the current figure of around $7–$8.

If we recognise that the average train journey is over twice as long as the average bus journey, the subsidy per km for rail in 2016 will be very similar to that of bus services. However, all similar Passenger Transport systems around the world require a subsidy.

Q7. Every single project has cost blowouts. The BCR is already comparatively low – how sensitive is this to project cost increases? If we assume there will be cost overruns, doesn't this make the business case entirely uneconomic?

Most NZ transport projects, including roads, are currently struggling with cost increases due to labour shortages and higher costs of raw materials, which will inevitably make a project's economics look less good. However, this applies to all projects equally, so all transport BCRs are falling together. The reality is that materials are traded and hence subject to day-to-day cost fluctuations, while the value of benefits is determined at intervals of 3 to 4 years by Land Transport NZ. While there is strong evidence that people's value of time goes up with their income, this is not yet taken into account in Project Evaluation Manual (PEM). Finally, in the context of strategies such as the NZTS and RGS, many of the rail upgrade benefits cannot be readily monetised.

The major risks to the cost and programme for the rail upgrade have been identified to occur if there is ongoing lack of clarity about both the scope of work and the roles and responsibilities of the organisations involved. Endorsement of the Rail Development Plan by Central and Local Government agencies will provide a clear mandate to enable ARTA and ONTRACK to work together to undertake the detailed planning and development of the Core Network Upgrade projects.

Q8. What about the "failed" urban rail systems in American cities that we read about?

Over the last year or so there have been magazine articles claiming that some US cities have rail systems that have "failed". The source of these articles appears to be papers published in the US which urge the US Federal Government to be more discriminating in how it funds Passenger Transport, particularly rail projects. The case studies in these papers revolve around:

(i) Capital cost overruns in some cities, notably in New Jersey.

The perspective of ARTA on this issue is that all transport infrastructure projects, particularly those in urban areas, have some risk of cost overrun, whether they be roading, busways or rail, and hence very careful project management is required, regardless of travel mode.

(ii) Some cities where the patronage take–up has been relatively slow, notably in Los Angeles and in the New Jersey area. The reasons for this situation appear to relate to attempts to use new PT systems to "rehabilitate" failing commercial precincts and urban areas; inevitably the rejuvenation takes some years.

The ARTA perspective is that Auckland is very similar to (say) Portland, Perth and Calgary in that our rail corridors pass through busy and thriving areas of Auckland, and each time we increase our rail service levels, patronage increases. The Auckland situation is very different to that of the quoted US cities.

Questions and answers (continued)

Q9. How do you answer claims that trains are less energy efficient than motor vehicles?

Information published by the International Union of Public Transport (UITP), based upon international data, shows that energy use by bus or rail is three to five times more efficient than cars or aviation per person/kilometre based on full loads.

Energy use by urban mode (Mega joules/passenger/km)			
Mode	Vehicles' Production	Fuel	Total
Bicycle	0.5	0.3	0.8
Light Rail	0.7	1.4	2.1
Bus	0.7	2.1	2.8
Heavy Rail	0.9	1.9	2.8
Car, Petrol	1.4	3.0	4.4
Car, Diesel	1.4	3.3	4.7

Source: Ticket to the Future – 3 Stops to Sustainable Mobility published by UITP 2003

Q10. Upgrading rail and electrification is a big investment – how do you know that the people of Auckland agree with your view that it is the right thing for Auckland?

Telephone surveys undertaken for ARTA by UMR Ltd indicate that there is strong support amongst Aucklanders for improving public transport as well as improving rail and electrifying the system.

- 92% of Aucklanders (238 out of a nationally representative sample of 750 people) rated reducing traffic congestion as an important priority (including 78% who ranked it as a "very important priority") with only 2% rating it as not important.
- 88% rated "improving public transport systems" as an important priority (including 75% as a "very important priority") with only 6% rating it as not important.
- 86% declared in favour of an improved commuter rail service to deal with Auckland's traffic problems (including 68% strongly in favour) with 6% opposed.
- 72% were in favour of an electrified commuter rail service (including 52% strongly in favour) with 10% opposed.
- 36% considered improved rail services were the answer to Auckland's traffic problems, 22% improved bus services, and a high 36% volunteered that both improved rail and improved bus services were needed.

Questions and answers (continued)

ALTERNATIVES TO RAIL

Q.11 Won't the new motorway construction relieve the traffic congestion?

The Government is making a huge investment in roads.

The expanded motorway network will undoubtedly improve off-peak travel speeds and road safety in the short term. These roads will also reduce truck travel times and freight costs in the short term. However, motorway expansion is much less effective than good-quality Passenger Transport systems at moving the huge number of people who wish to travel at peak periods. Moreover, current projections show that by the time Transit NZ's 10-year programme is complete, traffic growth will have outstripped the increased roading capacity. Average morning peak travel speeds will reduce. In other words, roads alone will not provide long-term sustainable solutions to Auckland's congestion. Passenger Transport enhancements are required as well.

It needs to be recognised that a single lane of motorway will only move around 2,000 vehicles per hour, or around 2,400 people per hour. In contrast, a single lane of busway can carry around 12,000 people per hour and a single line of rail can carry over 20,000 people per hour.

In the few major cities which have attempted a private car/motorway transport solution, such as Los Angeles, the huge scale of motorways has caused major urban blight. Traffic congestion is far worse in Los Angeles than in New York or Chicago, both of which use good-quality rail transport as well as roads.

ARTA believes that we need both improved roads and public transport.

Q12. Why don't we simply expand the Auckland bus network? Wouldn't the capital cost be much lower?

A bus carries many more people than a car, can use the existing roading network, and bus routes can be changed as required.

However, as they share their routes with other traffic, buses are caught in the same congestion. Even with bus lanes, it is hard for a bus to offer travellers significantly faster travel times and therefore an incentive to switch from the private car.

There have been numerous attempts in other comparable cities to drastically grow bus patronage on the normal road network. Unless the buses use dedicated roads, the patronage growth has been relatively modest. Improving bus services on the current roading network is certainly not enough to relieve current Auckland traffic congestion.

If, on the other hand, separate busways are provided then the results can be spectacular, as discussed overleaf.

Questions and answers (continued)

Q13. You say "do nothing" or "exit rail" is not an option – but $1 billion to upgrade busways, particularly with funding committed to roading in the budget, is much less than rail CAPEX and can be implemented quicker. Why NOT roads?

The new Northern busway, partly in operation with further construction under way, is a very different approach to bus services and when complete will offer a world–class Rapid Transit service to North Shore residents, similar to that enjoyed by the residents of SE Brisbane and Ottawa in Canada, both of which have successful busways.

However, the scope for similar busway construction is extremely limited, especially within the area covered by Auckland City.

Abandoning the rail passenger system in Auckland would require construction of new busways running parallel to the existing rail lines, in addition to the purchase of around 80 new buses, in order to provide anything approaching the quality of service and journey times to the areas of Auckland previously served by rail. As the rail lines would need to be retained for freight trains, new busways would either require existing roads to be widened or new roads built. This will almost certainly require land acquisition which is likely to be contentious and costly, and which is not covered by the additional roading funding committed in the recent 2006 Budget. Dedicated bus lanes are unlikely to be feasible within the Central Business District, so the rail replacement buses would have to fight for space on the already congested CBD streets, resulting in extended journey times and adding to local air quality issues. This is not considered to be sustainable and would lead to many Passenger Transport users switching to car as the uncongested travel times possible by rail cannot be achieved by bus.

For this reason alone, ARTA believes that the key Rapid Transit spines should be our three rail corridors, which are currently underutilised, together with the Northern Busway, followed by further busways in outer urban areas.

The "Do Minimum" option, which provides only the minimal levels of ongoing investment to maintain the current capacity of the rail system, is also not sustainable as the current high level of rail patronage growth in Auckland means that the capacity of the existing train fleet is likely to be exceeded by around 2008.

Q14. Buses currently make up 85% of public transport: aren't you simply going to build a very costly, unprofitable system that makes bus networks unprofitable by reducing their patronage?

Buses will continue to provide the majority of Auckland's public transport system; however, the restructuring of Auckland public transport, described in ARTA's Draft Passenger Transport Network Plan, will establish a Rapid Transit Network (RTN), comprised of the rail system and the Northern Busway that will provide fast journey times and frequent services between the CBD and regional centres. Feeder bus services will connect with RTN services at hub stations with transfers being facilitated by integrated ticketing, rather than running directly into the CBD as happens now, often duplicating rail services. The restructured PT network will optimise the strengths of each mode – rail carrying large numbers of passengers over longer distances on dedicated corridors and bus running large numbers of mainly short journeys to dispersed locations. Switching bus services from CBD radial routes to feeder services is expected to result in cost efficiencies from better bus utilisation and elimination of empty running back from the CBD.

Questions and answers (continued)

ELECTRIFICATION

Q15. Why not keep operating an Auckland rail network as a diesel system?

The answer to this question is in three parts:

Firstly, much of our existing train fleet is very old and only has limited life. Replacement trains are urgently needed.

Secondly, our remanufactured SA trains have considerable service life and provide good passenger comfort but they have high operating costs and are less efficient than modern rolling stock. Urban redevelopment near the tracks will be difficult unless the diesel locomotives are replaced.

Thirdly, modern diesel multiple units (DMUs) could be an effective way of replacing the very old trains and the SA trains, but even modern DMUs will not be able to operate at high frequencies through a CBD loop tunnel.

ARTA believes there is a very strong case for early electrification and purchase of new electric trains because:

- Electric trains are cheaper to purchase
- Electric trains are quieter and produce less vibration. As the residential development intensifies around transport hubs and the number of services increases, this will be of increasing importance
- There is no smoke and no fumes
- Electric trains offer better acceleration and so faster trips
- Electric trains are more reliable and cheaper to maintain
- Electric trains will become cheaper to operate as oil prices rise and are much less reliant on imported fuels
- Diesel trains cannot operate in long tunnels without significant investment in ancillary services (e.g. ventilation). Given the proposals for an underground CBD loop, it makes good sense to future-proof this possibility.

The number of SA trains finally acquired is very dependent on the timing of confirmation that funding for the Core Network Upgrade shortfall will be available. The fewer number of SA trains purchased then the more ARC funding available for new trains.

Q16. Why are electric trains cheaper to buy than diesel trains?

There are two basic reasons for this interesting situation:

Firstly, the most common types of suburban trains across the world are electrically powered. Therefore, manufacturers are geared to making these types of trains very economically. There are more suppliers of electric trains than there are diesel trains.

Secondly, a diesel train has far more moving parts, and this naturally adds to the manufacturing cost.

Questions and answers (continued)

Q17. What happens if you don't get the go–ahead on electrification? Does the whole plan fall apart?

The Core Network Upgrade is an essential piece of work, with or without electrification to increase the capacity of the rail system, and is essential to enable rail to contribute to the Passenger Transport growth targets that will make Auckland a better place to move within. If electrification is not undertaken, however, the ability for the rail system to be further expanded to cater for longer-term Passenger Transport growth will be constrained. In addition, the operational costs of a diesel system, over the life of the trains, will be considerably more than for an electrified railway.

Q18. Does the Plan address the full cost of electrification?

The capital costs for electrification included in the Rail Development Plan incorporate allowances for the provision of the power supply, including Transpower bulk power supply costs, overhead catenary system (OCS), civil engineering costs for raising overbridges or track lowering to provide necessary clearances for the OCS, together with works needed to immunise telecommunications and other utility services. In addition, the resignalling and train control costs allow for the provision of a modern high-capacity signalling system compatible with the electrification system.

Q19. Won't electrification place even more strain on Auckland's overloaded electricity supply?

The electricity demand for operating an electrified system for Auckland is about 30MVA, which is about the same as the forecast annual growth in electricity demand in Auckland between now and 2013.

Whilst the issues surrounding the capacity and security of the Auckland electrical supply in the next 5–7 years have been well publicised, Transpower has advised ARTA that, based on current demand forecasts and assuming that its proposals for upgrading the high–voltage transmission networks into and across Auckland are approved and implemented by 2012, there will be sufficient transmission capacity to meet Auckland's future needs including rail electrification. In addition, ARTA understands that there are several well–advanced proposals for constructing additional generating capacity within the next 5 years.

An early commitment to rail electrification will allow the additional electricity demand created to be taken into account in Transpower's planning for the transmission upgrades.

Taking a longer term perspective, the electrified rail system will have an economic life of at least 40 years. Over that timeframe New Zealand has the capability to plan and implement additional generation capacity and transmission systems to provide sustainability of electricity supply. By contrast, we don't have that level of control over imported fossil fuels.

Q20. Why won't the electrified system extend all the way to Waitakere?

Swanson is the planned final extent of both the Western Line double–tracking and electrification as it is the effective current limit of the metropolitan area that will provide sufficient passengers to support 10–min frequency services. Less frequent services will continue to be provided to Waitakere which could be extended in future to Kumeu and Helensville. However these services would not justify the cost of either double–tracking or electrification beyond Swanson and in particular the cost of enlarging the 450–metre–long tunnel between Swanson and Waitakere to accommodate the overhead catenary system.

Questions and answers (continued)

Q21. If we electrify, what will be the voltage?

In late 2004 and early 2005 ARTA completed a major study of the best form of electric power (or electric traction) for the Auckland suburban rail system. The Electric Traction Evaluation study concluded that we should:

(i) Use overhead wires to provide the power (rather than use third and fourth rail ground–level power supply), as this is safer for an unfenced railway system such as in Auckland.

(ii) Use a 25,000 volt alternating current (25kV AC) power supply. This is the same system used for the length of rail line from Palmerston North to Te Rapa. Most other modern urban rail systems, such as Perth and Brisbane, use this system.

In contrast, the Wellington suburban system uses a 1,500 volt DC system, but this is older technology and is more expensive to build and is less efficient.

Q22. Isn't there a health and safety risk with the electrified system?

The 25kV AC electrification system proposed for Auckland is used extensively overseas and on the North Island Main Trunk line between Hamilton and Palmerston North. A significant aspect of the electrification project will be to ensure that persons or objects do not come into contact with the overhead catenary system, such as by providing screens on overbridges. In addition, utilities such as electricity or telecommunications cables and pipelines that run beside or cross the railway will be immunised against interference from the electrification system.

Q23. Isn't there a considerable visual impact with the electrified overhead catenary system?

Modern 25kV AC overhead catenary systems (OCS) use lighter–weight steel or concrete masts and cantilever brackets and use smaller–diameter overhead wires than the 1950s design 1,500 volt DC system used in Wellington, which lessens the visual impact of the OCS. An important aspect of the electrification design process will be to identify sites, such as environmentally sensitive locations, where specific measures, such as pointing the masts, may be necessary to reduce the visual impact of the OCS.

Q24. Won't the electrification disrupt the Rugby World Cup in 2011?

During the next 3 to 4 years, ARTA and ONTRACK will be working together to complete the key infrastructure components of the Core Network Upgrade well in advance of the Rugby World Cup, including completion of the Western Line Duplication, redevelopment of Newmarket station, construction of the Manukau spur line, station upgrades, signalling improvements and train maintenance and storage facilities.

In addition, ARTA plans to purchase sufficient additional SA carriage trains to cater for projected passenger demand from 2011 including the Rugby World Cup.

Following the precedent of the recent 2006 Commonwealth Games in Melbourne, it is likely that there would be no planned construction or maintenance work taking place on the rail system during the actual period of the Rugby World Cup to minimise the risk of service delays.

Questions and answers (continued)

Q25. The Government does not see electrification as a priority in the short term – how can you be so ambitious?

ARTA considers that the optimum time for electric trains to enter service is from 2012/13, which will require the electrification construction works to take place from 2010 to 2012. These timeframes will permit ONTRACK to complete the initial infrastructure upgrading work (such as the completion of duplicating the Western Line) that the Government has recently announced funding for.

Q26. Why can't we continue to make the system electrification ready – but defer the development decision for five years or more?

Electric trains have been shown to have a better Benefit Cost Ratio than diesel trains with the capital and operating & maintenance costs of diesel trains being $10 m more (in Present Value terms) over the 25 year evaluation period than those for electric.

If, however, electrification was not pursued now due to current funding constraints, a fleet of 40 two–car diesel multiple unit (DMU) trains would need to be ordered within the next year in order to cater for projected capacity growth and to retire the existing DMU fleet during the next 10 years. Given that the new DMUs would have a life of around 30 years, it would be very difficult to make a business case for electrification while these trains were only 5 to 10 years old, due to their low residual value if disposed of. The value of the asset write-off would be of the order of $150 m and would reduce the BCR of the rail upgrade by 0.1.

Similarly, the full benefits of electrification in terms of reduced operating costs and environmental impacts would not be realised with a mixed diesel and electric fleet. In addition, continued diesel operation would effectively preclude future network extensions with extensive tunnelling, such as the CBD rail loop, until the new DMUs required replacement.

Q27. A big part of your argument for electrification is that you can then build a CBD loop. But given that the political view is that this is hugely costly, disruptive, doesn't that wipe out the main argument in favour of electrification?

The business case for electrification does not depend on the proposed CBD rail loop tunnel being built, although deciding to buy DMUs now would almost certainly defer the point at which the CBD rail loop could be justified due to the sunk investment in DMUs. By contrast, committing to electrification now future–proofs the ability for either of the post–2016 service intensification options (suburban or CBD rail loop) to be implemented.

Q28. How would we procure the new trains and electrify the system?

For the new trains there are three broad options to procurement:

(i) Full and open tendering against a set specification to purchase the trains – this is the approach adopted by many other transport authorities (but not all);

(ii) Initial open-tendering followed by an “alliance” approach to complete purchase and deliver - this is a relatively new approach but can have considerable merit;

(iii) Open-tendering including a financing offer for a consortium to “build own operate” and maintain the trains – this approach is being utilised for new trains in Sydney. It also has some similarities to our current system of procuring bus services (although the comparison is not perfect).

For all of these options it would be possible to focus only on the acquisition of trains, OR to include both the trains AND the electrification wiring and power supplies etc. ARTA could adopt any of these options but believes that the final choice will need to be shaped by the nature of the final funding package that is negotiated between the Government and the region. However, we do note that, from a time perspective, Option (ii) may be able to provide the quickest overall delivery of trains and power supply.

Questions and answers (continued)

TRAINS

Q29. How many carriages per train have we assumed?

Electric trains (Electric Multiple Units) are generally manufactured in two–carriage (2–car) or three–carriage groups; the various transformers, motors etc are distributed between the two or three carriages, which generally stay permanently coupled together.

The Auckland system is being developed to accommodate trains of up to six carriages, especially for big events. Our initial peak–period trains will have at least four carriages. Six–car trains are put together by simply coupling together either three 2-car trains, or two 3-car trains. For the purpose of this Rail Development Plan we have generally assumed that we will purchase two–carriage trains. However, if we identify a particular three–carriage system which is attractive at the time of tendering, we would acquire the same number of carriages in three carriage groups.

Q30. Are new technologies, such as fuel cells, available as an alternative to electrification?

Fuel cell–powered trains are an emerging technology that has yet to be introduced into commercial passenger service, although an experimental train has recently started test operations in Japan.

The fuel cell technology is part of a low-emission hybrid diesel–electric system that can also incorporate energy-saving features such as regenerative energy braking and low-exhaust systems.

The goal is to achieve 20% energy savings compared to current diesel rail cars, with additional environmental benefits such as the use of battery power when leaving a railway station to reduce noise pollution.

There is currently no published date for revenue–earning passenger trains using this technology to enter service in Japan.

Q31. Why can't we lease trains? Or purchase more refurbished SA stock and make the switch from diesel to electric locomotives later?

Leasing new trains provides a lower BCR and such are the bespoke requirements of the trains that the residual value provides a very poor economic case. The cost of the lease is partly determined by the type of lease required. We believe the cost of acquiring rolling stock by lease finance is likely to be more expensive than a conventional borrowing on a “like for like” basis.

Using more SA trains would have a lower CAPEX cost but they are considerably more expensive to operate and have poorer performance than modern trains, and in addition the diesel locomotives used to haul them are noisier and have higher emissions than new trains.