

Auckland Transport Alignment Project

Arterial Roads Report

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Preface

This is one of a series of research reports that were prepared as inputs to the Auckland Transport Alignment Project (ATAP). It is one of a number of sources of information that have been considered as part of the project, and which have collectively contributed to the development of the recommended strategic approach. The content of this report may not be fully reflected in the recommended strategic approach, and does not necessarily reflect the views of the individuals involved in ATAP, or the organisations they represent. The material contained in this report should not be construed in any way as policy adopted by any of the ATAP parties. The full set of ATAP reports is available at www.transport.govt.nz/atap.

1. Executive Summary

Auckland's transport system faces a major challenge in coping with strong population growth. Arterial roads (as distinct from motorways and local/collector roads) are a vital part of the system, helping provide access to employment, education, hospitals and leisure destinations; and providing essential links for road freight. For these roads significant through-movement is of primary importance. Many arterial roads also have a variety of other, potentially competing uses, including providing access to local centres. Many Aucklanders live along these roads, which are the focus of substantial future growth.

Auckland's projected growth will place greater pressure on these networks, meaning that congestion will increase unless steps are taken to improve network efficiency and productivity. This report investigates the extent to which arterial road productivity (throughput of people and freight) can be increased while taking these other functions into account..

Currently, the main approaches to improving arterial road productivity are:

- Network planning through Corridor Management Plans (CMPs) to identify interventions necessary for arterial roads to deliver on their strategic requirements
 - Network management through interventions such as optimising traffic signals, varying priorities at different times of the day, introducing bus and transit lanes to increase vehicle occupancy rates, and restricting on-street parking
- Network improvements ranging from minor intersection improvements through to large-scale grade separations

While these approaches often provide significant transport benefits, the extent to which they are pursued appears limited by challenging trade-offs on the arterial road network or resource constraints to investigate and deliver improvements.

Further recommended steps to improve arterial road productivity include:

- Better strategic network planning to identify and agree routes where through movement is of primary importance
- Better frameworks for resolving tensions between movement and place
- Evidence based decision-making on challenging interventions such as removing on-street parking, extending bus lane operating hours and improving pedestrian facilities
- Increased investment on arterial road improvements, to reflect the high proportion of travel that occurs on this network
- Maximising the benefits from demand management, such as smarter transport, and the application of new technologies (including intelligent transport systems, ridesharing and new vehicle technologies).

2. Background

Auckland's arterial road network represents 16% of the region's road network by length. The arterial network will have to cope with daily car trips increasing by an estimated 1 billion trips a year by 2046, from around 1.8 billion trips in 2013 to 2.8 billion in 2046.¹ There are always uncertainties about such long term projections but it is clearly important to improve the network's productivity and to find ways to reduce growth in demand.

Ongoing improvements to Auckland's public transport system are expected to result in continuing increases in public transport mode share, from around 7% of all peak time trips currently to 15% by 2046. . Despite this modal shift, car trips are still projected to predominate, accounting for an estimated 68% of all motorised trips in 2046. For parts of Auckland which are not well served by public transport services because of low demand or dispersed travel patterns, arterial road network productivity is particularly important.

The purpose of this paper is to outline the potential for improved productivity (movement of people and goods) on Auckland's arterial roads, so that this can be factored into future Auckland Transport Alignment Project (ATAP) assessment scenarios.

The ATAP objectives particularly relevant to this paper are:

- To support economic growth and increased productivity by ensuring access to employment/labour improves relative to current levels as Auckland's population grows
- To improve congestion results, relative to predicted levels, in particular travel time and reliability, in the peak period and to ensure congestion does not become widespread during working hours
- To improve public transport's mode share, relative to predicted results, where it will address congestion.

The approach in this paper is outlined below:

- Defining productivity, how it can be measured and compared – including in the Auckland context
- Auckland Transport's current approach for identifying interventions on the arterial road network
- Recommended approach to improving arterial network productivity

¹ Auckland Transport Alignment Project Foundation Report, December 2015.

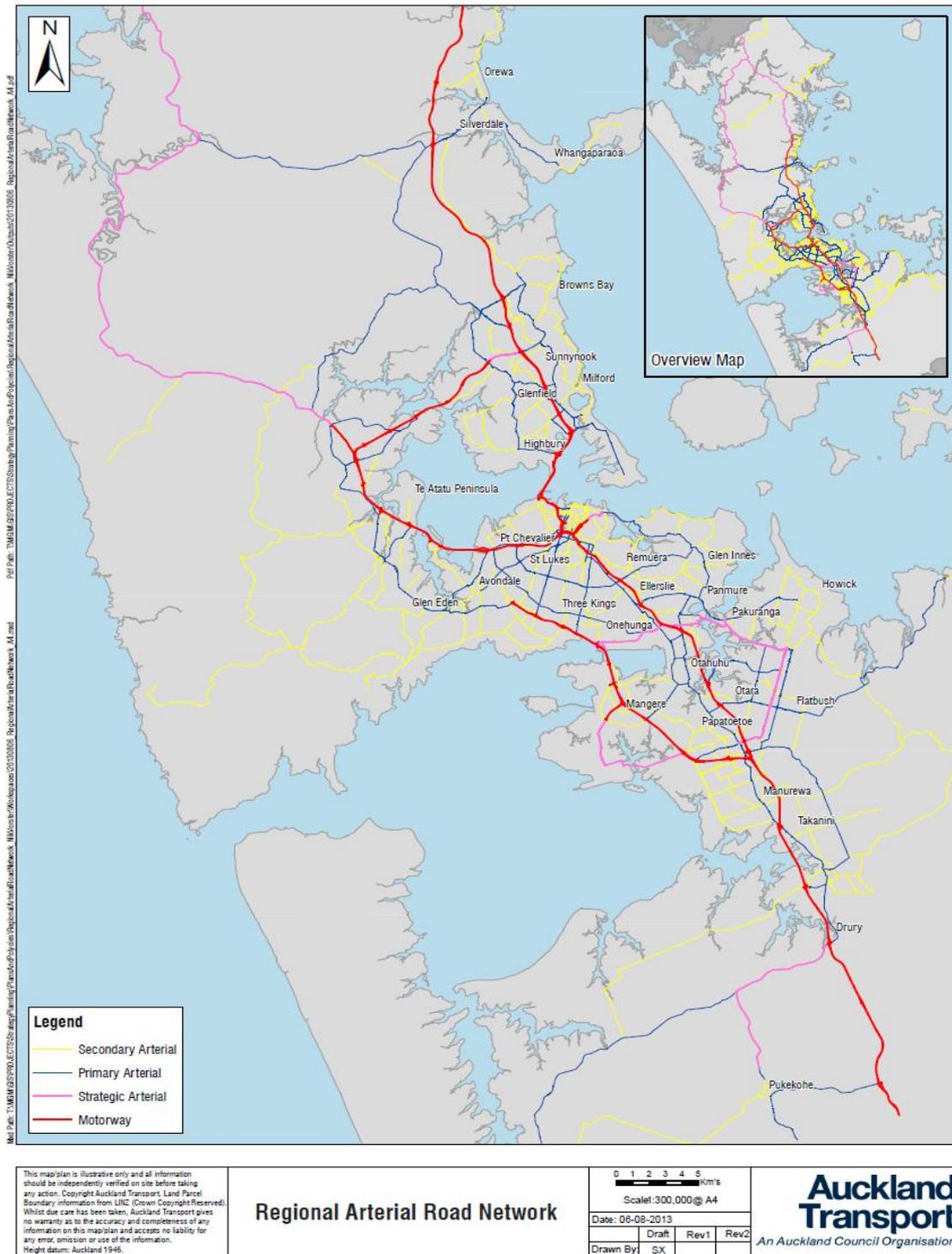


Figure 1. Auckland Arterial Road Network

3. Arterial Road Productivity

3.1. Defining Productivity

Productivity is about the volume of people and goods able to move through a transport corridor over time. There are two main components: the number of vehicles moving through a corridor (a product of travel speed and flow), and the people or goods in each of those vehicles. Pedestrians and cyclists also move in corridors and the management of vehicles can affect them and vice versa. The number of pedestrians or cyclists moving along a corridor is also a component of productivity.

The use of a productivity measure summarises the congestion levels and reliability of vehicle travel times on roads. Productivity can also be considered in terms of people and freight moving capacity and reliability, which may not be well captured within a vehicle movement assessment. For this reason, this paper also outlines the benefits of improving public transport mode share along arterials as an additional measure of productivity, and of improving freight movement.

The extent to which productivity is 'optimised' will depend on the situation. For example, optimal management of a main route that passes through a local business centre may involve different operational settings and arrangements at different times of the day. During periods of peak demand, the road may be configured with more emphasis on movement - with clearways, longer cycle times at intersections or even variable lane directions. During periods of low demand, the same section of corridor may be configured to give more priority to local access – with kerbside parking and longer pedestrian phases at lights.

Improving the productivity of a selection of arterial roads, and managing them as a network, is an important part of the response to Auckland's transport challenge.

3.2. Operational Performance Measurement and Target Setting

New Zealand uses Austroads guidelines to inform the way the network is managed and to measure the performance of the network and providers.

The Austroads guide to traffic management adopts a long established road hierarchy to determine how the trade-off between mobility and access is managed across the network. A road's position in the hierarchy determines whether mobility or access should be optimised. It can also inform land use policies applied to the land fronting the road, which should support the mobility function of arterial roads, the access function of local streets, and help resolve the tricky balance between access and mobility on the collector/distributor network.

However, in practice many Auckland (and indeed New Zealand) arterial roads pass through busy centres, where the movement and access functions heavily overlap – raising challenging trade-offs and the need to apply more sophisticated approaches to managing competing uses.

Austrroads *National Performance Indicators for Network Operations* (AP-R305/07)

recommends the use of five network performance indicators (NPI); namely:

- Traveller Efficiency: travel speed
- Traveller Efficiency: variation from posted speed
- Traveller Efficiency: arterial intersection performance
- Reliability: travel speed and variation
- Productivity: travel speed and flow.

The Government Policy Statement on Land Transport 2015 and the Auckland Long-term Plan 2015 use the Austrroads 'productivity' performance indicator (travel speed and flow) as the key indicator of the results being achieved by investment in local roading.

3.3. Auckland context

Auckland Transport has primarily targeted two measures:

- Traveller Efficiency: travel speed, which in turn includes intersection performance
- Productivity: travel speed and flow

Travel time and variability is also used as an indicator for journey time reliability along key freight routes in the region.

The Highway Capacity Manual 2000 (HCM) lists urban street levels of service (LOS) criteria based on average speed and urban street class, translatable into percentage of posted speed limit as follows:

Level of Service	Average Travel Speed relative to Posted Speed limit
A	greater than 90%
B	70% - 90%
C	50% - 69%
D	35% - 49%
E	20% - 34%
F	less than 20%

The Auckland arterial network currently has on average between 20% and 25% performing at LOS D, E and F (defined as experiencing congestion). Within built-up areas and closely spaced intersections Auckland arterial routes at best perform at LOS E. Whilst an aspiration is to have the arterial network operate at LOS D and above, high growth makes achieving this challenging. Auckland Transport focuses on the productivity of a corridor as reflecting priorities of moving people and goods.

There is debate about the extent to which Australian and Auckland arterials are similar, whether or not Auckland arterials are more likely to have to serve multiple roles, and hence

about the extent to which Auckland could move closer to the Australian benchmark levels through the types of intervention discussed in this paper. This debate highlights the key challenge for arterial roads: how vehicle-based objectives should be balanced against other objectives such as pedestrian amenity, local access, retail/parking and other types of “side friction”.

The productivity challenge is brought out in the Auckland Regional Land Transport Plan (RLTP) 2015-25:

"An arterial road is "optimised" when... the number and/or speed of people movements are improving and approaching the standard of productivity defined for arterial roads by Austroads."...

"Arterial roads are often not able to cope with additional vehicle traffic. Widening roads and intersections is prohibitively expensive and can create problems for pedestrians and local residents as multi-lane roads are significant barriers to local trips, especially the young and elderly. Auckland's arterial roads are also the location of most of the city shops, schools and other important destinations. It becomes essential to set priorities... The order of priority of different road users will vary depending on the road, and may vary by time of day. "

Source: *Auckland Regional Land Transport Plan 2015-25, page 47*

A significant proportion of Auckland's arterial corridors were not designed to perform at a 'highly productive' level for vehicles as measured by the Austroads standard; in Auckland Transport's view their form or location means that a lower level is appropriate.

For example, Broadway through Newmarket contains between four and six lanes and is heavily trafficked, but has a high density of intersections and crossings, friction of kerbside parking, manoeuvring of large volumes of buses and slower speeds inherent in a busy town centre. The corridor would therefore have a fairly low productivity rating, however efforts to increase this (such as by removing parking, fewer intersections or longer intersection cycle times, removing or restricting buses, etc.) would have detrimental effects on the town centre's economic performance or be unpalatable to the community. Instead, Auckland Transport has focussed on public transport improvements on connecting arterials to increase access the employment centre, and supportive pedestrian measures.

4. Current Approach to Improving Arterial Road Network Productivity

4.1. Arterial Network Planning

Auckland Transport's *Network Operating Plan* outlines six strategic principles for managing Auckland's arterials:

- Support “places” and activity centres
- Promote walking in high pedestrian areas
- Promote cycling links to activity centres and designated routes, reduce conflict
- Provide high priority for public transport on designated routes
- Promote freight on the freight network
- Promote general traffic on preferred traffic routes

The first three can conflict with providing for through traffic, but may result in higher people-moving capacity and more vibrant employment centres. Sometimes, competing objectives can be addressed by having different priorities at different times of the day, as discussed further in later sections.²

4.2. Corridor Management Plans

Corridor Management Plans (CMPs) are the main tool that Auckland Transport has used since 2012 to help identify the interventions necessary to allow critical sections of the arterial road network to deliver on their strategic requirements, which include productivity and other aims. The CMPs cover only some of the arterial network and other processes (including Network Operating Plans) are used to manage the rest of the network.

34 CMPs were developed between 2012 and 2015, covering approximately 25% of the arterial network, as shown in Figures 2 and 3. These were selected using an Arterial Network Deficiency Analysis (ANDA) covering issues such as predicted traffic and congestion levels, safety, public transport demands and operations, freight function and operations, active modes, urban realm, and relevant regional and local plans.

² As an example, operating arterial routes for commuting modes during commuting periods, except where they pass through town centres where there are other needs... An arterial in the suburbs is therefore expected to have a better experience for drivers than one the CBD or a town centre.

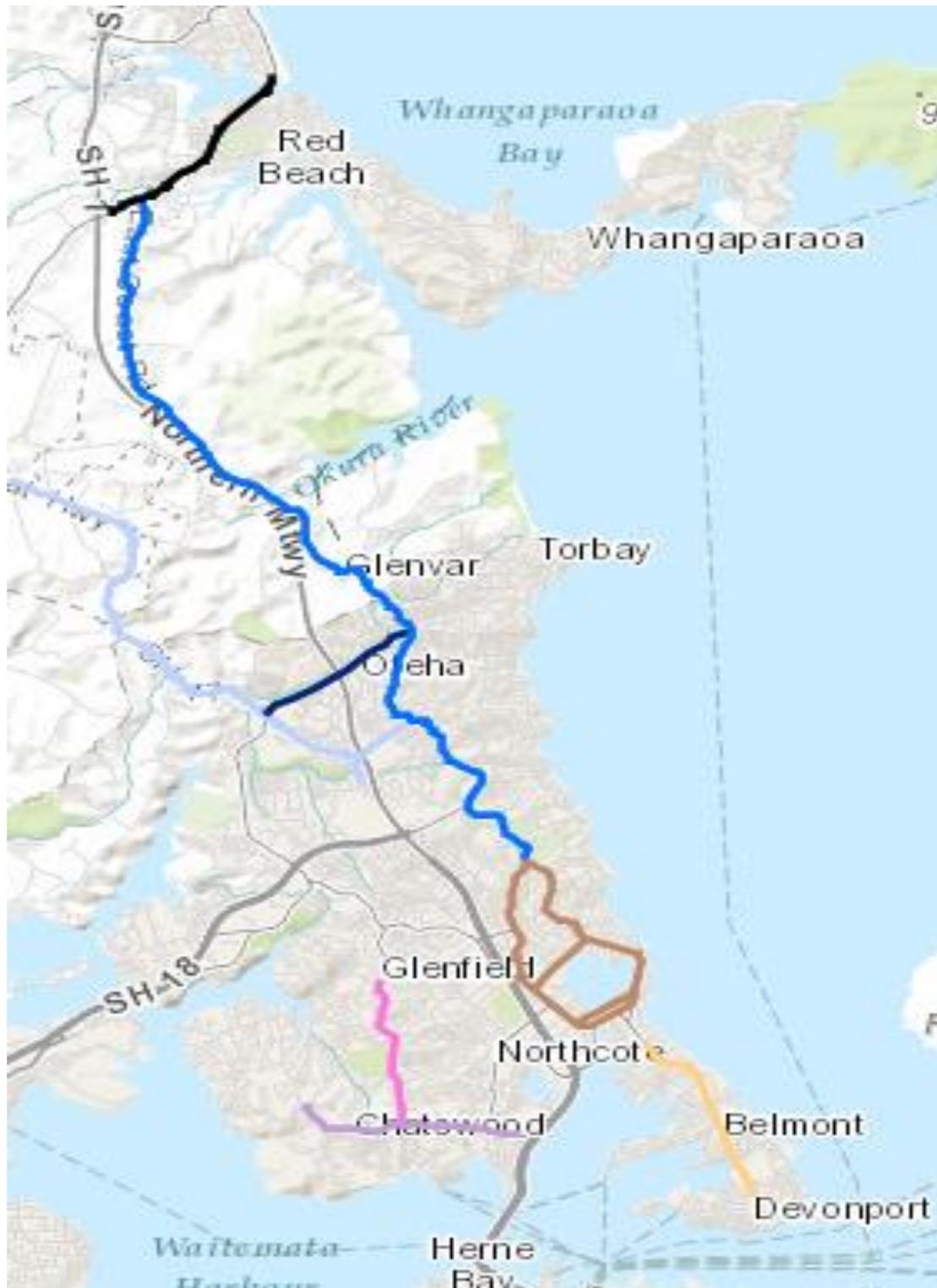


Figure 2. Auckland Corridor Management Plan - North



Figure 3. Auckland Corridor Management Plan - South

CMPs evaluate future population and employment growth projections and changes in land use. They also take into account known land use development and confirmed transport projects around corridor.

The aims of the CMPs are to:

- create a long term strategic vision for a corridor
- identify areas of change, future land use and transport demands, operational challenges and opportunities
- integrate transport, land use planning, economic development, community and open space development and infrastructure service interests
- create robust plans of prioritised projects to address future issues – in effect create Auckland Transport’s forward programme for arterial road development
- inform Network Operating Plans and other Auckland Transport projects and operations

- provide justification/rationale for projects and allocation of scarce road space, including road widening if needed
- provide local implementation of regional planning
- provide longer-term strategic vision but also actions over short, medium and long-term
- enable inter- and intra-organisational buy-in and co-ordination (e.g. New Zealand Transport Agency, Auckland Council, key stakeholders)
- assist in a wider understanding of the strategic context within the wider transport system.

CMPs do not necessarily result in an increase in the corridor's measured vehicle-moving productivity. Often they recommend some form of public transport improvement which may increase the corridor's Public Transport patronage and bus service reliability. CMPs also often recommend walking or cycling improvements, or improvements to the urban amenity of a corridor if it is in an important people-centred location.

CMPs evaluate and balance a corridor's movement-based requirements – for drivers, public transport, freight, cycling and walking – with other considerations, such as slower speeds or reduced traffic movements for safety or amenity reasons, improving pedestrian crossing provision, etc. A corridor's measured productivity may be deliberately lower than its theoretical maximum. This is most clearly observed wherever an arterial passes through a town centre, and traffic often slows to allow for greater pedestrian safety and amenity.

These conflicting roles can result in congestion and unreliable journey times. Specifying which routes are of particular importance for through-movement would help in addressing some of these conflicts.

4.3. Network Management

4.3.1. Optimisation

Arterial road optimisation aims to address deficiencies and gaps identified in the local Network Operating Plan. These performance gaps rely on input data detailing current operational performance of the network from a multi-modal perspective. For general traffic, bus travel and freight, the primary basic performance measure is travel time (or level of service as defined in the Highway Capacity Manual), which enables Auckland Transport to identify deficiencies. Operational performance for pedestrian and cycle performance is also included, although the information for these modes is still relatively limited, but improving.

This deficiency analysis is supported by a "SmartRoads" tool which highlights the extent of the deficiency by factoring in volume (and people movement), user performance and strategic significance/priority.

Improvements are then pursued, for example

- dynamic lanes proposed on Whangaparaoa Road to enhance general traffic movement, and productivity.
- transit lanes on Manukau Road to enable higher occupancy vehicles to travel through the route at more reliable and higher average speeds, increasing corridor productivity

- freight lanes on the strategic freight network to improve reliability and productivity.

These may resolve the issues being experienced or enable an interim solution until any major projects are implemented.

4.3.2. *Traffic Signal Optimisation*

Traffic signals throughout the city are monitored and controlled to optimise traffic flows for different times of the day. Incidents are monitored, emergency services and traffic contractors are advised, and information systems such as variable message boards and public information channels for drivers and other users are activated. The signals are run dynamically – both the intersection signals and the ramp signals respond to flows to determine their timings.

Currently all 830 traffic signals in the region are optimised on a four year programme, although Auckland Transport and the New Zealand Transport Agency are considering more frequent reviews for key centres and corridors.

The programme provides changes on the road corridor network that support increased network efficiency through greater corridor productivity, i.e. more movement of people and goods through the city. Operating to a plan provides clarity for infrastructure development and use of the network and its systems such as traffic signals and ITS to make the most of the network. It also enables a focus for communication to customers to make informed choices about their travel by mode, time of day and route choice. By way of example, the 2013-2014 Optimisation programme targeted the inner city for efficiency with increased access and safety improvements, and resulted in a Benefit Cost Ratio (BCR) of 14. For the same year routes in outlying areas achieved similar results with BCR of 13.4, largely achieved through improved operation of general traffic movement on these primarily general traffic movement-orientated routes.

There are numerous ways that traffic signals are being optimised and improved. These tactics and interventions have been further endorsed and supported by a recently released Austroads report *Research Report AP-R494-15 Signal Management Techniques to Support Network Operations*. This work developed guidance on how signal management and operation should be undertaken, providing a Signal Management Toolkit, including an indicative impact assessment for a range of signal timing and modal priority techniques. It is intended to assist signal operators in the identification and assessment of appropriate treatments in support of the Network Optimisation Programme.

4.3.3. *Pedestrian/Vehicle Interface*

Effectively managing the pedestrian/vehicle interface on the arterial road network is a challenging task. Unlike the motorway network or very low volume local roads, where conflict is generally avoided, arterial roads can have high volumes of both vehicles and pedestrians, requiring the same space and coming into frequent conflict. This has potentially major implications for safety, network efficiency and the place-value of areas the arterial network passes through.

To balance these competing requirements, some design elements that may improve corridor productivity are not pursued as they are perceived to negatively impact pedestrian amenity or safety. An example of this is the treatment of left turning vehicles at signalised intersections that are often removed for amenity reasons, which can result in more complex intersection phasing and vehicle delays.

Other design elements that may lead to improved intersection operation from a vehicle efficiency perspective and potentially improved productivity include the treatment of pedestrian crossings.

In some cases, traffic signal changes that have been adopted for amenity reasons within activity centres can affect traffic flows. Examples include:

- single long pedestrian crossings instead of a staggered pedestrian crossing
- "Barnes dance" crossings where there are few pedestrians

The level to which signal phasing favours pedestrians is a component of Route Optimisation and Network Operating Plans, so can be assessed and amended via that process.

4.3.4. On-Street Parking

The management of on-street parking affects corridor productivity but is a challenging issue, particularly as many local businesses highly value on-street parking on arterial roads. Most Auckland arterials have clearways during peak periods (some already have limited or no parking). Roadside parking at other times frequently acts as chokepoints on the busier arterials.

An example of this situation is along Mount Eden Road where the evening peak bus lane operating hours are limited to one hour instead of the normal two. Whilst roadside parking can constrain vehicle throughput, it can also be a vital part of local economic activity, so is sometimes retained for non-transport purposes. There are some opportunities to remove further parking at peak travel times. Auckland Transport's Parking Strategy sets out the way parking is managed on arterial roads by extending clearways or removing parking where it:

- inhibits the capacity of the road to carry more people (and goods) particularly in the peak periods, and/or
- causes significant delays to the speed and reliability of public transport on the Frequent Transport Network, and/or
- causes safety risks for cyclists or impedes quality improvements on the Auckland Cycle Network.

4.3.5. Increasing Vehicle Occupancy Levels

Increasing vehicle occupancy rates is a key way overall corridor productivity can be improved. Car occupancy can be increased by encouraging ride sharing, now made easier by specialised apps discussed in the technology workstream. Bus occupancy can be

increased by improving services and priority levels to increase attractiveness. Both types of occupancy affect the trade-off between car, bus and mixed (T2 or T3) use of a lane.

A key intervention to increase vehicle occupancy levels is bus and transit lanes. (Auckland *Transport Code of Practice 2013* Chapter 5.1). These lanes aim to enhance person throughput levels along constrained corridors, while also have improving bus reliability, speed and service delivery efficiency. By reducing travel times and improving reliability, bus and transit lanes can play a major role in encouraging modal shift to public transport.

However, where bus or transit lanes are created by repurposing what was previously a general traffic lane, there are important trade-offs that need to be appropriately considered through the Auckland Transport Code of Practice. In general, this guidance highlights bus service frequency thresholds that would justify the implementation of a transit lane or a bus lane. In general, some special treatment (e.g. bus advance signals) are considered as necessary from 15 or more buses an hour while bus lanes are increasingly justifiable at more than 20 buses per hour and likely at 25 buses an hour or more.

Application of this approach is based on actual survey data of inner city bus lanes, with observed vehicle occupancies. These can vary by route, location and area across Auckland. Travel speeds by mode form key inputs in these assessments. Where necessary, traffic model information is used to help assess likely changes in alternative lane configurations (clearway, T2, T3 or bus lane). By way of example, the proposed upgrade of Lincoln Road had previously envisaged bus lanes along the route but the current proposal is to implement the special vehicle lane as a T3 lane on inception. This provides greater people movement efficiency along this corridor than a bus lane (and higher than a general traffic lane), based on currently planned bus frequency numbers. As bus occupancies increase, reverting to a bus lane will become the most efficient configuration.

The new bus network that is currently being implemented has higher frequencies, fewer routes, a focus on busy roads that suit buses, more interchanges, better real-time information and greater use of bus lanes. The improvements increase the relative competitiveness of buses compared with cars and should lead to substantially increased patronage. This increase should further increase the cases for bus or transit lanes as appropriate.

4.3.6. Prioritising Freight

In discussions with the Ministry of Transport, road freight operators said they had been able to improve their productivity substantially over most of New Zealand but had gone backwards in Auckland, making fewer trips per day than they used to because of congestion. Efforts to reduce general congestion, including those discussed in this paper and possibly new forms of road pricing, would have benefits for road freight productivity – and hence for the cost of doing business and of living in Auckland.

Auckland Transport data show that congestion and signal phasing add an average of 21% extra time to road freight journeys. The median travel speed on the Auckland freight network

(including motorways) is 67 km/h, but it is an average of only 21km/hr at the 10 worst hotspots.³

Some of the hotspots are being addressed through truck bypasses of on-ramp metering lanes, through completion of the Waterview motorway and, later, construction of the East-West link near Neilson Street. Planning is under way to address some of the others. Increasing use is being made of the rail connection between the port and the freight precincts around Neilson Street and Wiri; it has ample spare capacity at night, albeit limited by noise sensitivity issues, and could eventually be expanded with a third line from the port. A third line to the south has also been suggested to relieve congestion between freight and passenger trains.

The ATAP freight workstream report considers freight demand, cost of delay, the economic contribution of freight, estimated increases in the "do nothing" freight delays and associated costs, estimated costs of such delay to the economy, and interventions to address key sources of delay (including the potential impact of tolled freight lanes). It aims to identify the need and type of new freight capacity.

4.4. Network Improvements

4.4.1. Minor Improvements

Auckland Transport has discretion to spend up to \$300-700k on minor individual works that generate more than half their benefits from efficiency, but the annual budget for these types of projects is only \$2.5 million. Larger scale interventions are usually identified through business case processes or out of Corridor Management Plans.

4.4.2. Projects identified in Corridor Management Plans

Auckland Transport has undertaken a prioritisation process to assess all projects/work packages (approximately 300 so far) identified in the existing CMPs to ascertain the top candidates to progress through an Indicative Business Case. The prioritisation process made use of a range of Auckland Plan, Integrated Transport Programme and New Zealand Transport Agency criteria to assess each project; the overall score then provides a priority profile.

An analysis of projects focussed on traffic improvements (i.e. excluding those with public transport, cycle, safety, etc. themes) showed that from the CMPs there were 20 solely traffic-focused projects/packages, coming to a total of \$275 million.

The cost of these improvements range from \$250,000 to \$60 million. Each proposal sought to separate out and improve a particular traffic movement, through intersection widening, signal changes, additional turning lanes or other improvements. The variety of locations across Auckland meant each was quite different from the next, but they could all be considered to address localised traffic congestion in some way. The analysis was not able to determine exact benefit-cost ratios, but noted they were typically around 1.0.

³ AT, Freight route performance, June 2015

In formulating the 2015 RLTP, few of these traffic-focused projects were highly ranked in the prioritisation process – possibly due to them being singularly focused on traffic movement and doing little for other modes or deficiencies, so having a limited range of benefits.

4.4.3. Grade separation

Whilst signal optimisation and minor widening can provide moderate relief from traffic congestion at intersections, often the vehicle demands on an intersection are so large as to trigger consideration of grade separation. This is typically avoided by Auckland Transport due to the significant cost and community impacts involved but is considered in certain locations. Grade separation of arterial roads can cost from \$30m (for a solution similar to removal of a rail level crossing) up to \$140m (for a major project like the planned Reeves Road flyover in Pakuranga) and is generally considered so expensive and intrusive that travel time savings alone would not justify such an intervention, and significant safety or urban regeneration benefits would likely be required. The grade separation currently being considered at Pakuranga would remove extremely large traffic volumes from passing through two congested intersections and free up space for a busway and urban regeneration.

4.5. Conclusions

As outlined in this section, a number of interventions are currently undertaken to improve arterial road network productivity. These range from optimisation activities right through to fairly major investments. At the moment, these interventions are guided by Corridor Management Plans and a Network Operating Plan.

Effectively delivering current activities appears constrained by difficulties in resolving a variety of challenging trade-offs between:

- different demands on the arterial road network from different transport modes
- competing movement and place functions
- competing regional and local priorities

It also appears as though resources for improving arterial road productivity are relatively limited, particularly for minor improvements. Large improvements appear to deliver modest benefit-cost ratios.

5. Recommended Approach

5.1. Introduction

The previous section highlighted various interventions being undertaken to improve arterial road productivity, as well as some of the challenges faced in delivering these interventions.

While these challenges are significant and need to be addressed, evidence from Sydney (detailed below) suggests that interventions focused on improving network productivity on arterial roads could deliver extremely high levels of benefit, relative to their cost.

New South Wales (NSW) interventions that worked best in improving productivity

Transport for NSW uses a range of interventions to improve the productivity on the state road network. These measures are applied to minimise congestion on the existing road network in Sydney in the NSW Government's Pinch Point Programme. The initiatives deliver efficiencies at relatively low cost and quickly to ensure benefits and congestion relief for customers. They include

- widening of small sections of road
- lengthening or widening of busy turn bays
- installation of variable message signs and closed circuit television cameras
- turning restrictions
- installation of no stopping, no parking and clearway restrictions
- other small modifications and additions to improve traffic flow, including new signage.

Estimated benefit cost ratios are

- 37 for an early phase of the programme
- 7 for infrastructure interventions, the mainstay of the programme
- 12 for Clearways, 10 for CCTV, and for vehicle message signs.

Source: extracted from a letter from Roads & Maritime Services, Transport for New South Wales, to the Ministry of Transport. BCRs rounded.

This section outlines a recommended approach to arterial roads that can improve their productivity in a way that also recognises other, competing uses for this space. A large part of this approach is defining which parts of the current arterial road network should be prioritised for through-movement.

5.2. Better strategic network planning

The biggest challenge for the arterial roads network is how to achieve improvements in productivity (throughput of people, goods and services) while balancing different user requirements, and addressing conflicts between through-movement and amenity.

In order to tackle these challenges, Auckland Transport has developed a *Roads and Streets Framework* which provides the direction for Auckland's roads and streets and reassesses the way it designs and delivers road space based on movement and place. This framework for managing and developing Auckland's roads and streets will enable Auckland Transport and key stakeholders to:

- Identify user needs in different circumstances and set priorities/make trade-offs accordingly
- Provide strategic direction to help resolve road space priority between different groups of users and places, while maintaining network integrity and strategic function
- Identify the types of tools that may be appropriate locally
- Balance place-specific needs with the overall function of the network through the applications of road and street typologies, which describe their roles, priorities and service standards
- Understand the need for intervention at a strategic level.

The framework considers roads and streets, including arterial roads, in a matrix of nine broad categories. It considers their various characteristics and where the conflicts are, and prioritise modes appropriately. For example, some arterials could be prioritised for through traffic and freight, while others could be prioritised for public transport and cycling. In some circumstances, the focus will be on meeting the needs of local centres with priority for safe pedestrian movement and access for local businesses.

Defining which arterial roads should form part of the "Strategic Road Network" is a crucial early part of this work.

5.3. Evidence based decision-making

Giving effect to strategic network planning of the arterial road network often involves difficult and controversial decisions, such as the removal of on-street parking, extending bus lane operating hours, increasing capacity by addressing chokepoints, providing additional pedestrian facilities in high volume areas that might slow down traffic and so forth.

Where these decisions align with the strategy and 'stack up' they need to be implemented consistently and at a much faster pace than has occurred in the past. This may require Auckland Transport to establish new systems for decision-making, and will require the support of the Auckland Council through future governance documents, like the annual Statement of Intent.

5.4. Increasing funding for arterial roads

Only around 7% of the funding allocated in the 2015 RLTP went towards existing local roads, despite these roads carrying a large proportion of Auckland's travel. Even this 'local roads' investment covers a range of activities, not all of which would be expected to increase corridor productivity in the way that Austroads measures.

Areas of investment that appear likely to deliver significant benefits, for relatively little additional investment include:

- Small and medium capital expenditure opportunities that could improve arterial road productivity (intersection upgrades, minor bottleneck removals etc.).
- Network optimisation and traffic signal system upgrades
- Bus or transit lane extensions that benefit large numbers of passengers, particularly where the impact on general traffic will be minimal.

5.5. Maximising the benefits from demand management and new technologies

Developing vehicle and ridesharing technologies (as discussed further in the Technology Workstream Report) provide new opportunities to use existing transport networks far more efficiently in the future. These include:

- Connected and autonomous vehicles, which can enable higher throughput through closer following distances and much more efficient intersection operation through vehicle to infrastructure communication.
- Ridesharing applications, which can increase vehicle occupancy rates by making it much easier to carpool or rideshare with others.

Demand management, including smarter transport pricing, also has significant potential to improve network performance by varying the cost of travel to encourage time, route or mode shift that results in more efficient overall travel patterns. Pricing is discussed further in the Demand Management Pricing Workstream Report.