2018 Asset Management Plan

Auckland Transport

Asset Management Plan

2018

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	Name	Signature	Date
Written by	Asset Planning and Policy Group		
Reviewed by	S B (Siri) Rangamuwa Manager, Asset Planning and Policy		8/10/18
Recommended by	Neil McLoughlin Asset Manager		8/10/2018
	Michael O'Halloran Chief Engineer		9/10/18
	Mark Lambert Executive General Manager, Integrated Networks		29/10/18
Approved by	Shane Ellison Chief Executive		15/11/18

Main Contributing Authors:

- S B (Siri) Rangamuwa
- Anna Percy
- May Oo
- Sanchit Shukla
- Carmela Tamayo
- Michael Mason
- Caroline Jamieson
- Martin Coates

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1. Executive summary

Prudent management of Auckland's $14.3 billion of road assets and $1.5 billion of public transport assets is central to Auckland Transport's (AT) legislative purpose of providing an efficient, effective and safe land transport system in the public interest.

This purpose has been given new impetus in AT's 2018 plans. As Auckland continues to grow at record rates, making best use of the existing transport network is being recognised as the foundation for all plans to improve transport outcomes (1).

AT's Asset Management Plan 2018 is a plan for change. It has been prepared using a business case approach, with the involvement of Auckland Council and the NZ Transport Agency. It forms part of a national effort to implement the recommendations of the One Network Road Classification (ONRC) framework in the 2018 planning round, under the direction of the Road Efficiency Group (2). The key principles that have been applied to develop the recommendations in this asset management plan (AMP) are:

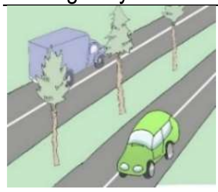
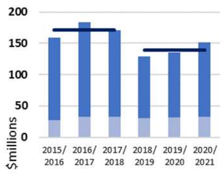
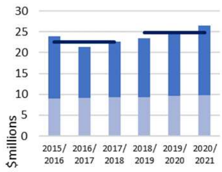
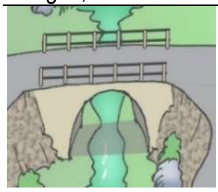
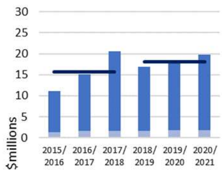
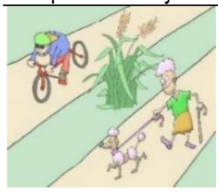
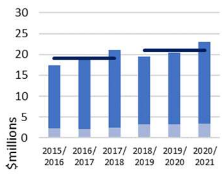
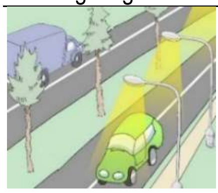
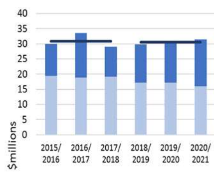
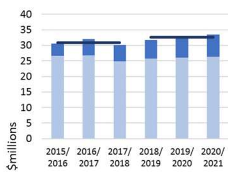
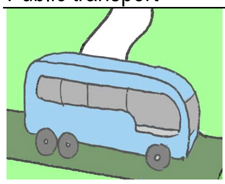
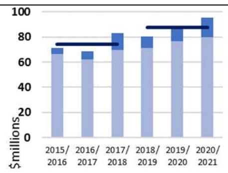
Deliver fit-for-purpose levels of service aligned with the ONRC	This AMP defines the fit-for-purpose level of service for each asset, and provides evidence of any gaps, where the current level of service is higher or lower than the agreed, fit-for-purpose level of service.
Manage risk	Failure of critical transport assets is to be avoided and AT takes a proactive approach to asset maintenance and renewals, and manages risk at acceptable levels.
Prioritise	The ONRC framework is used to set a fit for purpose level of service for roads. Arterial and regional roads will be maintained to a higher level of service, which is appropriate, as these roads carry 73 per cent of all traffic. Similarly for public transport, assets that form part of the Rapid Transit Network are maintained to a higher level of service than local bus stops.
Adopt a whole-of-life approach	This AMP recommends re-prioritisation of maintenance investment in some areas to reduce the need for costlier renewals. It also accounts separately for assets renewed in the course of AT's capital improvement projects.
Clarify the costs of growth	Growth impacts on maintenance and renewals by creating new assets and increasing the rate at which existing assets deteriorate, especially on the rural road network. New residents have expectations for higher levels of service. Accounting more clearly for these growth-related costs is the first step towards funding them in a fair and transparent way.

As well as applying these principles, this AMP focusses on key asset management decisions. In doing so, it delivers on the following key action from the Auckland Transport Alignment Project:

> "Agree appropriate asset management levels of service, associated funding requirements, and provide improved visibility of the trade-offs from different levels of asset management investment".

Table 1.1 summarises the key gaps where the current level of service is above or below a fit-for-purpose level, and then sets out a strategic response to close these gaps, including the financial implications and expected benefits of that strategic response. The detail supporting these decisions is presented in outline in the Chapter 2 to 6, and in detail for each asset class in Chapter 7.

Table 1-1: Summary of level of service gaps, and recommended response, by class of transport asset.

	Gaps	Strategic response	Investment needs	Benefits expected
Carriageway			Maintenance Renewals	
	Smoothness of the carriageway surface on less busy roads is better than it needs to be. Skid resistant surfaces could contribute to safety outcomes. Seal lives are below national averages.	Optimise pavement renewals, and target renewals for regional and arterial roads. Implement programmes to increase seal lives.		Proposed actions will improve safety, amenity, accessibility, value for money, travel time and sustainability.
Stormwater				
	The risk of flooding is increasing due to urbanisation and climate change. Parts of the AT stormwater network do not meet current standards.	Work with Auckland Council to implement proactive life cycle management. Redirect the renewals programme to focus on underground assets.		Proposed actions will improve safety, resilience, travel time, amenity, accessibility and sustainability.
Bridges, walls and structures				
	Need to address bridges that are in poor condition, although they are mostly on low-volume roads.	Appropriately increase the rate of bridge renewals to ensure bridges are fit for purpose, relative to the importance of the road.		Proposed actions will improve safety, travel time, resilience and accessibility.
Footpaths and cycleways				
	Faults and a lack of safe facilities discourage walking and cycling.	Move to a more proactive maintenance and renewals regime for footpaths and cycleways, informed by improved asset information.		Proposed actions will improve safety, amenity, accessibility, travel time and sustainability.
Streetlighting				
	Levels of service are improving with the implementation of the LED replacement programme.	Continue to retrofit streetlights with energy efficient LEDs. Use the LED tele-management system to optimise energy use and prioritise maintenance. Accelerate the renewal of light poles.		Proposed actions will improve safety, amenity, value for money and sustainability.
Traffic systems, signs and markings				
	Auckland's complex, busy network requires appropriate traffic signals and more active traffic management.	Direct operational, maintenance and renewals investment to activities that improve network productivity.		Proposed actions will improve safety, amenity, accessibility, travel time and sustainability.
Public transport				
	Auckland's step change in public transport is leading to a step change in public transport asset costs.	Increase provision for renewals and maintenance, in line with past and proposed capital works programmes.		Proposed actions will improve safety, resilience, amenity, accessibility, travel time and sustainability.

1.1 Key outcomes of this AMP

1.1.1 Value for money

The AT transport network provides for 8.3 billion kilometres of vehicle travel each year, which is 18 per cent of all vehicle travel in NZ, as well as 88.4 million public transport trips which is 58% of the national total.

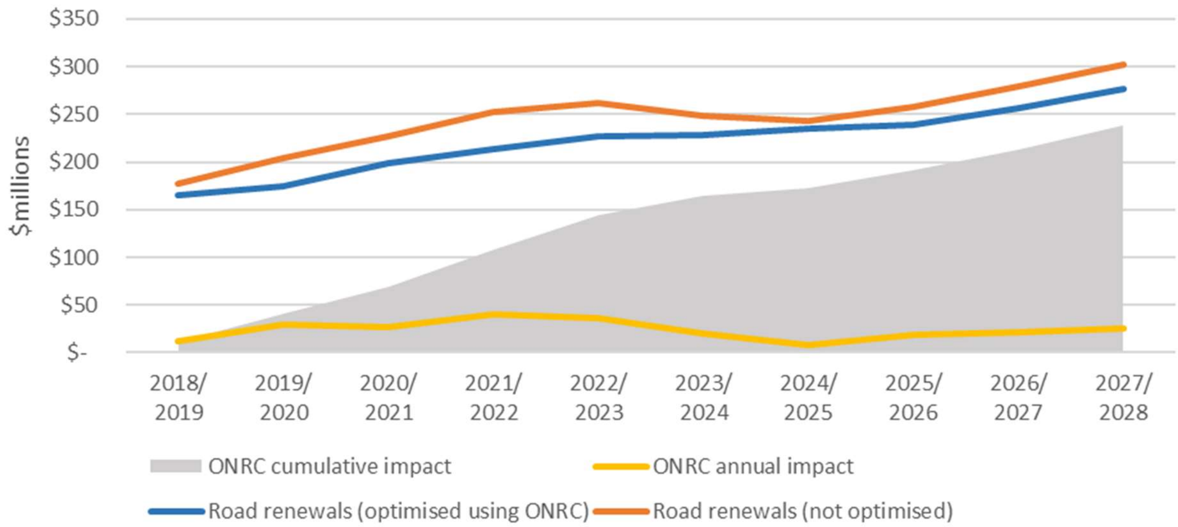
Keeping Auckland’s transport network in a fit-for-purpose condition requires ongoing investment, the cost of which is shared between Auckland Council and the NZTA.

Right roads, right time, right cost – applying the ONRC framework

Significant national effort has gone into setting the right level of investment for road maintenance and renewals. This work has been coordinated by the Road Efficiency Group. In this AMP, AT has applied the ONRC framework developed by the Road Efficiency Group to set fit-for-purpose levels of service for the road assets it manages. These levels take into account the importance of different roads in the overall network.

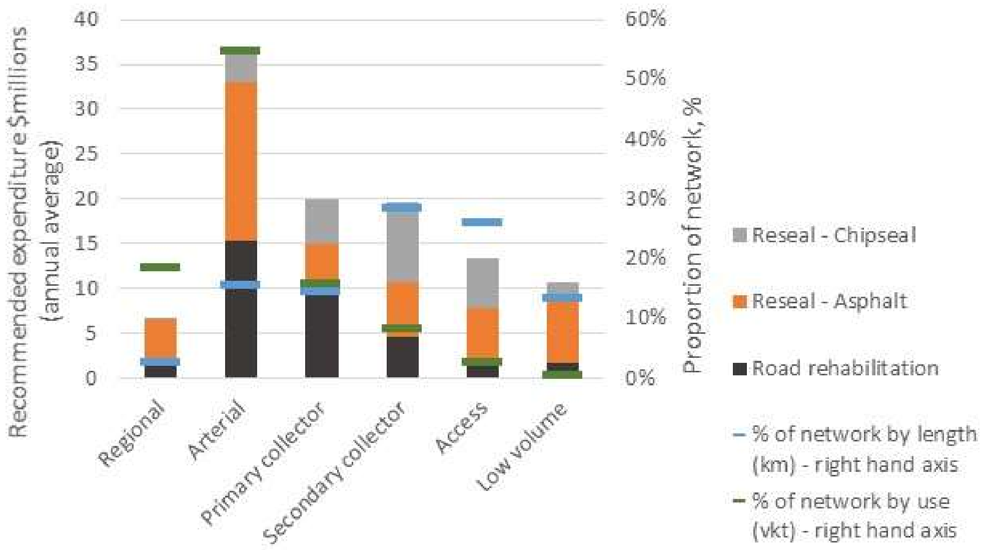
Applying the ONRC framework will reduce renewals investment needs by over $200 million in the first decade of this plan, as shown in Figure 1-1.

Figure 1-1: Ten year road renewals investment, with and without ONRC optimised renewals programmes



Renewals savings are achieved by directing a higher proportion of renewals investment to busy roads. In this AMP, 40 per cent of carriageway renewals investment is directed to regional and arterial roads. These roads make up only 18 per cent of the network by length, but carry 73 per cent of total traffic. Conversely, the level of renewals investment in access and low-volume roads is reduced. These roads make important local connections, but only carry 3 per cent of total traffic, as shown in Figure 1-2.

Figure 1-2: Road renewals expenditure in context of network length and network use



Increased service life from road pavement assets

The proposed investment plan will improve road pavement service lives. Asphalt and chipseal surfaces on collector and access roads will last longer (be resealed less often) than the current average seal lives of 12 years. This will be achieved by increasing the level of scrutiny of reseal projects, with the aim of postponing reseals if this can be done without impacting on customer outcomes, safety or long term costs.

Renewals of road pavement bases will reduce significantly. This proposed reduction takes advantage of the current good condition of the road pavements in the network, and takes into account road pavement assets that are renewed as part of capital improvement projects.

1.1.2 Network condition

Under the recommendations of this AMP, customer levels of service under the key result areas of amenity, accessibility, resilience and safety is expected to be maintained over the next 10 years. However, there will be some changes in asset condition, which are explained below for each major asset group.

Road pavement

Road pavements are AT’s most valuable asset, and comprise the pavement base, and the pavement surface of sealed roads which is either asphalt or chipseal. Condition forecasts for the base and surface of the road pavement asset over the coming 10 years are shown in Figures 1.3 to 1.5.

The implementation of ONRC will change the distribution of pavement asset condition. It will lead to some pavements, especially in the lower end of the ONRC classification, being in “poor” condition and a few being in “very poor” condition by the end of 10 years. Because the great majority (73 per cent) of all vehicle travel is on regional and arterial roads, which will be maintained to the current level of service, the customer impact of these changes in asset condition is expected to be minor and unnoticeable from a user’s point of view.

Figure 1-3: Impact of renewals recommendations on the condition of the road pavement base

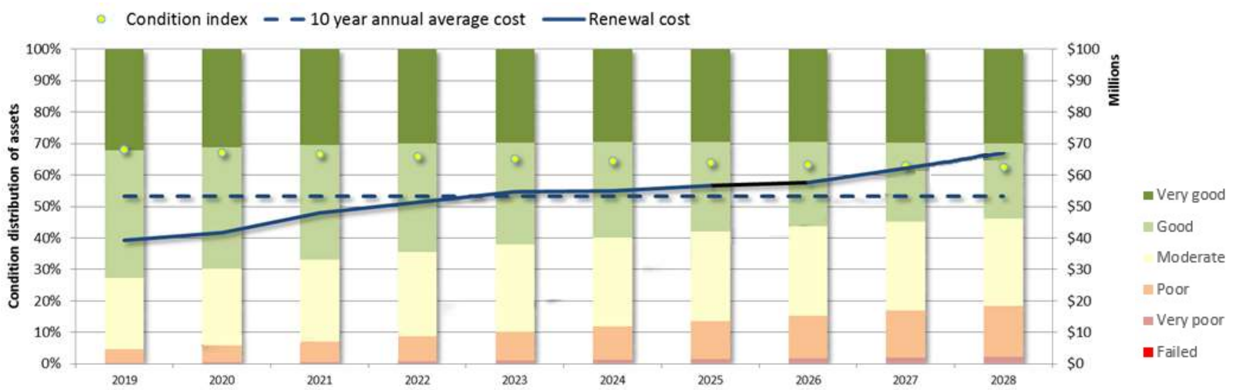


Figure 1-4: Impact of renewals recommendations on the condition of asphalt pavement surfaces

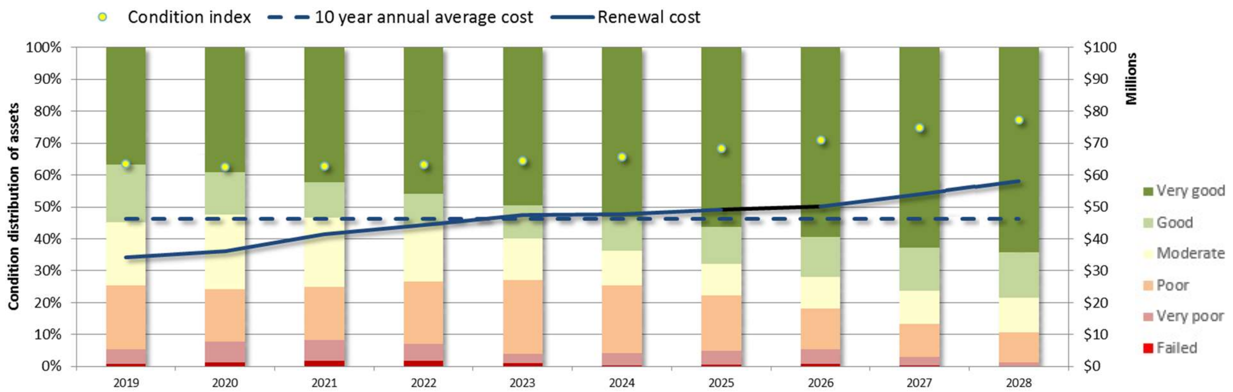
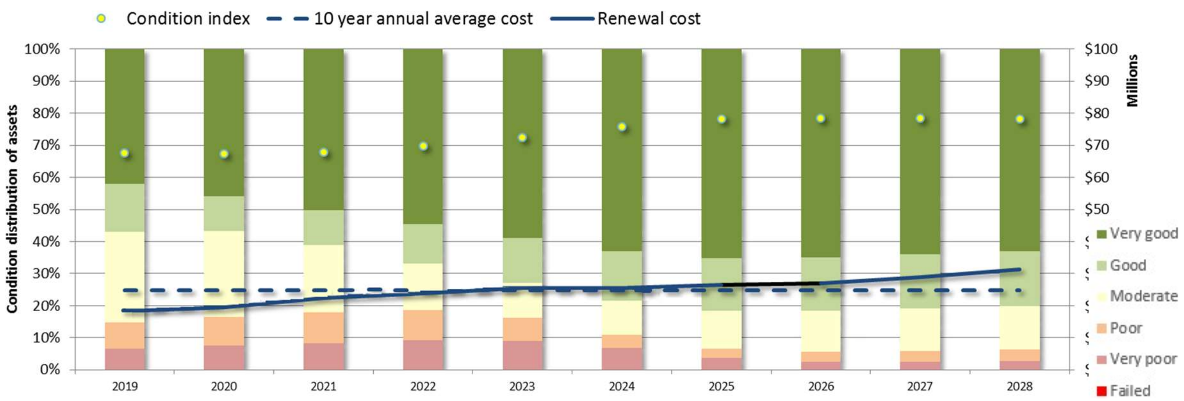


Figure 1-5: Impact of renewals recommendations on the condition of chipseal pavement surfaces



Further details of the carriageway asset management programme are set out in Section 7.1.

Stormwater

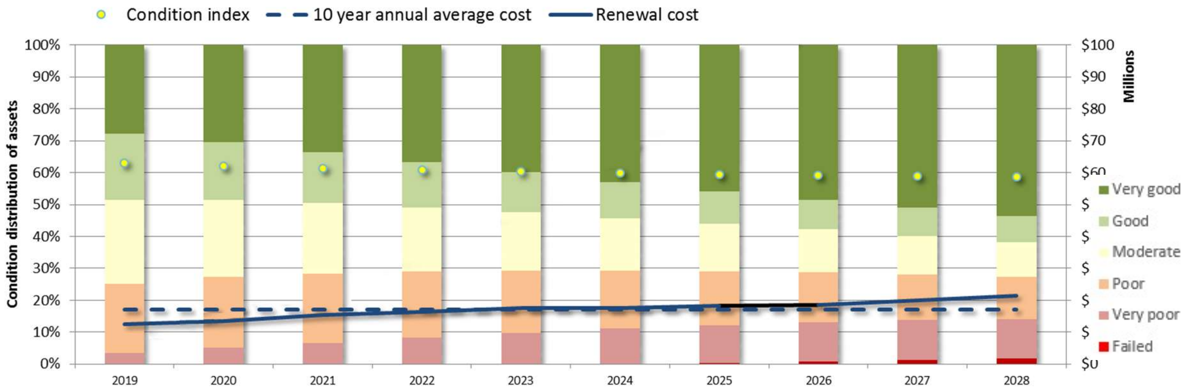
AT is responsible for the management of stormwater assets in the road corridor including kerb and channel, catchpits and culverts. The stormwater network is AT's second most valuable asset class after road pavements. Good stormwater management is key to extending the useful life of road pavements and providing a good level of service to all road users including pedestrians and cyclists.

AT works closely with Auckland Council, which is responsible for the bulk stormwater network and for stormwater infrastructure that serves private properties.

Figure 1-6 shows that the proposed renewal programme is expected to result in a small, but manageable, increase in the proportion of assets in very poor condition in the first three years of this AMP. Most assets in very poor condition will be on roads in the lower end of the ONRC classification – low volume and access roads.

AT also needs to consider future risks including sea level rise and the increasing frequency of extreme weather events. For these reasons, stormwater planning in collaboration with Auckland Council will be a major focus for the 2021 Asset Management Plan.

Figure 1-6: Impact of renewals recommendations on the condition of stormwater assets

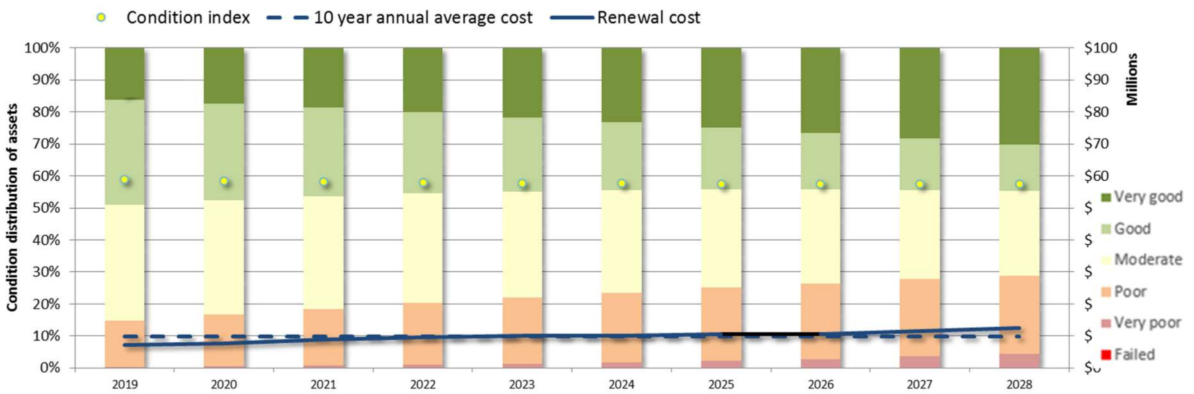


Further details of the stormwater asset management programme are set out in Section 7.2.

Bridges and structures

Bridges and other structures, including retaining walls and major culverts, are high-risk assets, which cannot be allowed to fail. This AMP increases investment in the renewals of bridges and structures, as shown in Figure 1-7. This will manage the risks facing bridges and structures in a manner consistent with the ONRC framework – fit for purpose levels of service. This means a higher proportion of bridges on access and low volume roads will be in poor condition. This is considered a manageable risk as mitigation measures such as reactive maintenance and renewals will be able to rectify any faults to minimise risk of asset failure.

Figure 1-7: Impact of renewals recommendations on the condition of bridges and major culverts



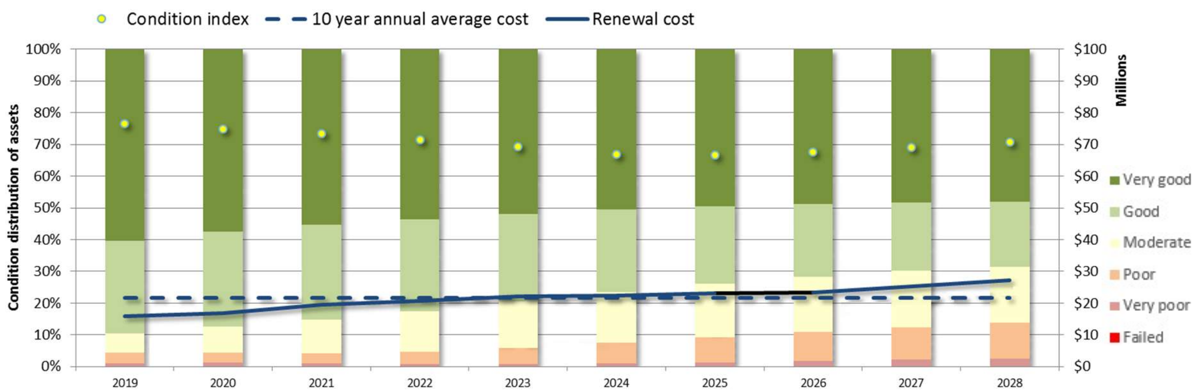
Further details of the asset management programme for bridges, walls and structures are set out in Section 7.3.

Footpaths and cycleways

Almost every Aucklander uses the footpath network every day, for walk-only trips or as part of a trip by public transport or by car, and two thirds (68%) consider themselves frequent walkers, walking for ten minutes or more, at least twice a week.

To maintain the condition of AT's footpath network at a level that encourages walking, this AMP recommends a steady increase in renewals expenditure on footpaths, as shown in Figure 1-8.

Figure 1-8: Impact of renewals recommendations on the condition of footpaths



Source: ROM, July 2017

AT is also investing in additional safe cycleways, especially in the city centre where many short trips currently are currently being made by car, there is limited opportunity to add space on existing roads, and several years before much needed capacity on public transport can be added.

Further detail of the asset management programme for footpaths and cycleways is set out in Section 7.4.

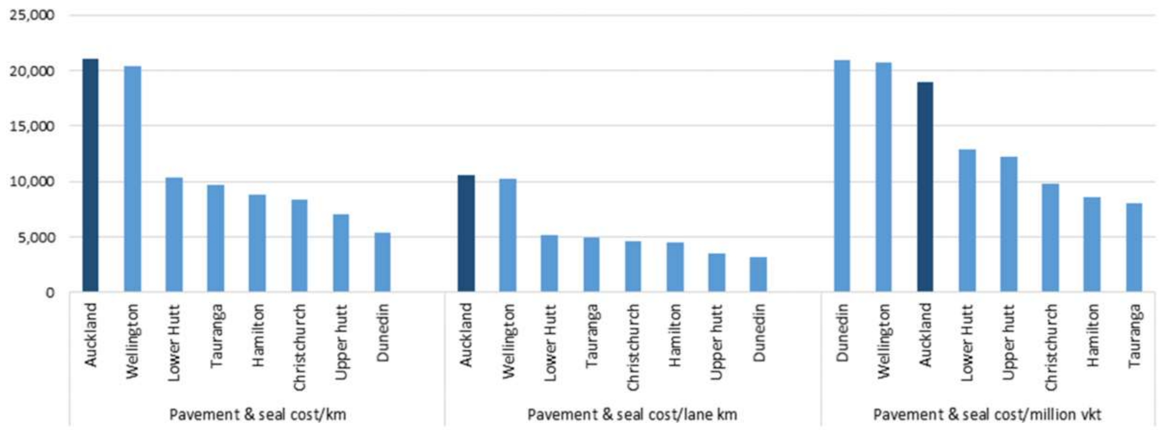
1.1.3 Benchmarking with other New Zealand cities

In 2017/2018, AT expenditure for road maintenance, operations and renewals was $157 million. This equates to:

- $21,000 per kilometre of road network
- $10,600 per lane kilometre of road network
- $19,000 per million kilometres of vehicle travel (or 1.9 cents per kilometre).

The comparison between these costs and other New Zealand cities is shown in Figure 1-9.

Figure 1-9: Benchmarked costs for maintenance, operations and renewals in 2017/2018

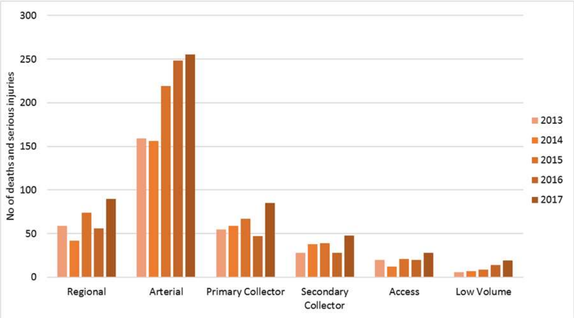


Source: NZ Transport Agency annual achievement reports

1.1.4 Road safety

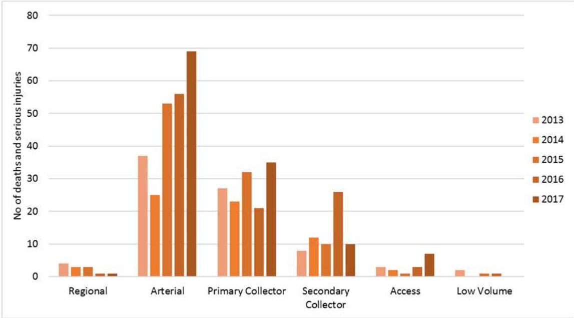
Analysis of safety trends by ONRC class has highlighted the very high proportion of crashes causing death or serious injuries that occur on arterial roads. This is shown in Figure 1-10 for urban roads and Figure 1-11 for rural roads.

Figure 1-10: Deaths and serious injuries on urban roads, by ONRC class



Source: AT's road safety performance reporting tool

Figure 1-11: Deaths and serious injuries on rural roads, by ONRC class



Source: AT's road safety performance reporting tool

The types of crashes that occur on urban and rural roads are also very different. Rural crashes typically involve loss of control and speed as contributing factors, where urban crashes are typically the result of small mistakes on a complex, crowded network. In recent years, around half of road users killed or seriously injured on urban AT roads have been pedestrians, cyclists and motorcyclists.

This information has helped develop the safety programme set out in this AMP. The programme encompasses maintenance, operations and renewals, and includes a strategic case for low-cost, low-risk capital improvements to improve safety.

1.1.5 Travel time reliability

This AMP continues the current trend of increasing our investment in traffic systems, for both maintenance and operations. This investment supports:

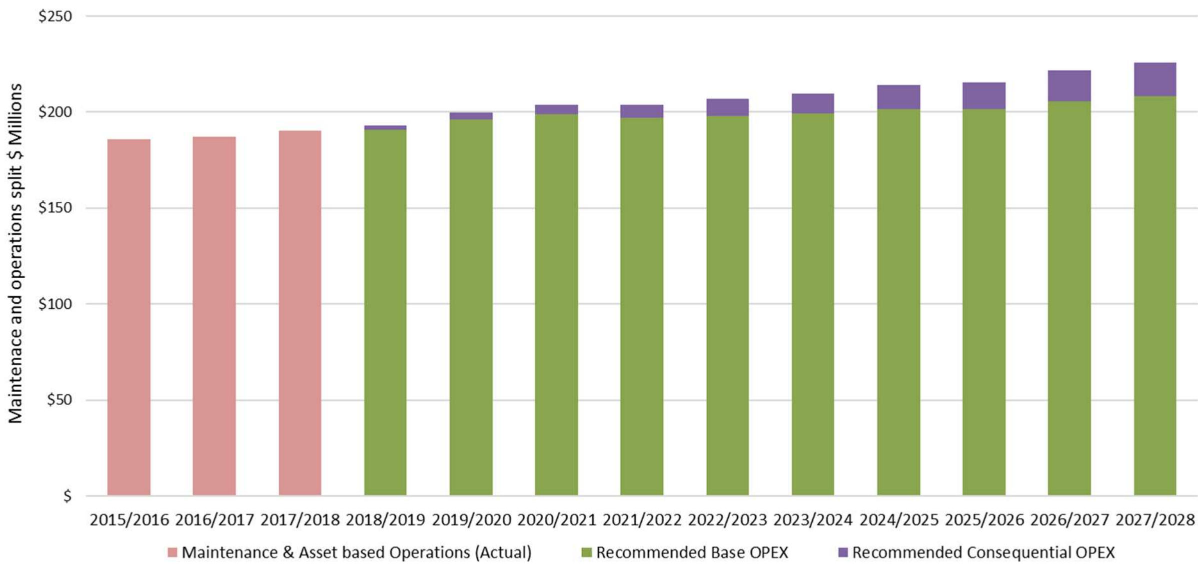
- analysing key arterial routes, and recommending how best to move more people and freight (but not necessarily more vehicles) on these routes
- optimising traffic signals on these routes on a 2-year rolling schedule
- optimising traffic signals in the city centre continuously, in real time
- continuing to expand network user information, including electronic signs and media traffic reports
- improving the safety of signalised intersections, and responding more quickly when crashes do occur.

This AMP also sets out the strategic case for low-cost, low-risk capital improvements to address identified network deficiencies and contribute to improved travel times for priority road users.

1.1.6 Impacts of growth

This AMP includes the consequential maintenance and operations costs from more roads, streetlights and other assets being added to the Auckland network, as shown in Figure 1-12.

Figure 1-12: Total maintenance and asset based operations



Source: AT (SAP), August 2018

Consequential opex costs have been estimated based on 40 km of new roads being added each year, and 2.4 per cent traffic growth each year.

Other costs of growth have been identified, but cannot yet be fully quantified. These include costs related to:

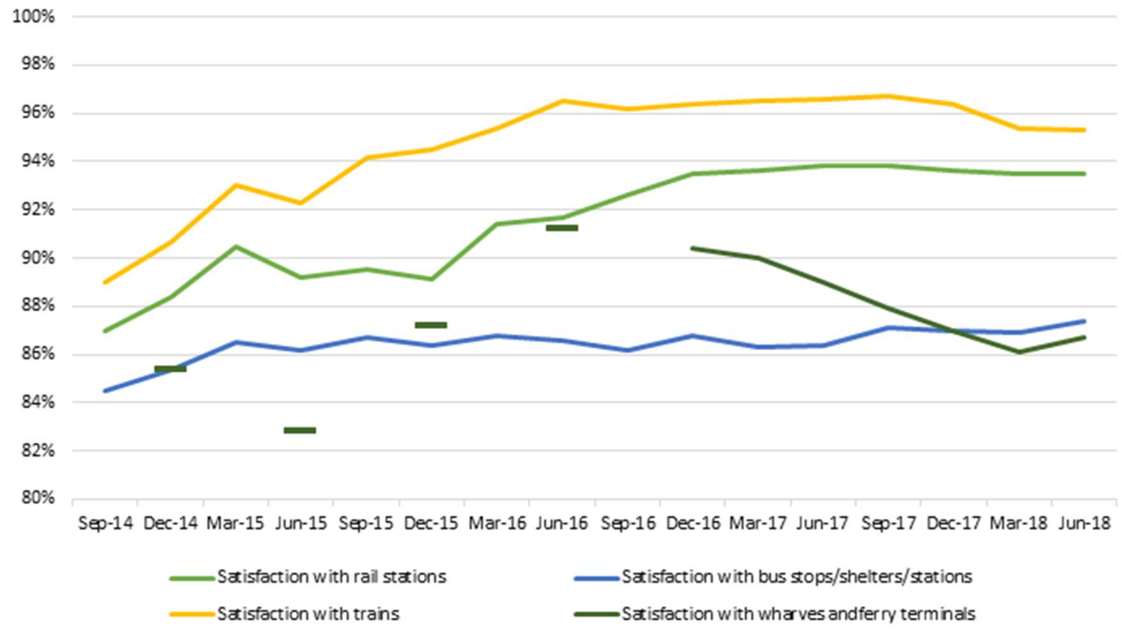
- the impact of heavy commercial vehicles, especially on rural roads
- higher customer expectations for an urban standard of assets and services.

1.2 Public transport

Auckland's public transport investment continues to be a success story, with 92.4 million boardings in the 2017/2018 year; this is well over half of all public transport boardings in New Zealand.

AT maintains its public transport infrastructure to a high level of service, with no customer-facing assets allowed to fall into very poor condition. Customer satisfaction with public transport assets remains high, as shown in Figure 1-13. This is contributing to the objective of increasing public transport mode share, particularly along high-volume, congested corridors.

Figure 1-13: Customer satisfaction with public transport infrastructure



Source: AT quarterly report to Auckland Council

Maintaining the current high levels of satisfaction with public transport assets will require ongoing increases in maintenance and renewals to keep up with capital investments, including the City Rail Link.

1.3 NZ Transport Agency funding

To meet Auckland's current and future needs for a safe, efficient and effective local road network, AT will need funding support from the NZ Transport Agency.

Table 1-3 provides a summary of AT's funding application for 2018/2019 to 2020/2021.

Table 1-2: AT funding application and Transport Agency approvals for 2018/2019 to 2020/2021, in comparison with 2015/16 to 2017/18

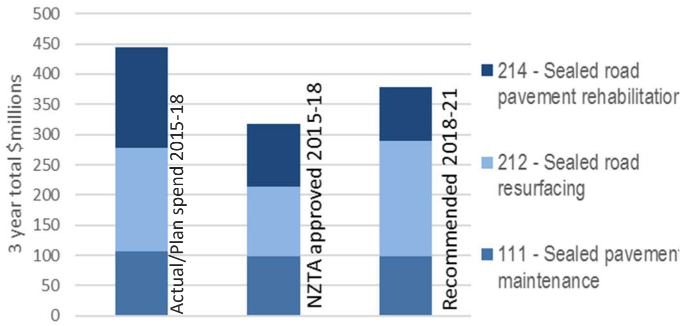
NZ Transport Agency Work Category (in millions)	2015/2016 - 2017/2018 Actual Spend	2015/2016 - 2017/2018 Approved for co-funding	2018/2019 - 2020/2021 Funding Application	2018/2019 - 2020/2021 Approved for co-funding	2018/2019 - 2020/2021 % of application approved
111 Sealed pavement maintenance	$41.2	$48.5	$47.5	$47.5	100%
111 Pre-seal repairs	$61.2	$48.3	$50.7	$50.7	100%
112 Unsealed road metalling	$10.9	$8.7	$11.4	$9.9	87%
113 Routine drainage maintenance	$28.9	$27.5	$30.3	$30.3	100%
114 Structures maintenance	$4.2	$4.3	$5.0	$5.0	100%
121 Environmental maintenance	$29.2	$25.2	$47.9	$34.9	73%
122 Traffic services maintenance	$89.9	$85.6	$90.2	$88.7	98%
123 Operational traffic management	$23.9	$26.9	$35.9	$34.4	96%
124 Cycle path maintenance	$.5	$.5	$3.2	$3.2	100%
125 Footpath maintenance	$57.5	$.0	$63.1	$63.1	100%
131 Level crossing warning devices	$.0	$.0	$.0	$.0	100%
151 Network and asset management	$35.7	$32.9	$43.7	$42.2	97%
Subtotal for fundable Road operations and maintenance:	$383.2	$308.3	$428.9	$409.9	96%
211 Unsealed road metalling	$6.7	$4.1	$6.3	$6.3	100%
212 Sealed road resurfacing	$182.7	$115.3	$190.5	$152.3	80%
213 Drainage renewals	$42.6	$26.8	$48.3	$44.8	93%
214 Sealed road pavement rehabilitation	$172.9	$104.1	$89.0	$89.0	100%
215 Structures component replacements	$16.8	$9.4	$34.7	$25.7	74%
222 Traffic services renewals	$53.1	$44.2	$64.3	$60.3	94%
Subtotal for fundable Road renewals:	$474.8	$303.9	$433.1	$378.4	87%
Total fundable budget:	$858.0	$612.2	$862.0	$788.3	91%

Source: AT (SAP), August 2018. Activities such as parking that are not eligible for subsidy are not included, so totals differ between recommended investment requirements and the funding application to the Transport Agency.

The 2018 funding application includes some significant changes, which were developed by applying the ONRC framework and the business case approach.

- Sealed road pavement rehabilitation has been reduced by 46 per cent, relative to AT's actual spend in the three years form 2015/2016 to 2017/2018. The new programme will maintain current levels of service on regional and arterial roads, but take a higher risk on lower order roads, consistent with a fit-for-purpose level of service.
- Sealed road resurfacing costs 11 per cent more than in the previous three years, due to:
  - more reseals being needed, as identified by AT's asset renewals models (ROM and dTIMS)
  - the need to keep up with resealing requirements on busy roads to safeguard pavements and minimise risk
  - cost pressures (as explained in Chapter 8).
- For rehabilitations and reseals combined, costs have reduced from $336 million in the previous three years to $279 million in our 2018/2021 funding request, as shown in Figure 1-14. AT's sealed pavement maintenance recommendation for 2018/2021 is equal to the approved amount for 2015/2018, at $106 million. Increases due to consequential opex are offset by efficiencies in pre-seal repairs.

Figure 1-14: Sealed pavement maintenance and renewals



1.4 Issues and risks

This AMP is based on AT's best current knowledge of how to manage Auckland's complex transport network in the public interest. It is being prepared at a time of rapid change, with many unknowns. Managing the issues and risks arising from this situation will be a constant challenge throughout the three years leading to the 2021 AMP.

The key issues and risks that will need to be addressed include:

- ensuring that the actions and changes set out in this AMP are applied in the annual forward works programme, and implemented on the network through AT's delivery contracts
- increasing monitoring and improving data management, as both are essential to improved asset management. While the accuracy and completeness of our asset data is improving, there are still some significant gaps
- accurately measuring heavy vehicle volumes on local road networks. There is still a national problem with this data, and without it, a key piece of information is missing for evidence-based decision making about AT's most valuable and important asset – our road pavements
- understanding the many demands that Auckland's growth places on transport networks. The costs of growth need to be fully understood to assess the impact on the network and on funding requirements.

1.4.1 Auckland's changing transport networks

This is a 10-year plan, which is a long time in relation to Auckland's rapidly changing network. Assets that AT manages now, that did not exist when the organisation was established in 2010, include:

- electric trains
- the HOP card system
- wifi access points
- electric vehicle charging stations
- electronic signs, with real-time traffic information

AT's asset management practice needs to keep pace with changes in the transport network.

1.5 Asset management planning improvements

Asset management planning is a process requiring continuous improvement to ensure that AT is ready for the changes and challenges that the next 10 years will bring.

This AMP implements a number of new initiatives, but has also highlighted areas where further improvement is needed for the 2021 planning round. These are summarised in Table 1-2.

Table 1-3: Asset management planning achievements and improvement tasks

<table>
<tr><th>Achievements of this 2018 AMP</th><th>Improvement tasks in preparation for 2021 AMP</th></tr>
<tr><td>Aligns with the strategic direction set by the Auckland Transport Alignment Project
Developed using the business case approach
Implements the ONRC framework</td><td>Enhance monitoring of the network, and in particular of any potential adverse effects of the reduced expenditure on road carriageway base
Continue to refine calculations of the consequential costs of new assets, and work towards quantifying all of the costs of growth
Continue to improve the quality of asset data and the use of this data to inform decisions
Clarify trends in heavy commercial vehicle routes and volumes
Improve and expand AT's renewals optimisation model (ROM), in partnership with the University of Auckland
Undertake research and development to meet new asset management challenges on a changing network</td></tr>
</table>

Full details of how AT will improve asset management planning over the coming three years are given in Chapter 14.

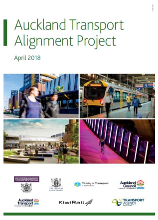
2. About this plan

2.1 Role and strategic alignment

This asset management plan (AMP) sets out a 10-year programme for Auckland Transport's (AT) prudent management of Auckland's transport network, including the maintenance, operation and renewal of Auckland's $14.3 billion worth of road assets and $1.5 billion worth of public transport network assets. It also considers new assets that will need to be added to the network in the coming 10 years, in response to the pressures created by an expanding population and a growing economy.

Auckland has a unique governance structure, as well as a complex and large transport network. Reflecting this, the programme for governing, developing and managing Auckland's transport network cannot be contained in a single document.

This AMP is one of a set of documents that provide the bottom-up detail to guide the 2018 review of Auckland's Regional Land Transport Plan, which in turn reflects the strategic priorities of Central Government and Auckland Council as documented in Figure 2-1 and described below.



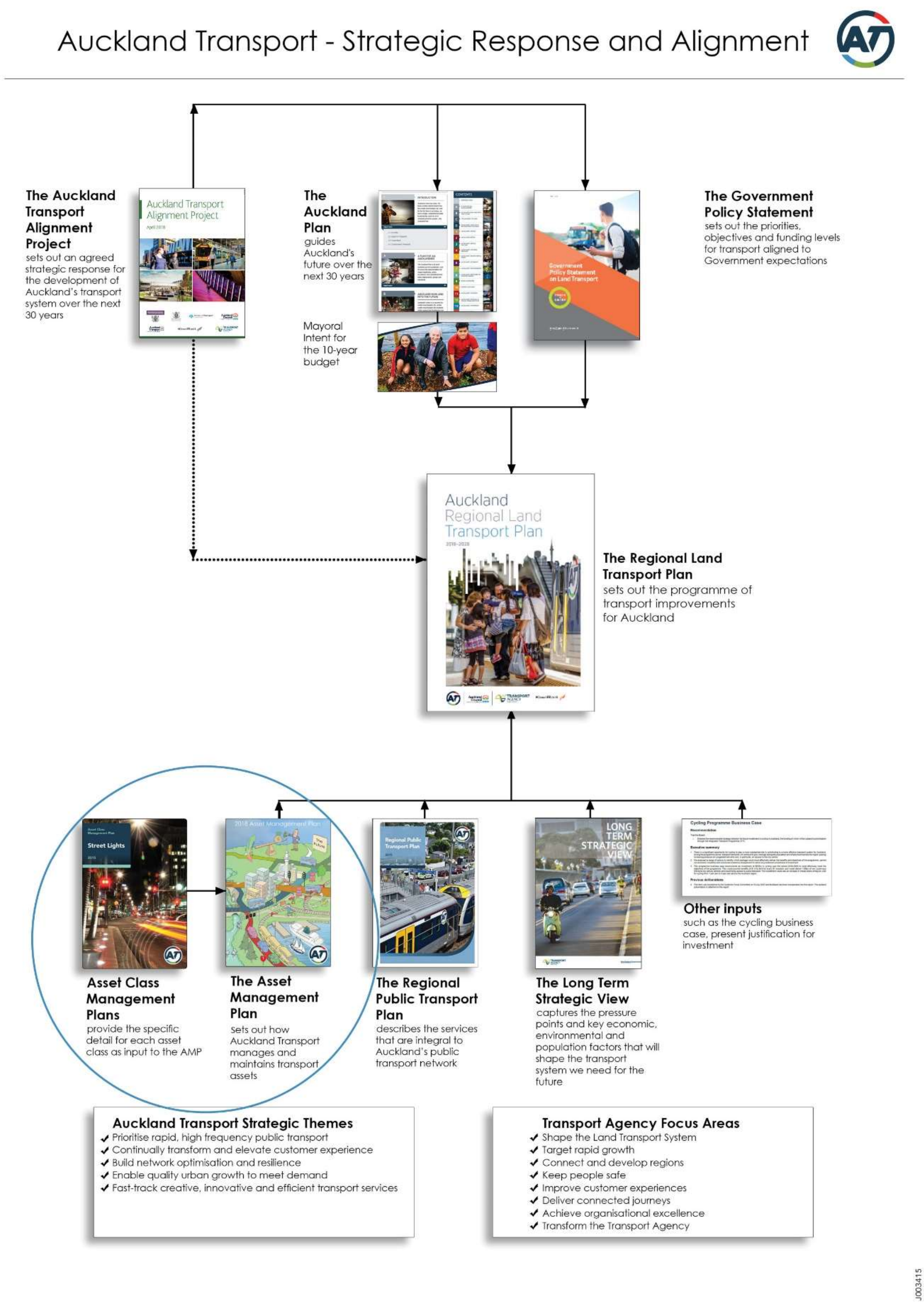
The **Auckland Transport Alignment Project** (3) sets an agreed strategic direction for land transport in Auckland, to achieve the aspirations of central government and Auckland Council, based on the following priorities:

- Accelerating the development of Auckland's rapid transit network, particularly to unlock housing and urban development opportunities
- Encouraging walking and cycling and making these active modes safer for Aucklanders
- Delivering improvements in health, safety, the environment and access, including disability access
- Ensuring the ATAP package of transport investments delivers the best possible value for money, including broader non-monetary costs and benefits.

The Auckland Transport Alignment Project package will deliver a substantial improvement to Auckland's transport system over the next decade. This includes:

- Enabling and supporting Auckland's growth
- Improving travel choice
- Congestion and access
- Safety, health and the environment
- Value for money.

Figure 2-1: Role of the AMP in relation to other plans and strategies for Auckland



The **Auckland Plan** guides Auckland's future over the next 30 years. It was adopted by Auckland Council in March 2012 and is currently being refreshed. The main impacts for transport as a result of this refresh are summarized in Table 2-1.

Table 2-1: Auckland Plan refresh: outcomes, strategic directions and focus areas relevant to transport

Outcome: *Access and Connectivity for Everyone*						
Strategic Direction 1: *Create an integrated transport system that efficiently connects people, places, goods and services*		**Strategic Direction 2:** *Increase real travel choices to support a vibrant, equitable and healthy city*			**Strategic Direction 3:** *Minimise harm from the transport system on people and the environment*	
Focus Area 1: *Make better use of existing transport networks, including a greater focus on influencing travel demand*	**Focus Area 2:** *Target new transport investment to the most significant challenges to support key long-term outcomes*	**Focus Area 3:** *Maximise the benefits of existing, new and emerging transport technology*	**Focus Area 4:** *Make walking, cycling and public transport preferred travel choices for many more Aucklanders*	**Focus Area 5:** *Better integrate land-use and transport decisions to support quality urban living.*	**Focus Area 6:** *Move to a safe transport network free from death and serious injury*	**Focus Area 7:** *Develop a resilient transport system with least environment and health impact*

The **Mayoral Intent for the 10 year Budget** was released by Mayor Phil Goff in August 2017. This document sets out the priorities which must inform the 2018 plans of Auckland Council and of its council-controlled organisations, including AT (4). In the area of transport, the Mayor requires a clear focus on:

> Accelerating investment in our transport network, in particular public transport and active transport, and optimising the existing network to address traffic congestion.

The **Government Policy Statement on Land Transport** sets out the government's priorities for expenditure from the National Land Transport Fund over the next 10 years. It sets out how funding is allocated between activities such as road safety policing, state highways, local roads and public transport.

The 2018 policy statement (5) sets four strategic priorities:

- safety
- access
- value for money
- environment

Safety and access are the key strategic priorities for the Government and reflect the transport system that we are striving for. To advance these outcomes investments should demonstrate benefits for the environment and offer value for money.

The **Regional Land Transport Plan** sets out an agreed statement of transport priorities for Auckland, based on the recommended strategic direction set by the Auckland Transport Alignment Project, as agreed between central government and Auckland Council.

The 2018 Regional Land Transport Plan details a programme of activities and funding required to deliver these benefits, including actions for AT, the NZ Transport Agency, KiwiRail and Auckland Council. The plan has been adopted by the Regional Transport Committee for Auckland, which comprises AT's Board of Directors and a representative of the Transport Agency.

The programme includes:

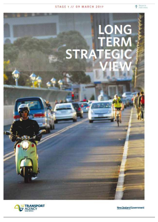
- asset management activities
- public transport services and investments
- capital projects

Asset management and public transport plans are also covered by a detailed 2018 plan as set out below.

This AMP – the **Auckland Transport Asset Management Plan 2018** – sets out a programme to prudently manage road and public transport assets in the long term. The plan is supported by 11 asset class management plans, which provide the specific details of how AT will manage:

- Road carriageway
- Stormwater
- Bridges, walls and structures
- Footpaths and cycleways
- Street lighting
- Traffic systems (signals, signs and markings)
- Parking
- Vegetation
- Bus network
- Rail network
- Wharves and ferries

The **Regional Public Transport Plan** describes the services that are integral to Auckland's public transport network, and the policies and procedures that apply to those services. The plan also describes the public transport services that AT envisages providing for the region over the coming 10 years, and outlines how this vision will be delivered.

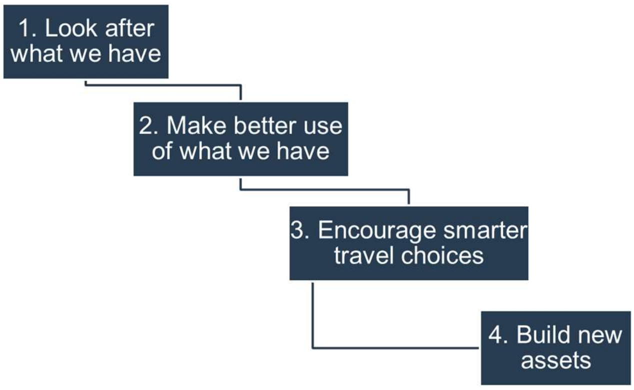


The **Long Term Strategic View** is prepared by the NZ Transport Agency. It describes the interconnected shifts in demographics, economics, technology and social trends that will shape land transport in New Zealand in the future, and sets out a planned response to ensure that transport systems will continue to support greater prosperity, security and opportunities.

2.2 Optimising the Auckland land transport programme

AT applies a four-stage intervention process when setting priorities for land transport investment, as shown in Figure 2-3. The process ensures transport funding is optimised, and it is used when allocating funding in the regional land transport plan.

Figure 2-2: Four-stage intervention process



Source: Auckland Regional Land Transport Plan 2015

This AMP sets out a plan to look after what we have, which is the first stage of the four-stage intervention process. Although it is the highest priority for funding, it is still worthwhile to improve value for money and to find efficiencies, without compromising the principle of prudent stewardship of community assets.

The investment assessment framework used by the NZ Transport Agency (6) allows road controlling authorities to apply for additional funding to improve levels of service through an enhanced maintenance programme. However, AT has elected to prepare a base maintenance programme, which delivers a fit-for-purpose level of service at least whole-of-life cost.

Even within a base programme, there are many opportunities to adjust how AT manages its infrastructure assets in order to make the best possible contribution to the objectives of the Auckland Transport Alignment Project and to the benefits sought by the Regional Land Transport Plan.

2.2.1 Optimisation of operations and maintenance activities

Operations and maintenance programmes for the transport network are competitively tendered and contracts are awarded after a rigorous tender evaluation process. The tender and evaluation processes comply with AT and NZ Transport Agency policies and guidelines.

AT ensures that its operations and maintenance programmes are optimised by:

- aligning the programmes to deliver the required levels of services for the network
- ensuring the most favourable costs are obtained for delivering these levels of service.

2.2.2 Optimisation of renewals activities

AT uses a renewals optimisation model (ROM) to develop renewals programmes and understand investment needs for the transport network. The ROM is an in-house optimisation tool developed to ensure the efficiency and effectiveness of our network renewal activities.

The main ways that we optimise our renewals programme are:

- assigning appropriate risk profiles to assets, in line with the asset criticality assigned to them in the ROM
- assigning appropriate intervention criteria for asset renewals, in line with the asset's risk profile and fit-for-purpose level of service as established by the One Network Road Classification (ONRC) framework
- aligning the ROM-based recommendations and our current renewals forward works programme wherever possible (we are planning to achieve even greater alignment in this area over the next three years, through our asset management improvement practices)
- accounting for the renewal activities that we complete through our capital improvement programmes. This will enable us to make efficiency savings in our base renewals programme.

2.2.3 Overall programme optimisation

In addition to the asset-related optimisation initiatives detailed above, AT's programme development processes also help optimise the overall land transport programme. These include:

- developing the capital improvement programme to align with the region's growth requirements, especially the Auckland Transport Alignment Project programme
- refining our programmes through Regional Land Transport Plan consultation and feedback from the AT Board (which acts as the Regional Land Transport Committee for Auckland)
- ensuring public transport services are competitively priced.

2.3 Process used to develop this AMP

This AMP was developed using a business case approach, and following Road Efficiency Group (2) and the NZ Transport Agency (6) guidance on how to apply the business case approach to maintenance, operations and renewals.

A governance group and working group have overseen each stage of the implementation of the ONRC framework and the preparation of this AMP. The groups were established in 2015 and included representatives from Auckland Council and the NZ Transport Agency, as well as AT.

The key steps we have followed in developing this AMP, and the chapters in the plan that discuss them in more detail, are as follows.

- Set the context

AT's existing assets are described in Chapter 3, including how priorities are set according to the function of each asset in the wider road and public transport networks.

- Define the problems

Chapter 4 summarises two key drivers of change:

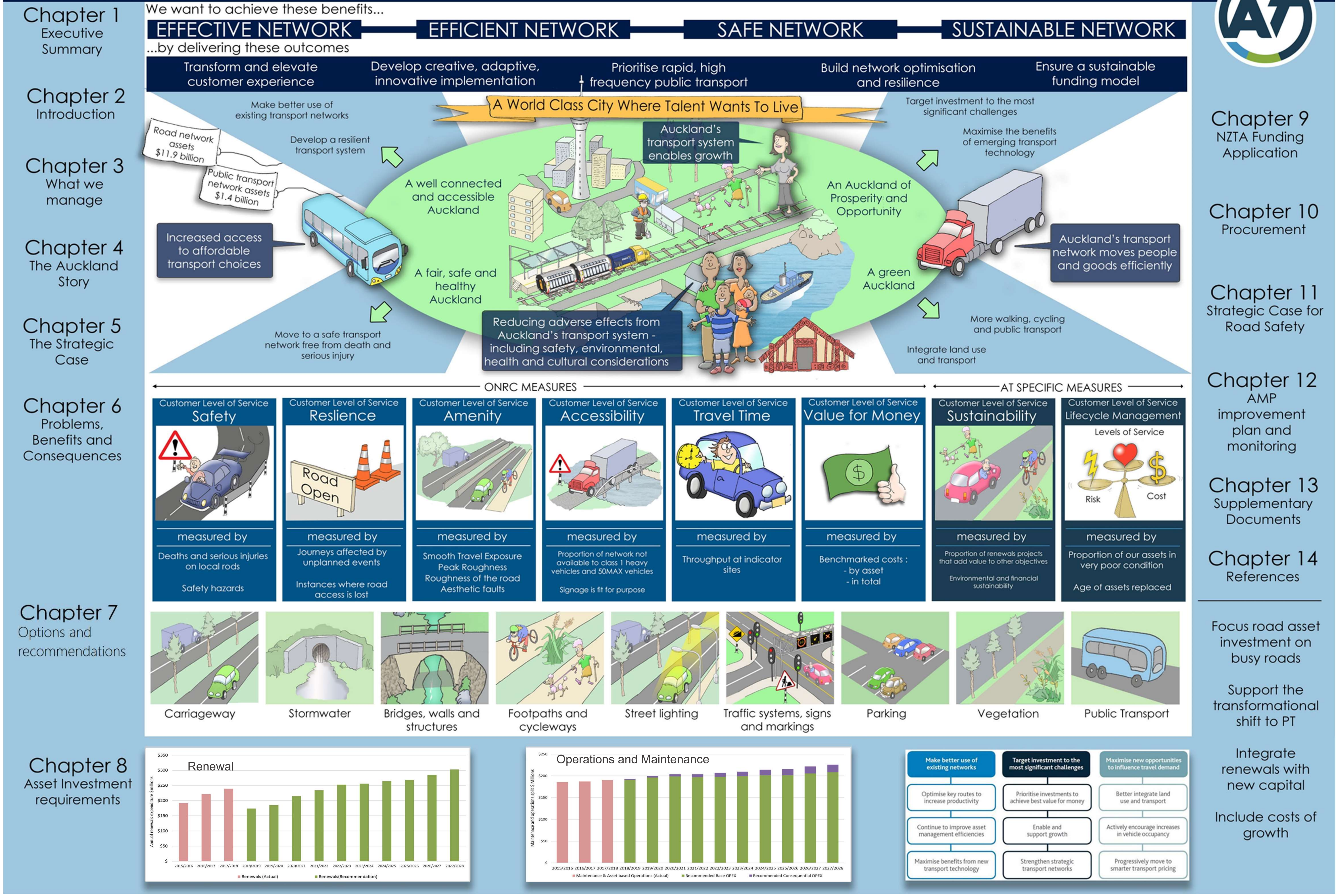
  - growth and demand
  - the customer perspective.

• Define the benefits of solving these problems	Chapter 5 sets out the benefits sought in AT’s 2018 plans and the role of asset management in delivering these benefits.
• Develop the overall response	AT’s planned overall response, to optimise the contribution of asset management to the benefits, is set out in Chapter 6. This includes measurement of the key customer outcomes sought under the ONRC framework.
• Develop specific responses for each asset class	The specific response for each asset class is set out in Chapter 7, with reference to both customer and technical outcomes.
• Evaluate options, and select a recommended option that optimises the contribution that asset management makes to achieving the benefits	Options are assessed for each asset class in Chapter 7 and for the programme as a whole in Chapter 8.

Figure 2-4 gives a strategic overview of this AMP

Figure 2-3: AMP Strategic overview

AUCKLAND TRANSPORT'S ASSET MANAGEMENT FRAMEWORK - supporting our vision for the next 30 years



3. What we manage

3.1 Road and public transport assets

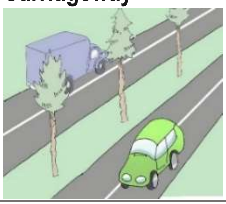
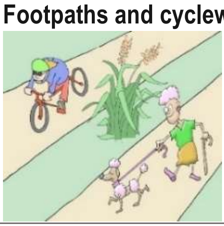
AT's road network assets have a total replacement value of $14.283 billion and its public transport assets a value of $1.515 billion, as shown in Table 3-1 (7).

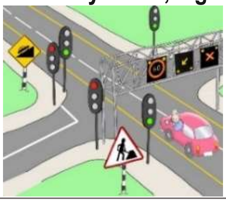
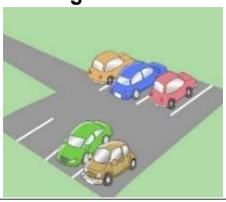
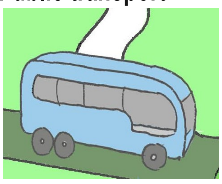
The current (depreciated) value of these assets is $9.689 billion, or around two-thirds of the replacement value, implying that these assets are, on average, around one-third of the way through their useful life.

AT's road network assets are depreciating by $202 million a year or almost $553,000 per day.

The depreciated value of public transport assets is 1.162 billion – close to their replacement value, because most of Auckland's public transport assets are relatively new. The network is still growing, with a new bus–rail interchange recently opened in Otahuhu, and construction underway on the City Rail Link.

Table 3-1: Road and public transport assets

Asset		Description	Replacement value	Depreciated value	Annual depreciation
Carriageway		7,391km of roads, of which 6,547km are sealed and 844km unsealed	$8,280.4 m	$6,135.3 m	$105.4 m
Stormwater		12,968km of stormwater channel and 59,833 catchpits	$2,629.9 m	$1,537.2 m	$38.3 m
Bridges, walls and structures		1,260 bridges, 3,827 retaining walls and sea walls, and 284.1km of railings	$1,489.4 m	$836.4 m	$6.4 m
Footpaths and cycleways		7,138km of footpaths, and 326.9km cycleways	$1,291.6 m	$805.6 m	$23.9 m
Streetlighting		111,739 streetlights	$231.8 m	$124.4 m	$9.3 m

Asset		Description	Replacement value	Depreciated value	Annual depreciation
Traffic systems, signs and markings		Traffic systems, including 694 signalised intersections and 112,200 road signs	$169.5 m	$80.6 m	$12.5 m
Parking		128 off-street parking areas, 34 parking buildings, and 895 pay-and-display units	$190.0 m	$168.9 m	$6.1 m
Public transport		43 active rail stations, 57 electric trains, 2,337 bus shelters, 9 busway stations, 21 ferry wharves, and public transport systems, including AT HOP ticketing	$1,515.7 m	$1,162.0 m	$62.5 m

	Replacement value	Depreciated value	Annual depreciation
Total roads and public transport network assets	**$15,798.3 m**	**$10,850.6 m**	**$264.4 m**
Corporate assets, and land held for future projects		**$7, 749.4 m**	
AT asset value		**$18,600.0 m**	

Source: AT asset database as at September 2016

3.2 Road network priorities and ONRC

The ONRC framework was developed jointly by the NZ Transport Agency and Local Government New Zealand. The framework divides New Zealand roads into six classes based on: traffic volumes; connections to important destinations like hospitals, airports or ports; tourist routes; and roads that provide the only access for communities. The six classes are shown in Table 3-2.

Table 3-2: ONRC classification

ONRC class	Regional	Arterial	Primary collector	Secondary collector	Access	Low-volume
Length	183km	1,140 km	1,049km	2,052km	1,897 km	1,098 km
Typical traffic volumes	Urban >15,000 Rural >10,000	Urban >5,000 Rural >3,000	Urban >3,000 Rural >1,000	Urban >1,000 Rural >200	Urban <1,000 Rural <200	Urban <200 Rural <50

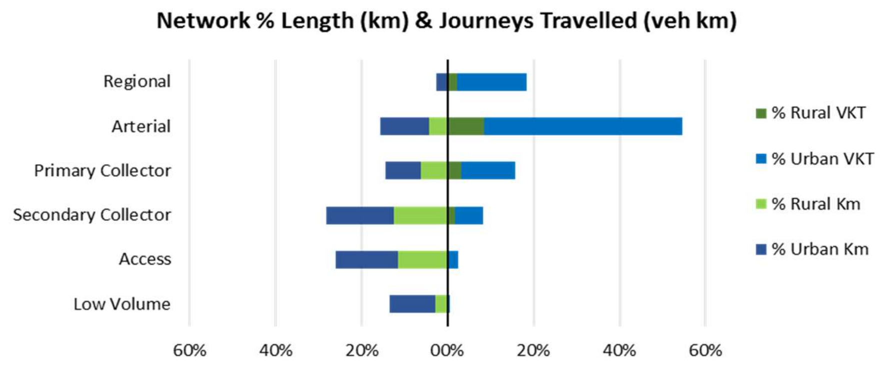
The two highest classifications in the AT road network – regional and arterial roads – make up only 18 per cent of the network by length, but carry three-quarters (73 per cent) of the traffic.

Looking at the road network from an ONRC perspective enables AT to direct investment to where it is needed most. AT manages some of the busiest roads in New Zealand. Maintaining these roads to a high standard makes an important contribution to national targets for access to social and economic opportunities, resilience and safety.

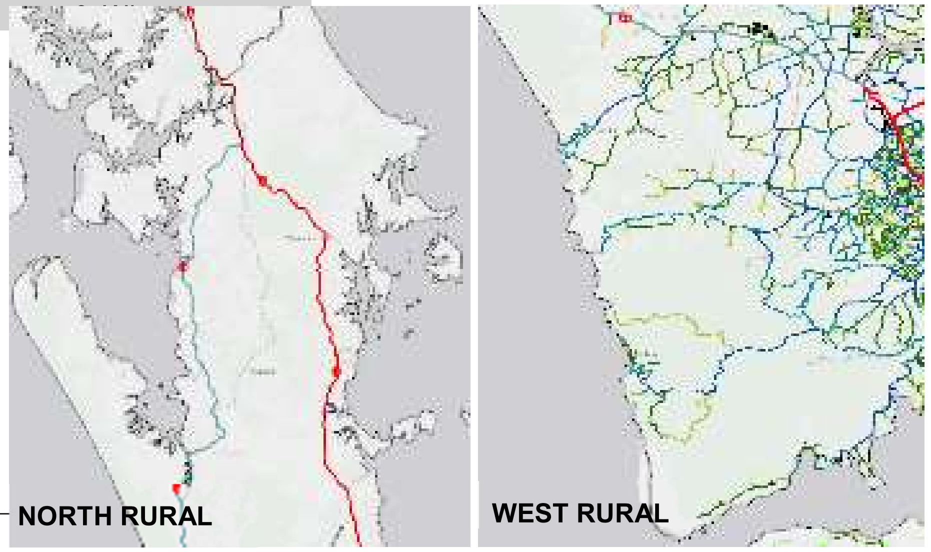
Further information on the AT network from an ONRC perspective is shown in the network-level overview in Figure 3-1.

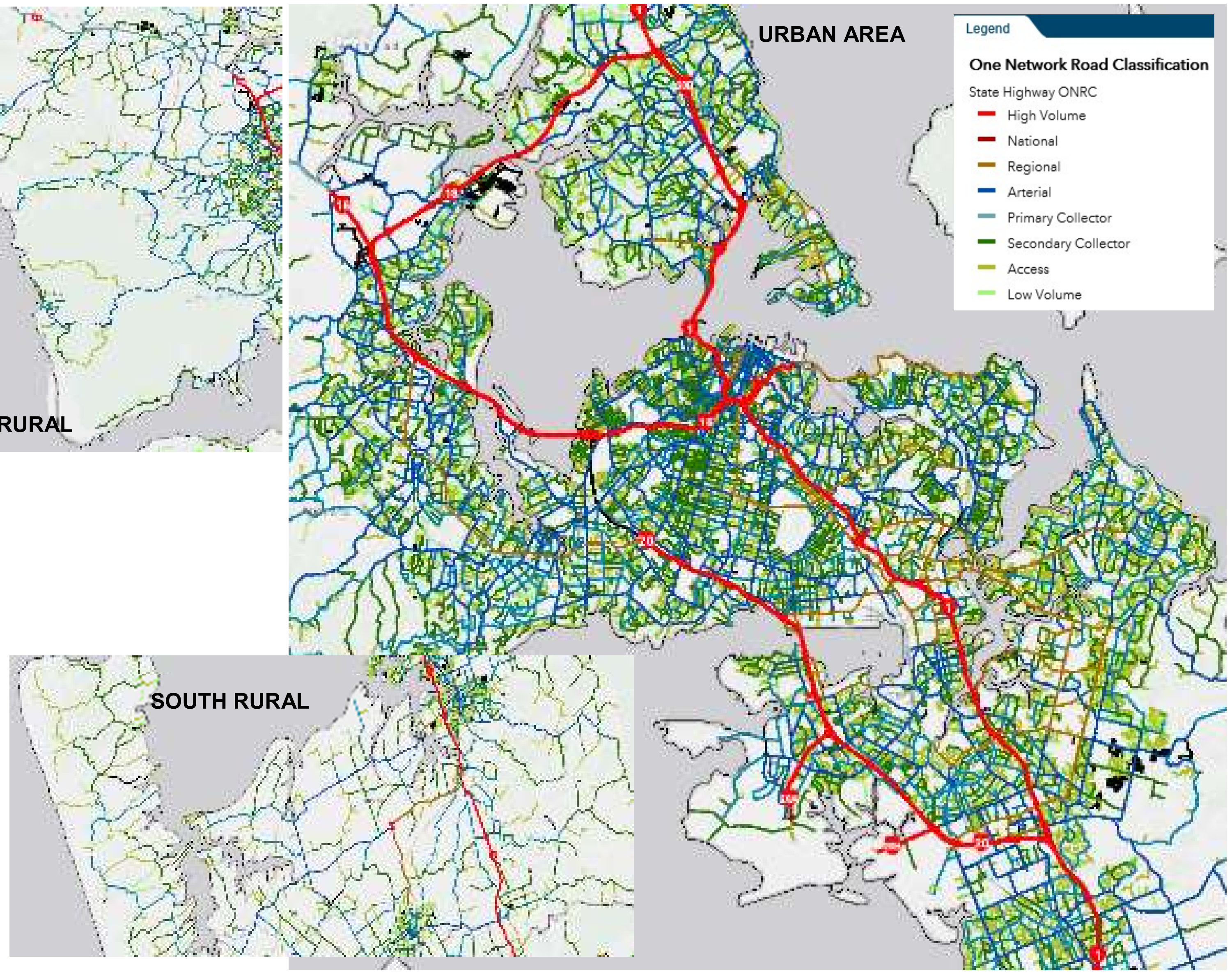
Figure 3-1: Network-level overview (see next page)

Network-level overview

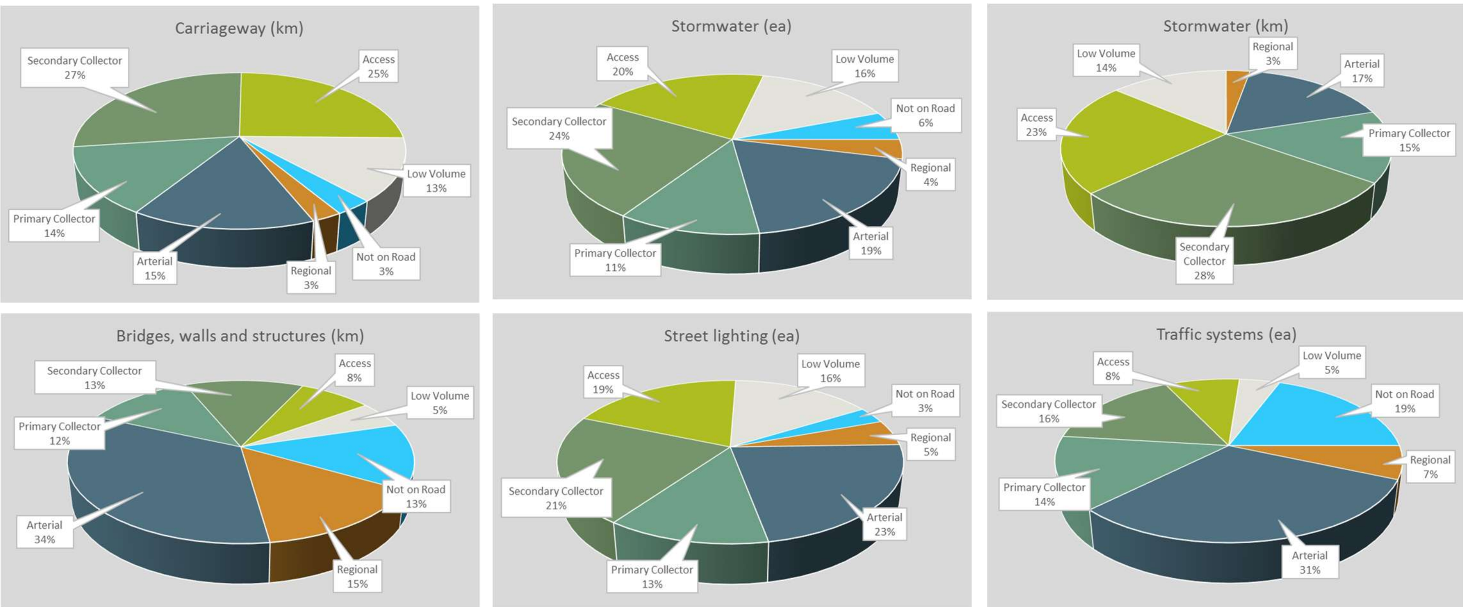


18% of the Auckland's road network carries 73% of the vehicle traffic





Key asset groups

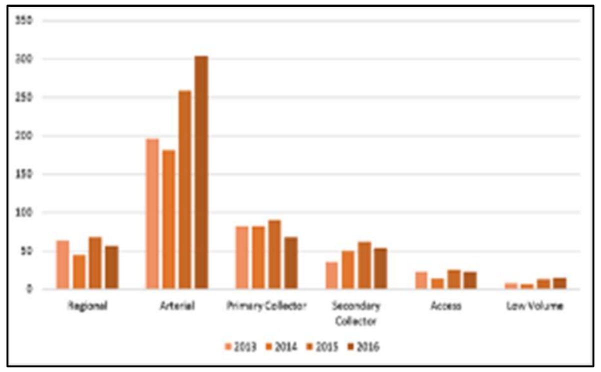


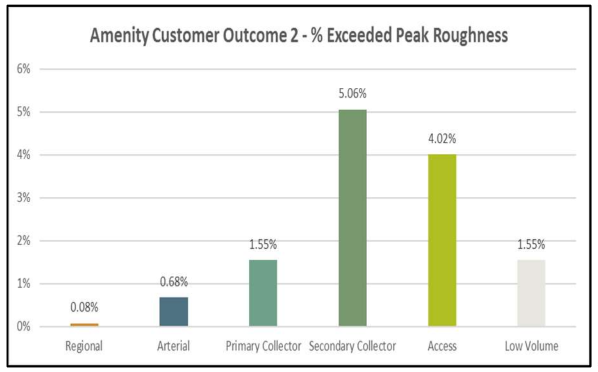
	Regional		Arterial		Primary Collector		Secondary Collector		Access		Low Volume		Not on Road		Total	Replacement Cost	Depreciated Repl	Annual Depreciation
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	($000)	Cost ($000)	($000)
Carriageway (km)	188.96	3%	1122.34	15%	1031.47	14%	2014.91	27%	1843.97	25%	953.26	13%	236.17	3.20%	7391.09	$8,280,385	$6,135,324	$105,415
Stormwater (ea)	2666	4%	13030	19%	7836	11%	16564	24%	13827	20%	10698	16%	4043	5.89%	68664	$382,548	$206,415	$4,851
Stormwater (km)	355.27	3%	2210.80	17%	1900.77	15%	3584.77	28%	2996.37	23%	1755.61	14%	164.44	1.27%	12968.04	$2,247,361	$1,330,826	$33,430
Bridges, walls and structures (km)	71.83	14%	168.88	34%	59.92	12%	65.62	13%	40.27	8%	26.20	5%	64.75	13.02%	497.46	$1,489,432	$836,432	$6,409
Street lighting - luminaries (ea)	5666	5%	25397	23%	14210	13%	23754	21%	21109	19%	17012	15%	4580	4.10%	111728	$231,799	$124,426	$9,328
Traffic systems (ea)	10159	7%	47976	31%	22353	14%	24790	16%	12851	8%	6990	5%	29922	19.30%	155041	$169,537	$80,612	$12,468
Footpaths and cycleways (km)															7464.63	$1,291,631	$805,646	$23,942
															Total Value	**$14,092,693**	**$9,519,681**	**$195,842**

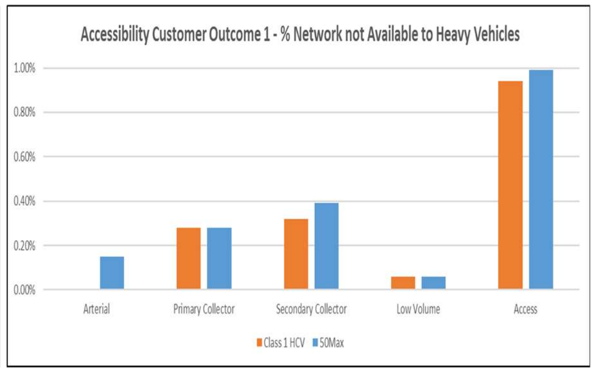
Stormwater (ea) includes catchpits-59,833; manholes-6,344; soakholes-2,487

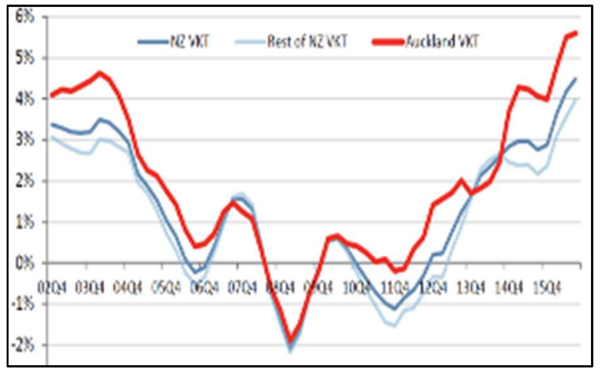
Stormwater (km) includes kerb and channel-8,627; minor culverts-244; surface water channel-4,097

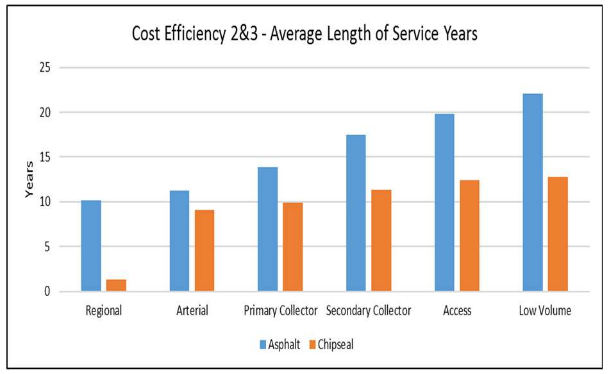
Level of service measures











3.3 Public transport network priorities

Auckland’s public transport network, like the road network, is classified according to priority and network function. Regular services are classified as rapid, frequent, connector and local. There are also some specialised services, e.g. school services. Key attributes for each level of the network are set in the Regional Public Transport Plan (8) and are summarised in Figures 3-2 and 3-3.

The public transport classification hierarchy applies to every aspect of the customer journey. This includes the level of service provided for public transport assets, including bus stops, stations and interchanges. Our intention is to provide an experience on the rapid and frequent networks that will encourage commuters to leave the car at home, reducing congestion on key corridors.

This strategy is working well. In the year to June 2018, public transport patronage overall grew by 3.9 million boardings (4.4 per cent). All of this growth was on the rapid and frequent networks (9).

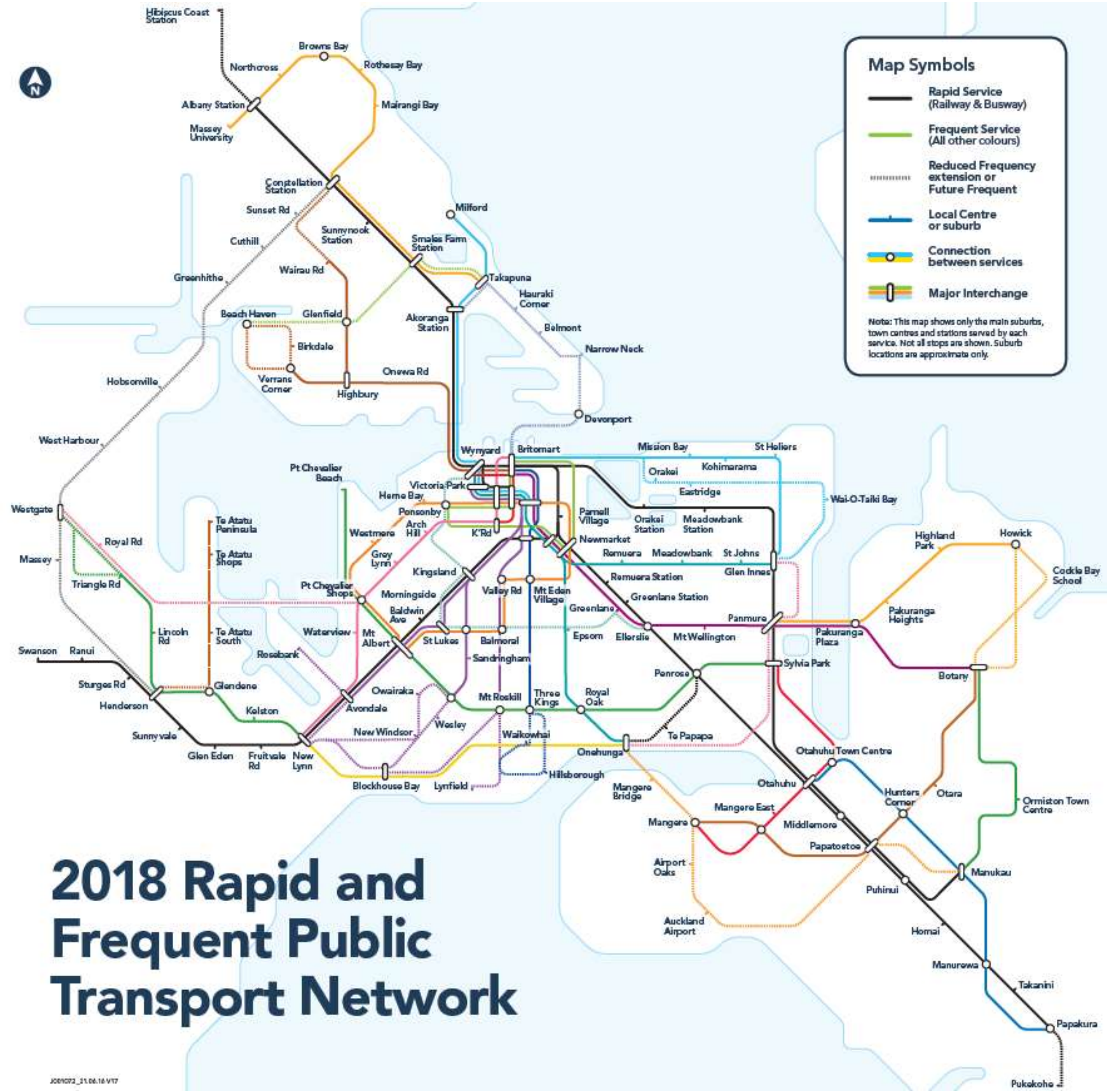
Figure 3-2: Current (2018) public transport network levels of service

Service Layers	Rapid	Frequent	Connector	Local
Defining features	All-day network			
Minimum Frequency	15 minutes		30 minutes	60 minutes
Operating hours	7am-7pm, frequency may be less outside these hours			
Achieving speed and reliability	Dedicated Right of Way	Priority measures	Some priority measures	Generally no priority measures

In addition, there will be some targeted services such as peak-only, school, rural and other single-destination services with frequency and service span determined by demand.

In future years, AT will progressively add capacity and services to meet the above levels of service on the rapid and frequent networks as shown in Figure 3-3, and to further improve the minimum frequency on the rapid and frequent network to provide a true “turn-up-and-go” service on these routes.

Figure 3-3: Rapid and Frequent public transport routes



Source: Regional Land Transport Plan (10)

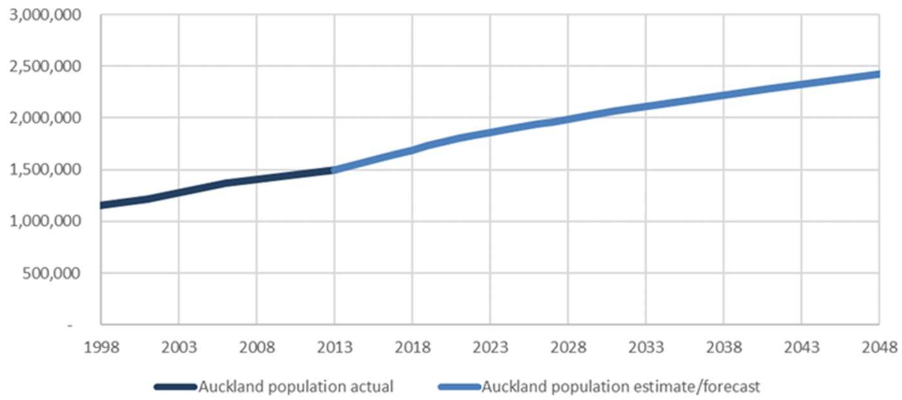
4. The Auckland story

4.1 Growth and demand

Auckland is doing well. This is a great place to live, business is booming, and our city is earning a place on the map as a world-class city where talent and enterprise can thrive. Auckland's GDP makes up 37.5 per cent of the national economy, and GDP growth over the past decade has averaged 2.2 per cent each year (11).

It is because of this success that Auckland is growing so rapidly – over the next 30 years the population is expected to grow by around 730,000 people, to 2.4 million as shown in Figure 4-1. Over the same period the economy is forecast to grow by 250,000 jobs.

Figure 4-1: Auckland population growth 1996 to 2048



Source: Statistics NZ, Auckland Council (12)

Currently, Auckland's population is growing by over 40,000 people each year, although this is expected to slow to about 25,000 after 2021 (12).

The main components of Auckland's growth are international migration (including returning New Zealanders) and babies born here. Internal migration, from other regions in New Zealand, has not been a major factor in the past decade, and recent trends show a small net migration away from Auckland (13).

Auckland does not compete with the rest of New Zealand for growth. Rather, the growth of Auckland supports and enables the growth of New Zealand as a whole. In the words of Mayor Phil Goff, "New Zealand needs an international city like Auckland that can compete with other cities across Australasia and across the world" (14).

Growth affects the costs of maintaining and renewing transport networks in four main ways:

1. More assets are added to the transport network, leading to consequential maintenance and renewals costs.
2. More people are travelling on the transport network, and with this growth in numbers come changes in travel choices and a busier, more complex network.

3. Development involves transporting many tonnes of material to and from development sites on the existing road network, often using large vehicles and heavy loads. This physically wears out the road carriageway.
4. As roads become busier and more urban, they also become more complex and expensive to build and to maintain.

These pressures are clearly visible in the urban fringe areas of Auckland. However, all four types of growth pressures also apply to the intensification that is occurring in the existing urban area.

4.2 Growth of the road network

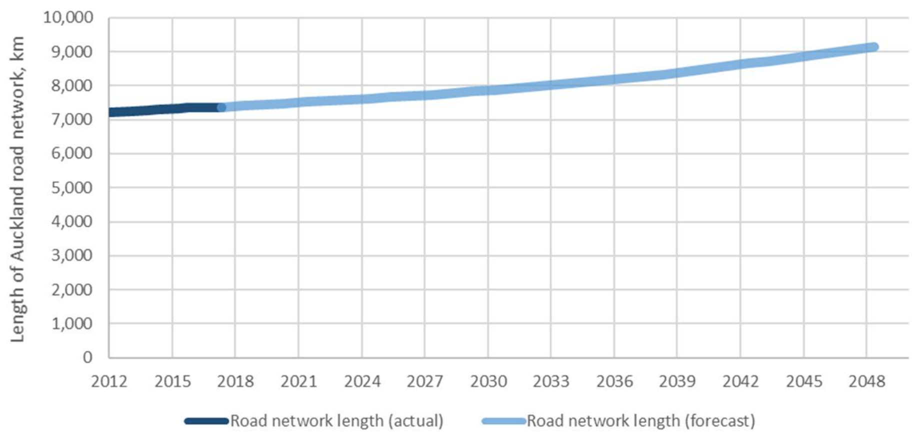
In the coming 30 years, an anticipated 15,000 hectares of greenfield land will be developed, with a capacity for 110,000 new homes and 50,000 new jobs (15).

Networks of new roads are being planned and constructed, particularly in the future growth areas identified in the Unitary Plan, which are:

- in the South, around Pukekohe, Drury, Paerata, and Takanini
- in the North, around Silverdale, Dairy Flat, Wainui, and Warkworth
- in the Northwest, around Kumeu, Redhills, and Whenuapai (15).

New roads are also being created within the urban boundary, through AT's capital programme and as part of major redevelopments. The total forecast length of Auckland's road network over the next 30 years is shown in Figure 4-2.

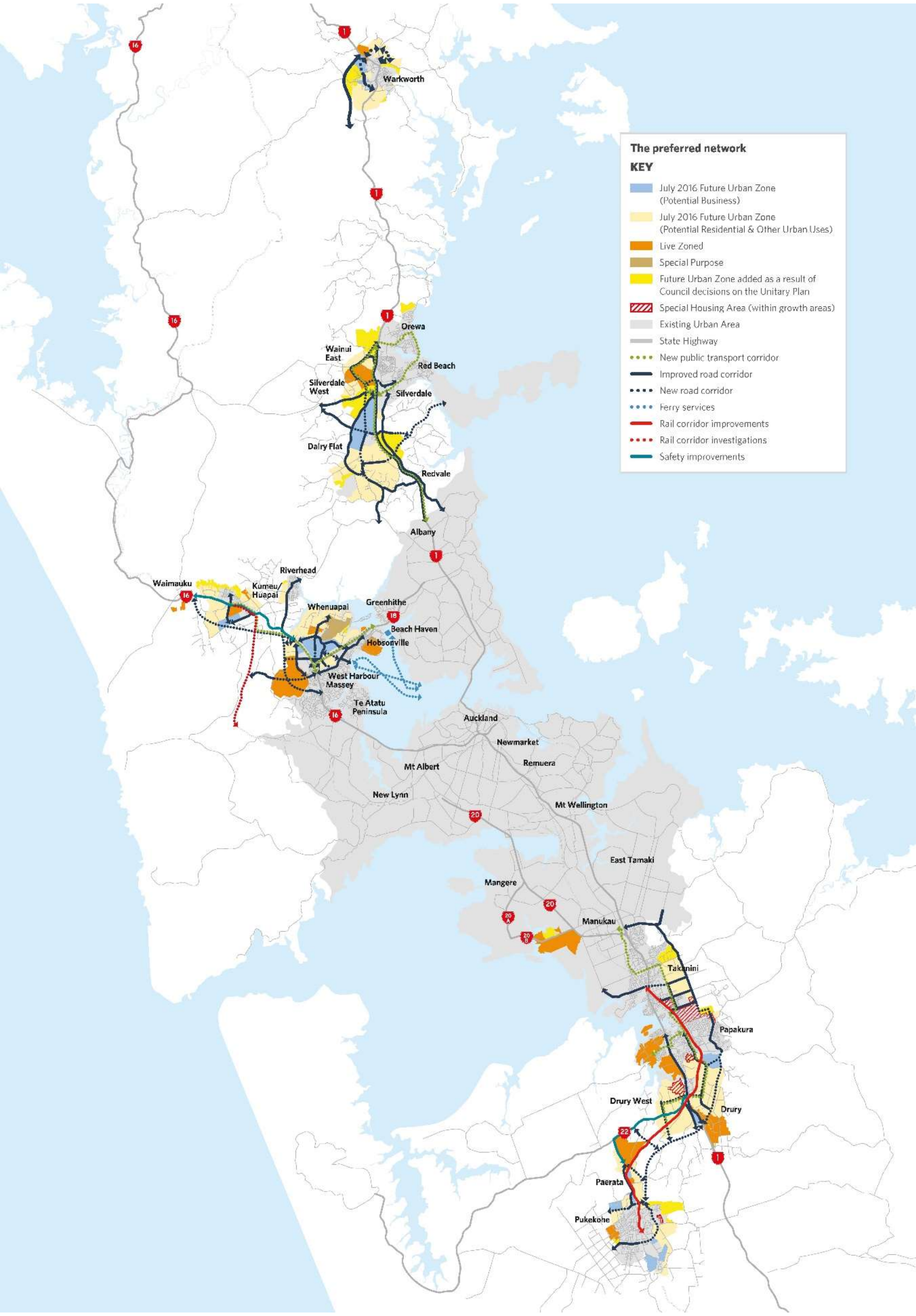
Figure 4-2: Actual and forecast length of the Auckland road network



Source: Auckland Transport Alignment Project (16)

The location of Auckland's major greeenfields growth areas is shown in Figure 4-3.

Figure 4-3: Auckland's urban growth areas and preferred future transport network

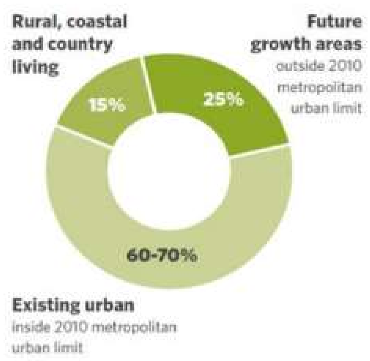


Source: Supporting Growth, Delivering Transport Networks (15)

Although the Auckland urban area is expanding on a scale never seen before, urban intensification is even more significant. Even when fully developed, new growth areas are only expected to accommodate around 25 per cent of Auckland's population growth, and around one in six new jobs. Most new households will locate in the existing urban area as shown in Figure 4-4.

While it is unusual for developments in the urban area to involve the construction of entire new roads, it is common for other transport assets to be added to the network, including new streetlights, new traffic signals, roundabouts, traffic islands and road markings.

Figure 4-4: Where future growth will go

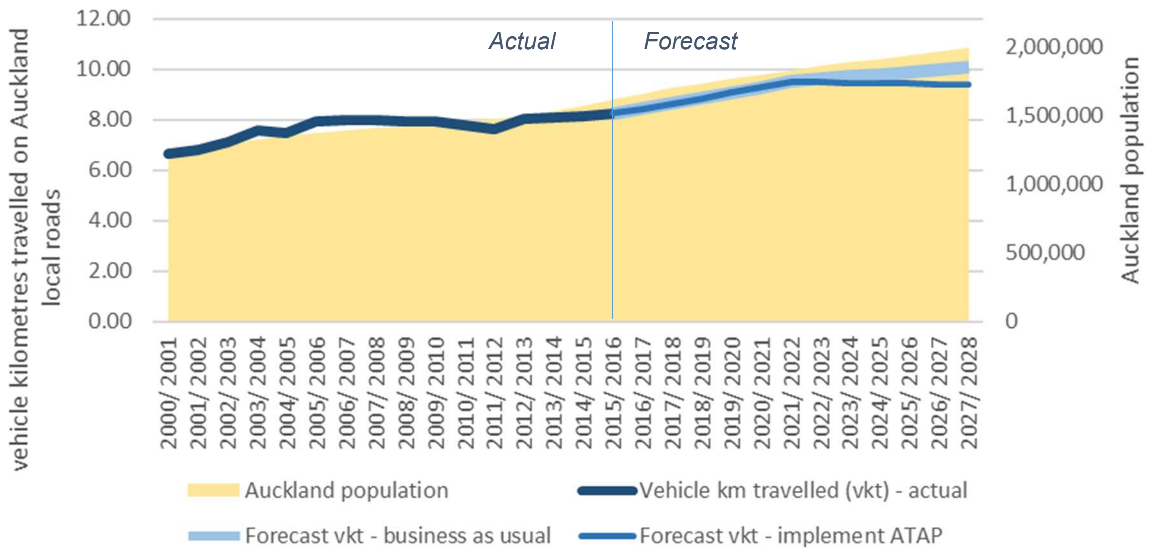


Source: Auckland Council (15)

4.3 Growth in travel demand

Increasing population will inevitably increase the demand for travel. However, whether car travel increases or not will depend also on people's choices about how often, and how far, to drive. For most of the past decade, from 2006/2007 to 2015/2016, traffic growth was slower than population growth, as shown in Figure 4-5.

Figure 4-5: Auckland traffic growth, in the context of population growth, 2001–2028

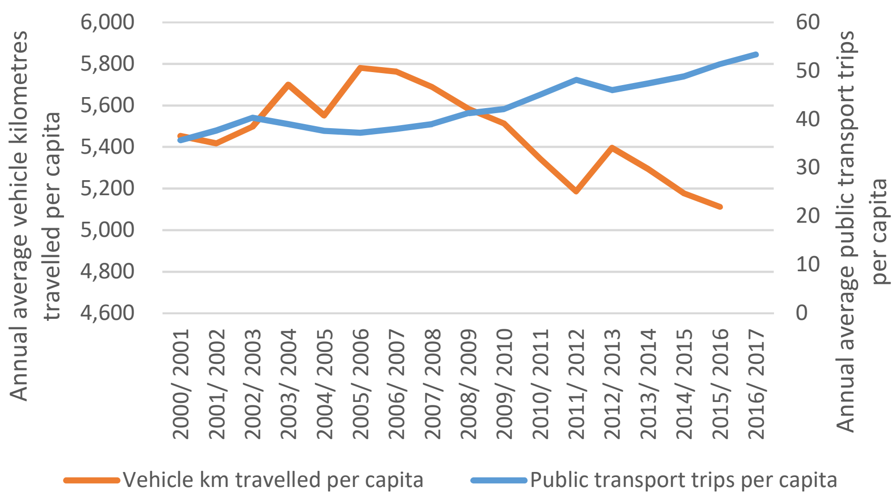


Source: Ministry of Transport (vehicle data), Statistics NZ (population data), Auckland Regional Transport Model (forecasts)

Trends in per capita travel since 2001 are shown in Figure 4-6.

- Car use (vehicle kilometres travelled per person) is lower now than it was in 2000/2001, although total car travel in Auckland has still increased, because the population has grown.
- Public transport use per person has increased from 36 trips in 2000/2001 to 53 trips in 2016/2017.
- There are also likely (but hard to measure) increases in walking, cycling, and motorbike and scooter travel.

Figure 4-6: Change in per capita car travel and public transport trips 2001–2017



Source: Population data from Statistics NZ, travel data from Ministry of Transport and AT

4.3.1 Vehicle traffic

The reasons for slower traffic growth in the decade from 2006/2007 include public transport service improvements, as well as demographic changes and urban intensification (5). People living in densely populated urban areas tend to drive less (17). This combines two effects; a 'push factor' because car travel is slower and parking is scarcer, and a 'pull factor' because it is more economical to provide a good public transport service, and there are more attractive destinations within easy walking and cycling distance (18).

Transport modelling for the Auckland Transport Alignment Project (19) forecasts that traffic will grow by 2.4 per cent per year over the coming decade, although that rate of growth could be slowed significantly by implementing the project's recommendations, in particular smarter transport pricing.

4.3.2 Public transport

Investing in public transport is central to the recommended strategic direction in the Auckland Transport Alignment Project, to manage high-volume, congested corridors. By providing a fast, reliable alternative to the car on key commuter routes, AT is reducing single occupant vehicle trips at peak times. This means valuable road space is freed up for priority users including trucks, commercial vehicles, buses, pedestrians and cyclists.

Public transport is also the safest way to travel, so attracting drivers to use public transport has the double benefit of reducing crash risk, as well as managing traffic congestion.

The City Rail Link is a transformational investment which will benefit all Aucklanders, not just those who catch trains to the CBD. Another key component of AT's public transport strategy is to provide larger, more frequent buses on Auckland's main roads. This, too, impacts on renewals budgets through the need for stronger pavements and more frequent renewal of road markings.

4.3.3 Cycling

AT is also connecting Auckland through the Urban Cycleways Programme which started in 2015, and has upgraded existing cycleways and created new links including the Glen Innes to Tamaki Drive shared path and the Lightpath/ Nelson St link. The Regional Land Transport Plan (10) provides for further investment of over $50 million per year in safe, connected local cycle routes.

This AMP provides for a high standard of maintenance for these new assets, for example more frequent sweeping with smaller vehicles.

4.3.4 Freight

Freight volumes in Auckland are forecast to nearly double over the coming 30 years (3). A large majority of freight movements are for the distribution of goods within Auckland, but inter-regional freight is also significant. Export volumes through New Zealand's largest port (Ports of Auckland) and main international airport (Auckland Airport) are also growing strongly.

Auckland's constrained geography and reliance on road freight mean that freight movements are being accommodated on the same congested corridors that are most in demand by other road users. Large and increasing freight loads will mean more stress on pavements and more need for active, 24/7 traffic management.

4.4 Impact of growth on existing roads

4.4.1 Construction traffic

Each year, around 10,000 new homes are built in Auckland (20) (21). One impact of this level of construction is the sheer weight of material being transported by road. The average house weighs around 150 tonnes (22) (23), and the construction process also involves moving plant and equipment to and from the construction site, and taking material to landfill and to clean-fill.

Commercial development is also significant, with 167,000 square metres of commercial and retail space planned, or under construction, in the central area alone (24).

Construction traffic therefore accounts for at least 3 million tonnes of freight movements each year, or around 5 per cent of total freight movements.

The structure of a road carriageway is designed to withstand decades of use, taking into account the expected traffic, in particular the expected amount of heavy traffic. The asphalt or chipseal surface of the carriageway will need resealing every decade or so, but the underlying carriageway base should last 50 years or more.

Cars have almost no effect on the expected life of the carriageway base, but each heavy vehicle that passes will deflect the carriageway pavement (25). Heavy construction traffic on a road that was designed mainly for light vehicles will eventually damage the carriageway base to the point where a road rehabilitation is necessary.

The impacts of construction traffic are visible on the access roads to new development areas, and also on the access roads to clean-fill and landfill sites. Many of AT's sealed rural roads were never actually designed, but are basically metal roads that were at some point given an asphalt or chipseal surface. Under sustained use by heavy traffic, these roads quickly begin to fail. Because the problem is not the surface, but the pavement base, road repairs do not last and the only long-term solution is to rebuild the whole road to a modern design standard.

In the rural north, road damage is also occurring from logging trucks as commercial forests are harvested.

The same issue of heavy construction traffic using roads of unknown structural strength also occurs in the urban area. Urban intensification also puts pressure on water and wastewater, electricity, gas and communications networks, which are usually located in the road corridor. Upgrading these networks often leads to further damage to roads.

AT is seeking to influence developers to locate their activities in areas where the road network is suitable, and to influence the choice of access routes for heavy vehicles, so that damage is at least contained to specific roads.

4.4.2 Customer expectations

On the urban fringe, the access roads to new development areas need to be upgraded to suit their new, urban purpose. This includes more expensive carriageway bases that are better suited to ongoing use by heavy traffic. It is also likely to include other urban features, such as stormwater infrastructure, footpaths, streetlights and traffic signals. These are capital improvement projects, but also have an element of renewal, as the existing road has been reconstructed and its useful life extended.

4.4.3 Optimising the existing urban road network

Within the urban area, where most of Auckland's growth is located, there are very few opportunities to add more road capacity, because land designated for roads is already used up and the cost of acquiring more land is prohibitive.

Auckland's busiest local roads carry more traffic than all but the busiest state highways. Local roads in Auckland that carry over 35,000 vehicles a day for some of their length include:

- South Eastern Highway
- Green Lane
- Maioro Street
- Esmonde Road
- Lincoln Road
- Te Atatu Rd
- Great North Road
- Newton Road
- Northcote Road
- Oteha Valley Road
- Taharoto Road
- Mt Wellington Highway
- Te Irirangi Drive

As well as carrying high volumes of traffic, most of these roads are important routes for public transport, walking and cycling. As the most crowded roads, with a complex mix of road users, they are also becoming less safe over time and present some of AT's most urgent road safety challenges.

Any realistic option to cope with growth has to involve optimising the existing road network through:

- providing real-time network performance monitoring
- undertaking low-cost, low-risk projects to address level of service gaps for priority road users (as identified from network performance monitoring)
- influencing travel choices
- optimising network performance, by allocating time at traffic signals to move people and freight most effectively.

4.4.4 Growth factors used in this AMP

One role of the AMP is to forecast future renewals and maintenance requirements based on the growth of the network.

For renewals, this is done by including the growth in our asset inventory as a factor when forecasting renewals needs. This is done using AT's ROM (16).

For maintenance and asset-based operations, this is done by increasing budgets over time in proportion to the growth factors shown in Table 4-1.

Table 4-1 : Growth factors used to forecast future renewals and maintenance costs

Road growth	40	km/ year (16)	This growth factor is used to calculate future maintenance requirements for stormwater, bridges, walls and structures.
Footpath growth	80	km/ year	Footpath maintenance costs are expected to grow at the same rate of growth as the footpath network, which is twice the rate of growth of the road network.
Traffic growth	2.4	%/year (26)	Sealed road routine maintenance, crash debris and spillage, and traffic systems are all expected to increase in line with traffic growth.
Streetlight growth	2,700	new lights per year	Renewals of streetlights and poles increase as more lights are added, both on new roads and to upgrade lighting on existing roads. Maintenance needs will change with the shift to LEDs, with the net impact being a reduction in maintenance costs over time.
Streetlight electricity		decline	Streetlight electricity requirements decline due to energy efficient LEDs.
Cycleway growth	7.6	km/ year (27)	Cycleway maintenance increases due to the proposed capital investment in cycleway construction. There is also a one-off increase in 2018/2019 to support the maintenance of cycleways constructed through the Urban Cycleways projects.
Population growth	2.3	%/year	Town centre cleaning, street furniture maintenance, and the management of urban street trees and gardens are expected to increase in line with population growth.
No growth			No increase is expected in the length of rural unsealed roads. Rural vegetation management and the costs of rural stormwater are not expected to increase. There is also no provision for increases in staff time, planning and technical support services.

4.4.5 Growth impacts not yet quantified

The above growth factors cover growth in the asset base and growth in travel demand. They do not adequately cover:

- the impacts of the development process on local roads
- changing expectations and changing technology.

Further work on these issues is included in Chapter 14: AMP Improvements.

4.4.6 Funding the costs of growth

Arguably the least change over the past decade has been in the area of funding. The need for new funding mechanisms relates not only to new infrastructure, but also to the costs imposed by growth on the maintenance, operation and renewal of existing infrastructure.

The government has now recognised that existing transport funding mechanisms are proving to be an increasingly poor fit when applied to Auckland's transport challenges, and there have been some changes implemented already, most significantly the decision to co-fund the maintenance of footpaths from the National Land Transport Fund. Further changes have been signalled in the Government Policy Statement (5).

The Auckland Transport Alignment Project recommends closing the funding gap, so that Auckland can have the transport system it needs to support its continued success.

Heavy vehicles pay road user charges to the NZ Transport Agency at a rate that is calculated to recover the costs each vehicle imposes on the land transport network (28). However, when local roads are damaged by trucks, the agency will only fund a proportion of the cost of repair. The maximum funding available for Auckland local road repairs is 51 per cent of the cost. Once a road is seriously damaged, AT has no choice but to repair it, with the local share (49 per cent) of the cost being met by existing ratepayers.

Funding the costs of growth by increasing the burden on existing ratepayers is not an equitable or sustainable option. Auckland Council is looking at a number of options for funding infrastructure related to growth, but there are no easy answers (29).

4.5 Voice of the customer

Like all customer focused organisations, AT relies on information from customers to continuously improve service levels. 'Voice of the Customer' is the term we use in AT to describe the range of performance, satisfaction and quality reporting we produce, as well as the market research and insight surveys we undertake periodically in order to better understand the expectations, aspirations, likes and dislikes of our current and potential customers.

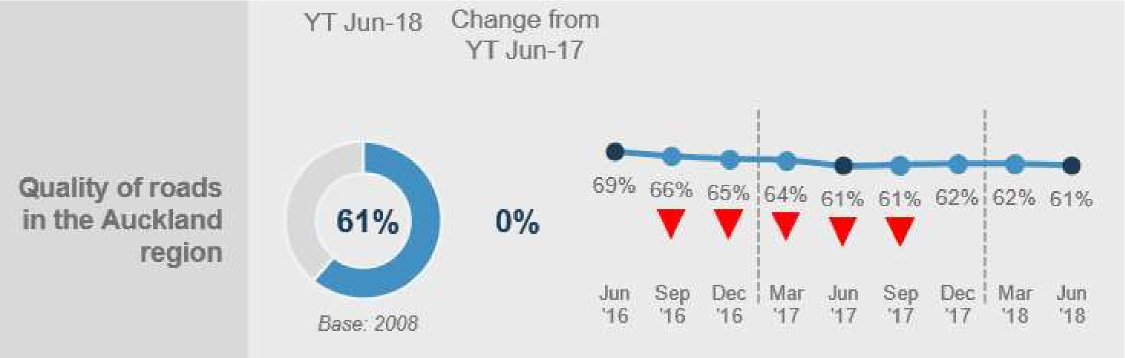
AT has two regular customer surveys:

- the road customer satisfaction survey is a phone interview of residents and asks about their experience of driving, walking, cycling and travelling by bus around Auckland
- the public transport customer satisfaction survey is an on-board survey of bus, rail and ferry customers.

4.5.1 Road user satisfaction

The overall satisfaction of Auckland residents with the quality of roads in the Auckland Region is 61 per cent. This level of satisfaction has been stable for almost a year, following statistically significant falls in satisfaction during the 2016/ 2017 year, as shown in Figure 4-7.

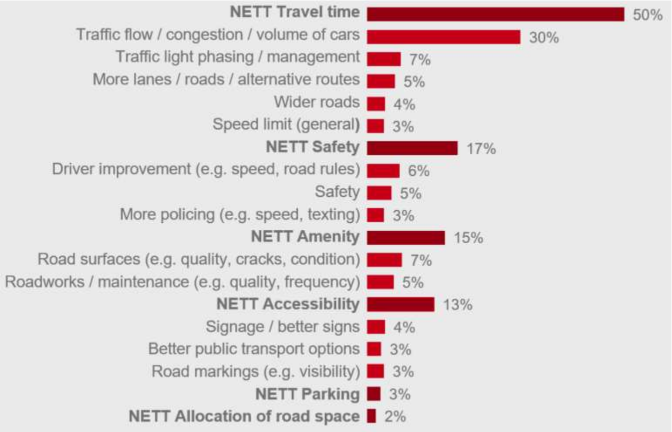
Figure 4-7: Satisfaction with quality of roads in the Auckland region



Source: AT road user satisfaction survey

AT's road customer satisfaction survey also asks customers about their priorities for improvement. For drivers and vehicle passengers, the clear priority for improvement is travel time., as shown in Figure 4-8.

Figure 4-8: Driving/travel by car: priorities for improvement



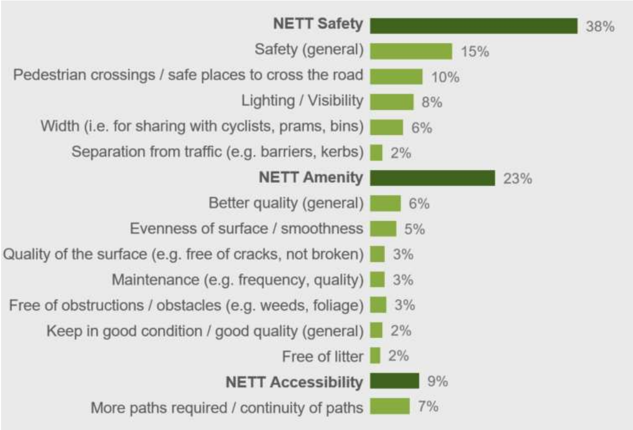
Source: AT road customer satisfaction survey, December 2017

When asked about their satisfaction with the experience of driving around Auckland, as distinct from satisfaction with the quality of roads, 35 per cent of respondents are satisfied. This is the lowest rate of satisfaction for all travel choices in the survey.

The concern 'allocation of road space' in Figure 4-9 is used to classify comments asking for the removal of on-road cycle lanes or special vehicle lanes. These concerns were raised by only 2 per cent of respondents, and are far outweighed by those wanting more cycle facilities (18 per cent).

For walking, the most important priority for improvement is safety, followed by suggestions to improve amenity of walking and physical quality of footpaths. A more connected network of paths was also mentioned. These and other priorities are shown in Figure 4-9.

Figure 4-9: Walking: priorities for improvement

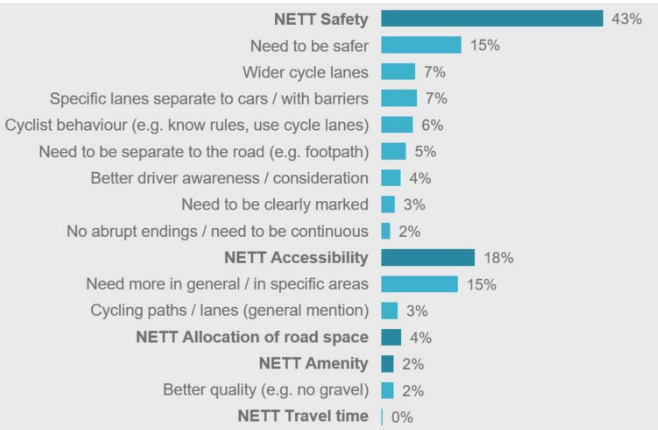


Source: AT road customer satisfaction survey, December 2017

Satisfaction with the experience of walking around Auckland is 66 per cent, which is the highest for all travel choices in the survey.

Customer priorities for improving cycling focus even more strongly on safety, as shown in Figure 4-10. There are also requests to improve the network of cycle lanes and cycleways.

Figure 4-10: Cycling: priorities for improvement



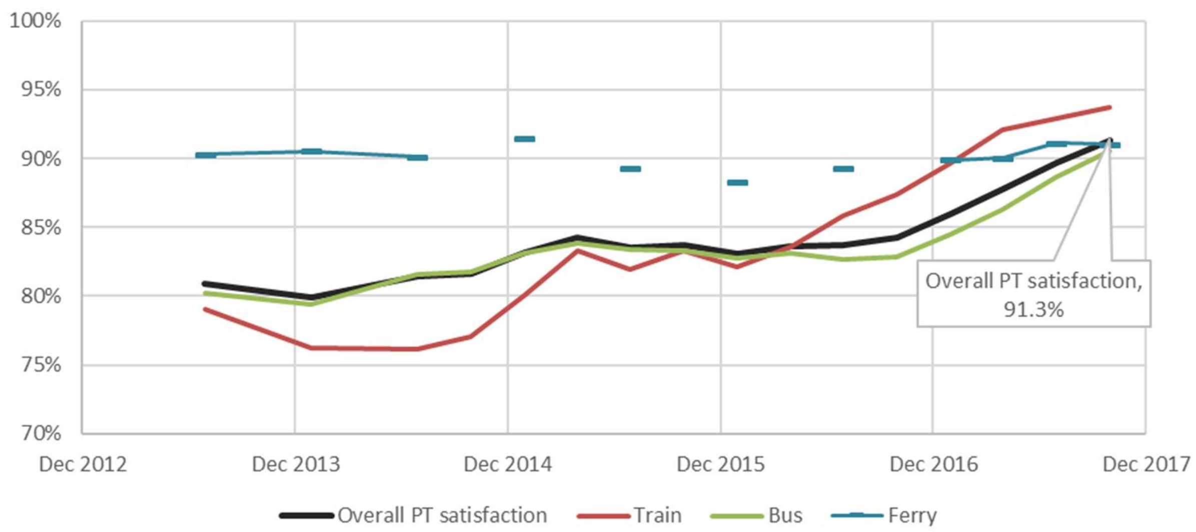
Source: AT road customer satisfaction survey, December 2017

Satisfaction with the experience of cycling around Auckland is 43 per cent.

4.5.2 Public transport customer satisfaction

Overall, customer satisfaction with public transport services is the highest it has been since surveys began, at 91.3 per cent. AT has not set targets to further improve these satisfaction ratings; rather the aim is to maintain satisfaction levels, while growing patronage. Figure 4-11 shows how customer satisfaction with public transport has changed over the past five years.

Figure 4-11: Public transport customer satisfaction



4.6 New technologies

Developing transport technology provides new opportunities to get more out of existing networks by increasing vehicle throughput (for example counter-flow lanes, as currently used on the Panmure Bridge) and vehicle occupancy (for example T3 lanes and bus priority measures at intersections) (3).

Changes in communication technology, as well as in transport technology, open up new possibilities and change the way our customers use existing networks. We expect that the next 30 years will see the introduction of autonomous vehicles, the widespread use of intelligent traffic systems, and a continuing trend to faster, easier, real-time and more personalised transport services (18).

The impact of new technology on transport is only just beginning, with new tools available each year, but also new challenges. Many of these new technologies and challenges have not yet been discovered.

Yet despite all this change, the main AT assets of roads, stormwater drains and footpaths will still be needed in 2048. Indeed, they would still be recognisable to a time traveller from ancient Greece.

The need to look after existing transport assets does not change when considering new technologies. But the task is bigger than simply looking after more of what we currently have. We also need to expand our asset management processes to manage a more diverse range of assets, on a bigger, busier, more complex future transport network.

5. The strategic case

5.1 Benefits sought from this AMP

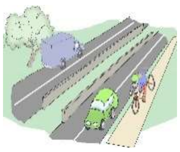
This Strategic Case sets out how AT's infrastructure assets will be managed in order to:

- make the best possible contribution to nationally agreed priorities by applying the One Network Road Classification (ONRC), and
- contribute to the agreed strategic direction for Auckland as described in Chapter 2.

5.1.1 Alignment with ONRC

The customer levels of service and measurable outcomes which form the basis of this Strategic Case are summarised in Table 5-1. This table also distinguishes which measures were developed by the national Road Efficiency Group for the national ONRC initiative (unshaded), and which measures were added to reflect the complexity and urban nature of the AT network (shaded).

Table 5-1: The ONRC customer level of service framework, with AT additions

Customer level of service	Customer outcome 1	Customer outcome 2	Customer outcome 3
Safety 	The number of deaths and serious injuries on Auckland local roads	Collective risk (deaths and serious injuries per kilometre of road)	Personal risk (deaths and serious injuries per kilometre of travel)
Resilience 	The number of journeys impacted by unplanned events	The number of instances where road access is lost	Proportion of jobs accessible within a 30-minute drive or 45-minute public transport journey, by area
Amenity 	Smooth travel exposure – percentage of vehicle travel on smooth roads	Peak roughness	Roads that enhance surrounding land values
Accessibility 	Proportion of the network not available to Class 1 heavy vehicles and 50MAX vehicles	Average response times to road or lane closure events	
Travel time reliability 	Vehicle throughput at indicator sites	People throughput at indicator sites	
Value for money 	Cost per unit of work done	Cost per kilometre of network (benchmarked with other councils, taking into account road classification)	Age of assets replaced

Customer level of service	Customer outcome 1	Customer outcome 2	Customer outcome 3
Life cycle asset management 	Proportion of assets in very poor condition (current and forecast)		
Sustainability 	Proportion of renewals projects that add value to other objectives	Long-term balance between costs and funding	

5.1.2 Contribution to the agreed strategic direction for Auckland

This AMP will contribute to the agreed strategic direction for Auckland by aligning asset management actions with the recommended strategic approach of the Auckland Transport Alignment Project and the benefits sought by the Regional Land Transport Plan, which are summarised in Table 5-2.

Table 5-2: Auckland's strategic objectives (from the Auckland Transport Alignment Project) and benefits (from the Regional Land Transport Plan)

Auckland Transport Alignment Project recommended strategic approach	Benefits sought from Auckland's Regional Land Transport Plan
Enable and support growth	Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours
Optimise key routes to increase productivity	Access to employment and labour will improve relative to current levels, supporting economic growth and increasing productivity
Increase public transport, walking and cycling mode share	Public transport and active transport mode share will increase relative to projected results, addressing congestion
Continue to improve asset management efficiencies	Any increases in the financial costs of using the transport system will deliver net benefits to users of the system
Improve road safety	There will be a reduction in deaths and serious injuries, including for vulnerable road users

5.2 Summary of strategic case

This AMP sets out a plan to make best use of existing assets in order to deliver the above objectives and benefits, using a business case approach. The key steps in this business case are:

- summarising national and Auckland strategic goals, and demonstrate that these align
- measuring our current asset management performance, in light of these goals
- identifying gaps and problems
- developing a strategic response, a set of agreed actions to improve the contribution that our asset management makes to achieving these goals.

The following tables 5.2.1 to 5.2.8 summarise how these key steps have been applied to each of the customer outcomes. Detail of the gap analysis and problem statements is set out in Chapter 6, and the strategic response is set out in full in Chapter 7.

5.2.1 Level of service map 1 – safety

Auckland Council alignment (Auckland Plan 2018 refresh)	Government alignment (Government Policy Statement on Land Transport)	Benefits sought from the Auckland Transport Alignment Project and the 2018 Regional Land Transport Plan	Performance measures – safety	Issues or problems (asset management problem statements)	Strategic response
Make better use of existing transport networks, including a greater focus on influencing travel demand Target new transport investment to the most significant challenges to support key long-term outcomes Maximise the benefits of existing, new and emerging transport technology Make walking, cycling and public transport preferred travel choices for many more Aucklanders Better integrate land use and transport decisions to support quality urban living **Move to a safe transport network free from death and serious injury** Develop a resilient transport system with least environment and health impact	Drive improved performance from the land transport system by focusing on: • economic growth and productivity • **road safety** • value for money	Access to employment and labour will improve relative to current levels, supporting economic growth and increasing productivity Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours Public transport and active transport mode share will increase relative to projected results, addressing congestion Any increases in the financial costs of using the transport system deliver net benefits to users of the system **Reduction in deaths and serious injuries, including for vulnerable road users**	**AT Statement of Intent measures** Deaths and serious injuries on AT roads **ONRC measures** Collective risk (compared with peers) Personal risk (compared with peers) Loss of control on wet roads Loss of control at night Intersection crashes Vulnerable road users Other ONRC technical levels of service not yet measured, e.g. sight distances Must improve · Could improve · Maintain · Data gap	Deaths and serious injuries on urban AT roads are increasing. Around half of road users killed or seriously injured on urban AT roads are pedestrians, cyclists and motorcyclists	**Road carriageway:** Improve skid resistance at priority sites. Continue to maintain road surfaces so hazards such as potholes, bleeding and scabbing do not present a risk to road users. **Stormwater:** Improve stormwater management to reduce crashes on wet roads. **Bridges, walls and structures:** Proactively manage the risk of failure of critical asset components. **Footpaths and cycleways:** Move to a proactive maintenance regime for footpaths and cycleways, informed by a region-wide survey of asset condition. **Streetlights:** Improve lighting levels, especially in areas with high pedestrian use.
				Deaths and serious injuries on rural AT roads are increasing. A large number of deaths and serious injuries occur on a small percentage of local rural roads. Loss-of-control, head-on, speed and motorcycle crash risks are key contributors to this trend	**Traffic systems:** Increase provision for active management of traffic signals. Improve emergency response times. **Vegetation:** Implement Auckland's weed and pest strategy, to maintain sightlines and manage roadside hazards on the rural network. **Public transport:** Provide a high level of service on public transport, so more people choose to leave the car at home, reducing risk. Continue to offer a service that achieves world-class standards of physical safety and personal safety. Increase safety level of service · Maintain safety level of service

5.2.2 Level of service map 2 – resilience

Auckland Council alignment (Auckland Plan 2018 refresh)	Government alignment (Government Policy Statement on Land Transport)	Benefits sought from the Auckland Transport Alignment Project and the 2018 Regional Land Transport Plan		Performance measures – resilience	Issues or problems (asset management problem statements)	Strategic response
Make better use of existing transport networks, including a greater focus on influencing travel demand Target new transport investment to the most significant challenges to support key long term outcomes Maximise the benefits of existing, new and emerging transport technology Make walking, cycling and public transport preferred travel choices for many more Aucklanders Better integrate land use and transport decisions to support quality urban living Move to a safe transport network free from death and serious injury **Develop a resilient transport system with least environment and health impact**	Drive improved performance from the land transport system by focusing on: • **economic growth and productivity** • road safety • value for money	**Access to employment/ labour will improve relative to current levels, supporting economic growth and increasing productivity** Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours Public transport and active transport mode share will increase relative to projected results, addressing congestion Any increases in the financial costs of using the transport system deliver net benefits to users of the system There will be a reduction in deaths and serious injuries, including for vulnerable road users		**ONRC measures** Road closures for more than 2 hours Journeys prevented through road closures Availability of Auckland lifeline routes Must improve · Could improve · Maintain · Data gap	Unplanned events cause delay and disruption for road users The risk of failure of critical assets along Auckland's lifeline and main arterial routes needs to be minimised	**Road carriageway:** Maintain current operation, maintenance and renewal strategies. **Stormwater:** Work with Auckland Council to implement proactive life cycle management of stormwater assets, based on shared data-sets. Redirect the stormwater renewals programme away from kerb and channel and towards catchpits, leads and culverts. **Bridges, walls and structures:** Increase the allocation for bridge renewals and target renewals based on risk as well as condition. Proactively manage risk of unforeseen failures. **Footpaths and cycleways:** Provide a high level of service on walking and cycling networks – offering choices and improving system resilience. **Streetlights:** Maintain current practices. **Traffic systems:** Maintain current practices. **Vegetation:** Maintain current practices. **Public transport:** Provide a high level of service on AT's public transport network – offering choices and improving system resilience. Increase resilience level of service · Maintain resilience level of service

5.2.3 Level of service map 3 – amenity

Auckland Council alignment (Auckland Plan 2018 refresh)	Government alignment (Government Policy Statement on Land Transport)	Benefits sought from the Auckland Transport Alignment Project and the 2018 Regional Land Transport Plan	Performance measures – amenity	Issues or problems (asset management problem statements)	Strategic response
Make better use of existing transport networks, including a greater focus on influencing travel demand Target new transport investment to the most significant challenges to support key long term outcomes Maximise the benefits of existing, new and emerging transport technology Make walking, cycling and public transport preferred travel choices for many more Aucklanders **Better integrate land use and transport decisions to support quality urban living** Move to a safe transport network free from death and serious injury Develop a resilient transport system with least environment and health impact	Drive improved performance from the land transport system by focusing on: • **economic growth and productivity** • road safety • value for money	Access to employment and labour will improve relative to current levels, supporting economic growth and increasing productivity Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours Public transport and active transport mode share will increase relative to projected results, addressing congestion Any increases in the financial costs of using the transport system deliver net benefits to users of the system There will be a reduction in deaths and serious injuries, including for vulnerable road users	**ONRC measures** Smooth travel exposure ● Peak roughness ● Average and median roughness ● **Roads and Streets Strategy Framework KPIs** Pedestrian counts ● Crime rates/trends from New Zealand Police ● ● Must improve ● Could improve ● Maintain ● Data gap	Inconsistent quality of roads, not aligned with a fit-for-purpose level of service, leads to inefficient use of resources, especially funding	**Road carriageway:** Maintain road rehabilitation levels of service for regional and arterial roads, but reduce the programme on collector and access roads. = Align reseal programme with fit-for-purpose levels of service, by targeting a higher proportion of reseals to regional and arterial roads. ▲ Align reseals and rehabilitation works with the delivery of improvements required to meet the standards set in the Roads and Streets Strategy Framework. Continue to deliver maintenance activities that retain the current amenity of the streetscape.
					Stormwater: Proactively manage flooding risks to properties. =
					Footpaths and cycleways: Treat footpath renewals as an opportunity to improve amenity and safety, including de-cluttering, and providing good quality surfaces and appropriate footpath widths. ▲
					Streetlights: Manage LED lighting levels to provide better lit footpaths and crossings that improve personal safety. ▲
				Increasing demands on roads and streets are making it more difficult to balance the needs of through movement against the quality and enjoyment of local places Place function of local roads needs to be acknowledged and activities need to respond accordingly	**Traffic systems:** Implement the road user priorities set in the Roads and Streets Strategy Framework in the operation and renewals of intersections, signs, markings and traffic systems. ▲
					Vegetation: Continue to maintain urban street trees and gardens. ▲
					Public transport: Maintain bus and rail stations and ferry terminals to a high level of service to create a safe, welcoming environment that builds patronage and enhances the surrounding community. ▲
					▲ Increase amenity level of service = Maintain amenity level of service

5.2.4 Level of service map 4 – accessibility

Auckland Council alignment (Auckland Plan 2018 refresh)	Government alignment (Government Policy Statement on Land Transport)	Benefits sought from the Auckland Transport Alignment Project and the 2018 Regional Land Transport Plan	Performance measures – accessibility	Issues or problems (asset management problem statements)	Strategic response
Make better use of existing transport networks, including a greater focus on influencing travel demand Target new transport investment to the most significant challenges to support key long term outcomes Maximise the benefits of existing, new and emerging transport technology **Make walking, cycling and public transport preferred travel choices for many more Aucklanders** Better integrate land use and transport decisions to support quality urban living Move to a safe transport network free from death and serious injury Develop a resilient transport system with least environment and health impact	Drive improved performance from the land transport system by focusing on: • **economic growth and productivity** • road safety • value for money	**Access to employment and labour will improve relative to current levels, supporting economic growth and increasing productivity** Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours Public transport and active transport mode share will increase relative to projected results, addressing congestion Any increases in the financial costs of using the transport system deliver net benefits to users of the system There will be a reduction in deaths and serious injuries, including for vulnerable road users	**ONRC measures** Proportion of the network not available to heavy vehicles The number of instances where the road is not marked in accordance with national standards **Roads and Streets Strategy Framework KPIs** Jobs accessible within a 30 to 45 minute trip – specifically from West and South Auckland Proportion of household income spent on transport **AMP KPIs** Proportion of properties and businesses impacted by temporary traffic management Must improve · Could improve · Maintain · Data gap	Weight restricted roads and bridges mean that trucks cannot always access the roads they need to Temporary road closures and inappropriate temporary traffic management plans impede access to properties, businesses and employment Increased congestion and longer travel times means declining access to jobs for people living in large parts of West Auckland and some parts of South Auckland (8)	**Road carriageway:** Continue with operations, maintenance and renewal activities that ensure access to properties, businesses and employment. **Stormwater:** Proactively manage flooding risks. **Bridges, walls and structures:** Continue to maintain and renew bridges, taking into account the ONRC classification of the road. **Footpaths and cycleways:** Increase maintenance and renewals expenditure on walking and cycling, to support better use of existing transport networks. **Streetlights:** Maintain adequate lighting standards that support accessibility. **Traffic systems:** Increase maintenance and renewals expenditure on traffic systems, to support better use of existing transport networks to improve accessibility. **Parking:** Provide parking as appropriate on urban streets and roads. **Public transport:** Provide a high level of service on AT's public transport network – offering choices and improving access to jobs, education, and social and leisure opportunities. Increase maintenance and renewals expenditure on public transport to support better use of existing transport networks to improve accessibility. Increase accessibility level of service · Maintain accessibility level of service

5.2.5 Level of service map 5 – travel time reliability

Auckland Council alignment (Auckland Plan 2018 refresh)	Government alignment (Government Policy Statement on Land Transport)	Benefits sought from the Auckland Transport Alignment Project and the 2018 Regional Land Transport Plan	Performance measures – travel time reliability	Issues or problems (asset management problem statements)	Strategic response
Make better use of existing transport networks, including a greater focus on influencing travel demand Target new transport investment to the most significant challenges to support key long term outcomes **Maximise the benefits of existing, new and emerging transport technology** Make walking, cycling and public transport preferred travel choices for many more Aucklanders Better integrate land use and transport decisions to support quality urban living Move to a safe transport network free from death and serious injury Develop a resilient transport system with least environment and health impact	Drive improved performance from the land transport system by focusing on: • **economic growth and productivity** • road safety • value for money	Access to employment and labour will improve relative to current levels, supporting economic growth and increasing productivity **Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours** Public transport and active transport mode share will increase relative to projected results, addressing congestion Any increases in the financial costs of using the transport system deliver net benefits to users of the system There will be a reduction in deaths and serious injuries, including for vulnerable road users	**AT Statement of Intent measures** Bus service punctuality Arterial road productivity Travel times on key freight routes **ONRC measures** Throughput at indicator sites Must improve · Could improve · Maintain · Data gap	Rapid growth in traffic has exceeded our ability to increase road network capacity or address demand, leading to increases in congestion (18) Non-optimised control of signalised intersections leads to delays and inefficiencies Poorly managed temporarily traffic management schemes lead to delays	**Carriageway:** Maintain road carriageway to a level of service suitable to the speed limit of the road, and minimise travel delay due to defects on the road surface (e.g. potholes, bleeding, scabbing, edge breaks etc). **Stormwater:** Proactively manage flooding risks that impact on travel time. **Bridges, walls and structures:** Proactively manage risk of failure of critical asset components that impact on travel time. **Footpaths and cycleways:** Maintain safe, connected walking and cycling links, so fewer people choose to travel by car for short journeys. **Streetlights:** Continue to provide adequate lighting standards appropriate to the speed and volume of traffic. **Traffic systems:** Actively manage traffic signals to optimise travel times and travel time reliability. **Vegetation:** Continue with current management practices. **Parking:** Enforce special vehicle lanes and widely communicate their benefits. **Public transport:** Provide a high level of service on public transport so more people choose to leave the car at home. Provide faster, more reliable services on the frequent network through bus-priority measures. Expand AT's network of bus and high-occupancy vehicle lanes where this will improve the overall productivity of congested roads. Improve travel times, relative to current levels · Maintain travel times/ improve relative to projected levels

5.2.6 Level of service map 6 – value for money

Auckland Council alignment (Auckland Plan 2018 refresh)	**Government alignment (Government Policy Statement on Land Transport)**	**Benefits sought from the Auckland Transport Alignment Project and the 2018 Regional Land Transport Plan**	**Performance measures – value for money**	**Issues or problems (asset management problem statements)**	**Strategic response**
Make better use of existing transport networks, including a greater focus on influencing travel demand **Target new transport investment to the most significant challenges to support key long term outcomes** **Maximise the benefits of existing, new and emerging transport technology** Make walking, cycling and public transport preferred travel choices for many more Aucklanders Better integrate land use and transport decisions to support quality urban living Move to a safe transport network free from death and serious injury Develop a resilient transport system with least environment and health impact	Drive improved performance from the land transport system by focusing on: • economic growth and productivity • road safety • **value for money**	Access to employment and labour will improve relative to current levels, supporting economic growth and increasing productivity Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours Public transport and active transport mode share will increase relative to projected results, addressing congestion **Any increases in the financial costs of using the transport system deliver net benefits to users of the system** There will be a reduction in deaths and serious injuries, including for vulnerable road users	**AT Statement of Intent measures** Public transport farebox recovery **ONRC measures** Chipseal resurfacing cost and average life Asphalt resurfacing cost and average life Cost comparison with peer group **AMP measures** Cost of maintenance and renewal activities (unit rates) Must improve Could improve Maintain Data gap	AT needs to continuously seek out and implement efficiencies in the management of its assets. Opportunities exist to optimise life cycles – especially in areas such as pavement rehabilitation and road resurfacing	**Road carriageway; stormwater; bridges, walls and structures; footpaths and cycleways; streetlights; traffic systems:** Implement an optimised programme for operation, maintenance and renewals to provide fit-for-purpose levels of service aligned with the ONRC framework. Use AT's ROM to develop renewal programmes. This approach will use the appropriate intervention thresholds aligned to the ONRC framework. **Public transport:** Maintain the proportion of public transport operational costs that are recovered through fares at 50 per cent or better. Improve value for money Maintain value for money

5.2.7 Level of service map 7 – life cycle asset management

Auckland Council alignment (Auckland Plan 2018 refresh)	Government alignment (Government Policy Statement on Land Transport)	Benefits sought from the Auckland Transport Alignment Project and the 2018 Regional Land Transport Plan	Performance measures – life cycle asset management	Issues or problems (asset management problem statements)	Strategic response
Make better use of existing transport networks, including a greater focus on influencing travel demand Target new transport investment to the most significant challenges to support key long term outcomes **Maximise the benefits of existing, new and emerging transport technology** Make walking, cycling and public transport preferred travel choices for many more Aucklanders Better integrate land use and transport decisions to support quality urban living Move to a safe transport network free from death and serious injury Develop a resilient transport system with least environment and health impact	Drive improved performance from the land transport system by focusing on: • economic growth and productivity • road safety • **value for money**	Access to employment and labour will improve relative to current levels, supporting economic growth and increasing productivity Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours Public transport and active transport mode share will increase relative to projected results, addressing congestion **Any increases in the financial costs of using the transport system deliver net benefits to users of the system** There will be a reduction in deaths and serious injuries, including for vulnerable road users	**AMP measures** Proportion of the road network rehabilitated each year Proportion of the chipseal road network resurfaced each year Proportion of the asphalt road network resurfaced each year Must improve Could improve Maintain Data gap	Transport assets have a finite life and must be continuously maintained, and periodically renewed, so the network as a whole will continue to deliver a fit-for-purpose level of service for current and future generations	**Road carriageway; stormwater; bridges, walls and structures; footpaths and cycleways; streetlights; traffic systems; vegetation; parking; public transport:** Continue to optimise life cycle management, based on whole-of-life costs and benefits. Monitor deterioration and loss of service potential. Improve life cycle asset management Maintain life cycle asset management

5.2.8 Level of service map 8 – sustainability

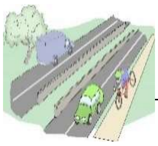
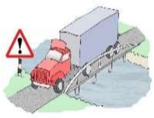
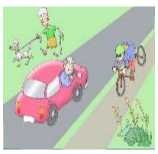
Auckland Council alignment (Auckland Plan 2018 refresh)	Government alignment (Government Policy Statement on Land Transport)	Benefits sought from the Auckland Transport Alignment Project and the 2018 Regional Land Transport Plan	Performance measures – sustainability	Issues or problems (asset management problem statements)	Strategic response
Make better use of existing transport networks, including a greater focus on influencing travel demand Target new transport investment to the most significant challenges to support key long term outcomes Maximise the benefits of existing, new and emerging transport technology Make walking, cycling and public transport preferred travel choices for many more Aucklanders Better integrate land use and transport decisions to support quality urban living Move to a safe transport network free from death and serious injury **Develop a resilient transport system with least environment and health impact**	Drive improved performance from the land transport system by focusing on: • economic growth and productivity • road safety • value for money	Access to employment and labour will improve relative to current levels, supporting economic growth and increasing productivity Congestion will improve relative to projected levels – in particular travel time and reliability in the peak period will improve, and congestion will not become widespread during working hours Public transport and active transport mode share will increase relative to projected results, addressing congestion Any increases in the financial costs of using the transport system deliver net benefits to users of the system There will be a reduction in deaths and serious injuries, including for vulnerable road users	**Sustainability Framework measures** Proportion of renewals projects that deliver sustainability improvements, rather than simply replacing like with like Number of sustainability initiatives implemented Must improve Could improve Maintain Data gap	Existing transport infrastructure falls short of AT's aspiration to provide an effective, efficient and enduring transport solution for a growing city, while maintaining those things about Auckland that we value as Aucklanders	**Road carriageway:** Increase the proportion of renewals projects that deliver sustainability improvements, rather than simply replacing like with like. **Stormwater:** Continue with current initiatives to improve the water quality of stormwater runoff. **Footpaths and cycleways:** Increase renewals and maintenance programmes in line with the expansion of walking and cycling networks. **Streetlights:** Continue the roll-out of energy efficient LED lighting. **Traffic systems:** Increase renewals and maintenance programmes in line with the expansion of traffic systems networks and activities. **Public transport:** Increase renewals and maintenance programmes in line with the expansion of public transport networks and services. Improve sustainability Maintain sustainability

5.3 Gap analysis summary

A summary of the key gaps identified in Section 5.2 is presented in Table 5-3.

More detail of the performance measures and gaps is set out in Chapters 6 and 7.

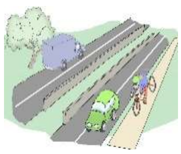
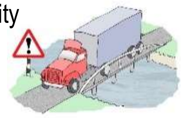
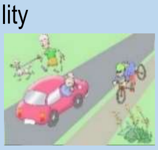
Table 5-3: ONRC gap analysis

	Road carriageway	Stormwater	Bridges, walls and structures	Footpaths and cycleways	Streetlights	Traffic systems	Public transport
Safety 	Poor skid resistance, and narrow road shoulders contribute to rural crashes.			High number of pedestrians and cyclists involved in urban crashes	Increasing deaths and serious injuries on busy roads at night	Increasing deaths and serious injuries at urban intersections	
Resilience 		Extreme rain events can cause road closures					
Amenity 	Roads are smooth to drive on – perhaps smoother than needed						
	More traffic makes roads less pleasant for other road users						
Accessibility 	Access to employment and education from West and South Auckland		Class 1 HCV do not have full access on the low-volume network			Need to actively manage traffic at peak times	Public transport makes better use of limited road space
Travel time reliability 	Unreliable travel times due to congestion					Traffic volumes and congestion increasing	Too many bus services are still stuck in congestion
Value for money 	Opportunities exist to optimise the life cycles of carriageway pavement and surfacing		Cost of replacement of structural components are high				Lack of overhaul facility for electric trains
Life cycle asset management 				Need to continuously optimise life cycle management, based on whole-of-life costs and benefits			
Sustainability 	AT lacks policy tools to influence travel demand	Increased frequency and severity of floods		Lack of safe facilities discourages walking and cycling			

5.4 Problem statements

The problem statements in Section 5.2 are summarised in Table 5-4, with Auckland-specific problems highlighted. This table also includes links to where these gaps have already been identified in one or more of AT's strategic documents.

Table 5-4: Problem statements for the AMP strategic case

	Problem statement
Safety 	Deaths and serious injuries on urban AT roads are increasing. Around half of road users killed or seriously injured on urban AT roads are pedestrians, cyclists and motorcyclists.
	Deaths and serious injuries on rural AT roads are increasing. A large number of deaths and serious injuries occur on a small percentage of local rural roads. Loss-of-control, head-on, speed and motorcycle crash-risks are key contributors to this trend.
Resilience 	Unplanned events cause significant delay and disruption for road users.
Amenity 	Inconsistent quality of roads, not aligned with a fit-for-purpose level of service, leads to inefficient use of resources, especially funding.
	Increasing demands on roads and streets are making it more difficult to balance the needs of through movement against the quality and enjoyment of local places.
Accessibility 	Weight restricted roads and bridges mean that trucks cannot always access the roads they need to (30).
	Increased congestion and longer travel times mean declining access to jobs for people living in large parts of West Auckland and some parts of South Auckland (3).
Travel time reliability 	Rapid growth in private vehicle travel has exceeded AT's and the NZ Transport Agency's ability to increase road network capacity or address demand, leading to increases in congestion.
Value for money 	AT needs to continuously seek out and implement efficiencies in the management of its assets. Opportunities exist to optimise life cycles – especially in areas such as pavement rehabilitation and road resurfacing.
Life cycle asset management 	Transport assets have a finite life and must be continuously maintained and renewed, so the network as a whole will continue to deliver a fit-for-purpose level of service for current and future generations, while managing the loss of service potential.
Sustainability 	Existing transport infrastructure falls short of AT's aspiration to provide an effective, efficient and enduring transport solution for a growing city, while maintaining those things about Auckland that we value as Aucklanders.

6. Problems, benefits and consequences

This chapter provides the evidence behind the problem statements set out in Chapter 5.

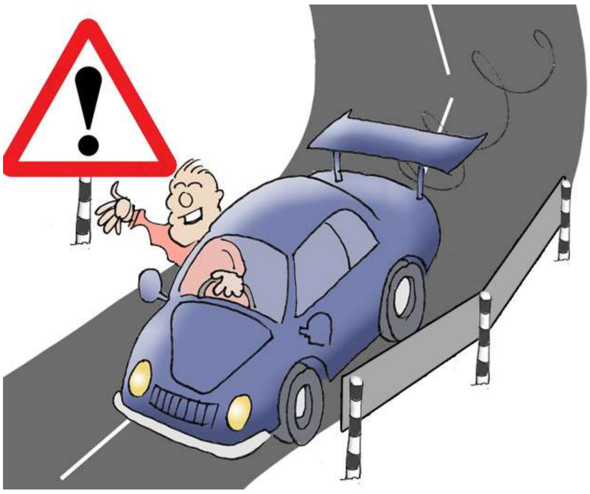
There are 11 problem statements aligned against eight customer outcomes, as set out in Table 5-4 in Chapter 5. For each problem statement, a description and evidence of the problem is provided, along with options to solve the problem and the benefits of doing so.

This analysis forms the heart of the business case for this AMP and makes the case for change, where change is needed. Chapter 7 then deals with each asset class in turn and sets out how we will manage the asset class and prioritise the activities and investment relating to it.

6.1 Safety

6.1.1 Background

Deaths and serious injuries on the Auckland local road network increased in 2015 and again in 2016: see Figures 6-1 and 6-2.



The annual social cost of road trauma in Auckland is over $1 billion. AT shares the task of reducing road trauma with the NZ Transport Agency, the Accident Compensation Corporation and the New Zealand Police. Working together as RoadSafe Auckland, each organisation takes action within its own mandate to make Auckland's roads safer.

Road safety capital expenditure investment has remained static for the past five years at approximately $20 million, despite increasing road trauma. AT customer requests have also increased significantly and customer satisfaction with safety has declined. Customers have told us that road safety concerns are the main thing holding them back from walking and cycling more. Their concerns are valid; vulnerable road users (pedestrians, cyclists and motorcyclists) now make up around half of urban road deaths and serious injuries (31).

The Safer Journeys approach looks at road trauma as predictable and preventable. While people make mistakes, and crashes will happen, implementing the SafeRoads strategy will mean more people walk away from crashes. The ultimate vision is to have a safe system where no-one is killed or seriously injured on New Zealand roads. This will be achieved by applying safe system thinking both within AT and when working with our RoadSafe Auckland partners, in four priority action areas:

- safe roads and roadsides
- safe speeds
- safe roads users
- safe vehicles.

Auckland is growing, but the Safer Journeys approach is to aim for a reduction in road trauma, in absolute terms as well as in per-person or per-kilometre terms.

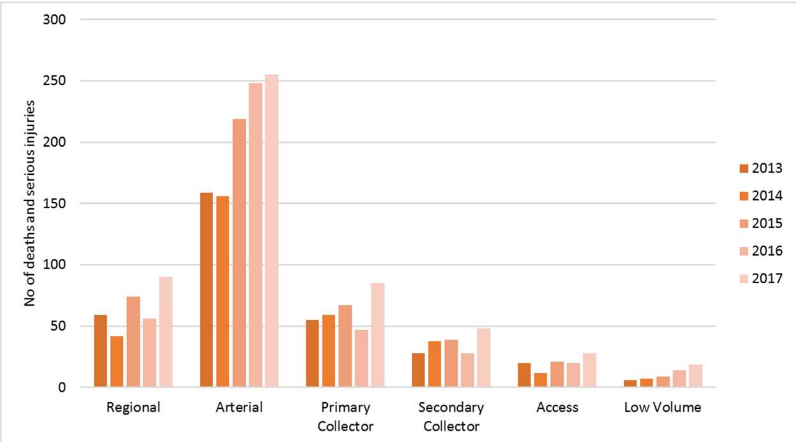
The two safety problem statements in this AMP are based on the different growth and user profiles for urban and rural roads. Both statements refer to the underlying principles of safe system thinking.

6.1.2 Deaths and serious injuries on urban roads

With increasing growth in urban areas, greater density and mixed land uses have led to a greater mix of travel modes and more potential conflicts, as well as more trips. The diversity of trips taken creates an increasingly more complex experience of the urban road environment. Existing standard road designs and layouts are based on historic assumptions about safety, including a focus on drivers. Keeping everyone safe on a modern urban road demands a new approach.

Problem statement	Deaths and serious injuries on urban AT roads are increasing. Over half of road users killed or seriously injured on urban AT roads are pedestrians, cyclists and motorcyclists (14).

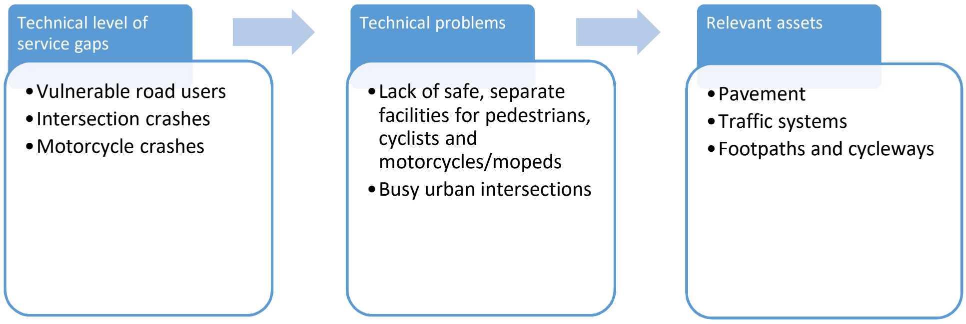
Figure 6-1: Deaths and serious injuries on urban roads



Source: AT's road safety performance reporting tool

Problem description and evidence	There were 525 deaths and serious injuries on urban roads in 2017, up 88 per cent compared to the historic low point of 279 deaths and serious injuries on urban roads in 2012 (32): see Figure 6-1. Around half of those killed or seriously injured on AT urban roads are vulnerable road users (pedestrians, cyclists and motorcyclists).
AT strategy	The strategy for urban road safety is to move away from car-dominated road design towards 'self-explaining' roads, where road users will naturally travel at safe speeds and with consideration for other road users. Practical changes to the layout of urban roads and streets, which will improve the protection of vulnerable road users, are set out in AT's Roads and Streets Strategy Framework (31) and Transport Design Manual (33). Over time, these changes will transform conditions for walking and cycling and deliver better quality places, while continuing to ensure that vehicles can get about reliably. Lowering speeds will reduce the frequency of crashes, and significantly increase the probability that a crash can be survived without death or serious injury. Speed management improvements are prioritised through our Auckland Speed Management Implementation Plan. The process we have followed to develop this strategy is shown in Figure 6-2.

Figure 6-2: Steps to derive an evidence-based road safety improvement programme for AT urban roads



Key options

Maintaining and operating roads, especially streetlights and traffic signals, can contribute to safety improvements.

Renewals priorities can be set with safety in mind, which will direct a higher proportion of renewals investment to high-risk urban roads and intersections. Assets will be renewed to a fit-for-purpose standard, consistent with AT's strategy. This standard is likely to differ from a like-for-like replacement.

Traffic systems can be managed to enable a speedier response to incidents, for example by using traffic signals to give priority to ambulances. This will give anyone injured in a crash a greater chance of full recovery.

Capital projects that provide safety and operational improvements are prioritised according to the incidence of fatal crashes, urban KiwiRAP high-risk roads and intersections, high-risk motorcycle routes and pedestrian crash risk areas, as set out in Chapter 12.

Benefits

By investing in the options listed above, AT should see a reduction in deaths and serious injuries on its urban network. Other benefits include:

- increased uptake of walking, cycling and public transport
- fewer short car trips, leading to a more productive road network for freight and other priority road users
- health benefits for individuals and for the community as a whole
- increased customer satisfaction.

Consequences

The primary risk of not increasing safety investment would be a further increase in deaths and serious injuries each year. Safety concerns would continue to constrain the uptake of walking and cycling, and this in turn would limit access to public transport. An additional risk is an increased call for safety investment in the future, as well as a rise in customer requests and levels of dissatisfaction.

Asset management actions

The following maintenance and renewals actions will contribute to road safety outcomes.

- Continue to maintain road surfaces, so hazards such as potholes do not present a risk to road users.

- Move to a proactive maintenance regime for footpaths and cycleways, informed by a regionwide survey of surface condition, to reduce slips, trips and falls.
- Regularly inspect footpaths, cycleways and pedestrian crossings to identify any sub-standard provision, for example missing signs or markings, or a lack of pram ramps.
- Improve lighting levels, especially in high pedestrian areas.
- Increase provision for active management of traffic signals.
- Improve emergency response times.
- Provide a high level of service on public transport, so more people choose to leave the car at home, reducing risk.
- Continue to offer a public transport service that achieves world-class standards of physical and personal safety.
- Ensure safe temporary access for vulnerable road users during physical works.
- Treat all maintenance and renewals projects as an opportunity to review safety issues and incorporate safety improvements, based on expert advice.

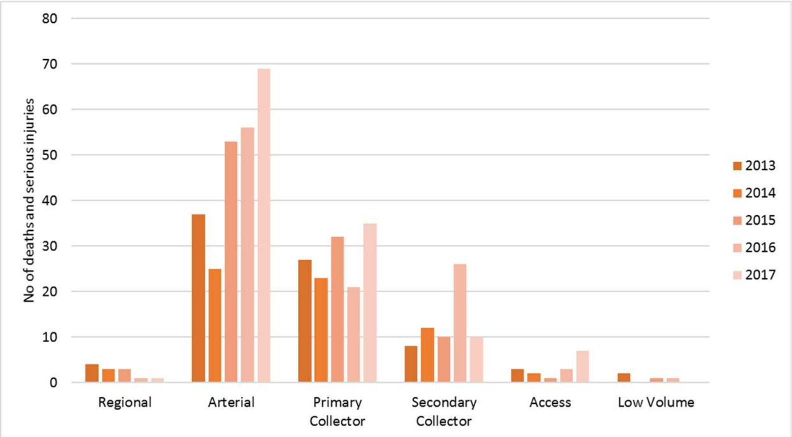
To reduce deaths and serious injuries on AT urban roads in absolute terms, despite a growing population and increasing car travel, will require capital investments as set out in Chapter 12.

6.1.3 Deaths and serious injuries on rural roads

On rural roads, we have growth in residents and traffic in the rural area and at the urban boundary, leading to new users of rural roads that are designed for low use. Avoiding deadly mistakes requires clear and consistent information about the road environment. 'Self-explaining' rural roads are one solution to reducing risk here.

Problem statement	Deaths and serious injuries on rural AT roads are increasing. A large number of deaths and serious injuries occur on a small percentage of local rural roads. Loss-of-control, head-on, speed and motorcycle crash-risks are key contributors to this trend (14).

Figure 6-3: Deaths and serious injuries on rural roads



Source: AT's road safety performance reporting tool

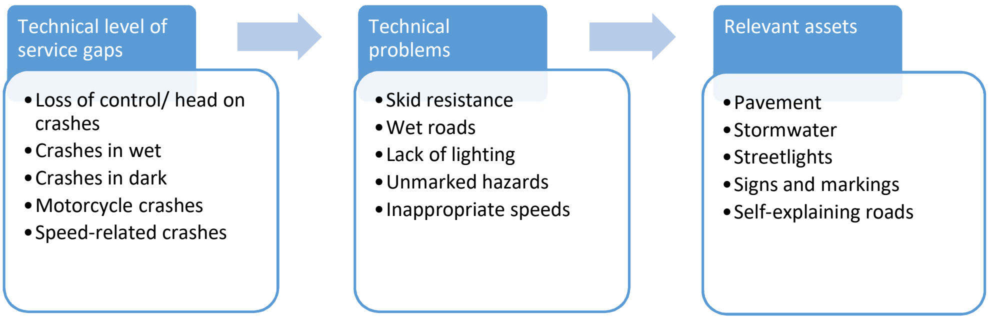
Problem description and evidence

There were 122 deaths and serious injuries on rural roads in 2017. This continues a worsening trend for deaths and serious injuries on rural roads, from 2012 (75 deaths and serious injuries) and 2014 (71) (32): see Figure 6-3. A small proportion of local rural roads are responsible for a large number of deaths and serious injuries. Loss-of-control, head-on, speed and motorcycle crash-risks are key contributors to this trend.

AT strategy

AT has analysed rural death and serious injury crashes, and the technical problems that made these crashes more likely or more deadly. This information is used to set priorities among the relevant assets in order to improve safety. The process we have followed is shown in Figure 6-4.

Figure 6-4: Steps to derive an evidence-based road safety improvement programme for AT rural roads



Key options

To improve rural road safety, AT needs to focus on maintaining, renewing and improving:

- skid resistance of rural road pavements
- the layout of bends on high-speed roads
- stormwater drainage, where ponding water constitutes a hazard
- streetlighting
- rural road signs, including school variable speed signs and advance intersection warning signs
- delineation and marking
- hazard warnings.

Speed management is a key opportunity to reduce both the frequency and the severity of rural road crashes. The Safer Journeys approach identifies two potential ways to achieve safer speeds on rural roads.

- Manage speeds down – reduce the posted speed limit and make minor engineering adjustments to encourage drivers to travel more slowly.
- Engineer up – improve the road and roadsides, so it is safe to travel at rural speed limits of 80 km/h or 100 km/h.

Either initiative will improve safety for motorcyclists, and contribute to a reduction in head-on and loss-of-control crashes. Rural communities are likely to favour the high-cost engineer-up options, but managing speeds down can also achieve

	community support, especially where actual travel speeds are already low in comparison to the posted speed limits.
Benefits	By investing in the key asset areas above, AT should see a reduction in deaths and serious injuries on its rural network each year, as well as safer rural communities and increased public satisfaction with road safety.
Consequences	If safety investment is not increased, AT can expect ongoing increases in deaths and serious injuries on the Auckland rural road network.
Asset management actions	The following maintenance and renewal actions are necessary to improve rural road safety. • Improve skid resistance on rural roads. • Continue to maintain road surfaces, so hazards such as potholes do not present a risk to road users. • Improve the management of stormwater, where this can contribute to safety. • Improve emergency response times in rural areas. • Implement Auckland's weed and pest strategy, to maintain sightlines and manage roadside hazards on the rural network. • Treat all maintenance and renewals projects as an opportunity to review safety issues and incorporate safety improvements, based on expert advice. To reduce deaths and serious injuries on AT rural roads in absolute terms, despite a growing population and increasing car travel, will require capital investments as set out in Chapter 12.

6.2 Resilience

6.2.1 Background

Within the ONRC, there are two customer outcome performance measures for resilience:

- the number of journeys impacted by unplanned events
- the number of instances where road access is lost.

In an urban network, it is very rare for road access to be closed completely, to the point where journeys become impossible. However, the cumulative impact of unplanned events across the network can be significant.

Transport resilience is a wider concept than just the impact on customers of sudden events such as earthquakes or extreme weather. The resilience of a transport network to longer term chronic stresses, for example climate change or an ageing population, is also relevant (34). The level of resilience depends not only on having resilient physical assets, but also includes operational changes that foster community preparedness and promote a long-term view. This concept of resilience, with examples of both acute and chronic stresses, is illustrated in Table 6-1.

Table 6-1: The four concepts of resilience

Resilience Of: / Resilience From:	Organisational	Network
Acute Stress	City Blackout Cyber Attack	Earthquake Volcanic Eruption
Chronic Stress	Mass Job Loss Aging Workforce	Sea Level Rise Greater Storm Frequency

Source: Resilience recommendations to AT (35)

6.2.2 Resilience of the network to unplanned events

Problem statement	Unplanned events cause significant delay and disruption for road users.
Problem description and evidence	Complete, unplanned road closures on the Auckland network are rare events, and alternative routes are usually available. However, although these events are rare, their impact can be very significant. Following a major rainfall event in 2017, there was a full road closure of Great North Road through New Lynn from 12 March to 15 March, and again from 3 April to 14 April following a second major rainfall event. Traffic continued to have access via alternative routes, but there were significant delays. See Figure 6-5 and Section 7.2 for further information about this event.

Figure 6-5: Closure of Great North Road, New Lynn

Prior to the Great North Road closures, the most recent extreme event causing complete road closures was on 10 June 2014 on Great Barrier Island.

Auckland has not recently experienced a widespread emergency, but if it were to happen, then the transport network would be vital to rescue and evacuation efforts, and network failures could compound the impacts of the original event. Planning and preparedness for extreme events is coordinated through the Auckland Lifelines Group and through Civil Defence.

To date, there has been less work to address the aspect of resilience that relates to chronic stress. A key stress is the increasing volume of traffic on the Auckland network, which means that an incident on any part of the road network can have a significant impact on the network as a whole, particularly during peak travel times. The problem is exacerbated by the limited number of viable detour routes for certain parts of the network, especially the approaches to the city centre and to the central isthmus from the north, west and south of the region.

AT strategy

AT is an active member of the Auckland Lifelines Group and of Civil Defence. Regular exercises test AT's responsiveness to a future extreme event.

AT has completed an assessment of seismic risk for the bridges, walls and wharves within the network, and is implementing the required improvements through its new capital programme.

AT and Auckland Council share responsibility for the stormwater network, with AT being responsible for assets in the road corridor that drain the road surface, and Auckland Council being responsible for bulk stormwater infrastructure. The strategy to improve stormwater outcomes and to manage the risks of high-intensity rainfall is being developed jointly. Once adopted, the strategy is likely to include an enhanced role for Auckland Council in the day-to-day management of road stormwater assets.

AT has also started assessing the vulnerability of network infrastructure to climate change and sea-level rise.

Resilience strategies need to be customer-centric, creating ways for people to get to their destinations and for businesses to move freight, even in difficult conditions. AT is investing to provide more integrated connectivity, both at an inter-regional and a local level (36). A transport network where customers have a range of travel choices, including walking, cycling, driving or using public transport, is expected to be more resilient than a network dominated by private vehicles.

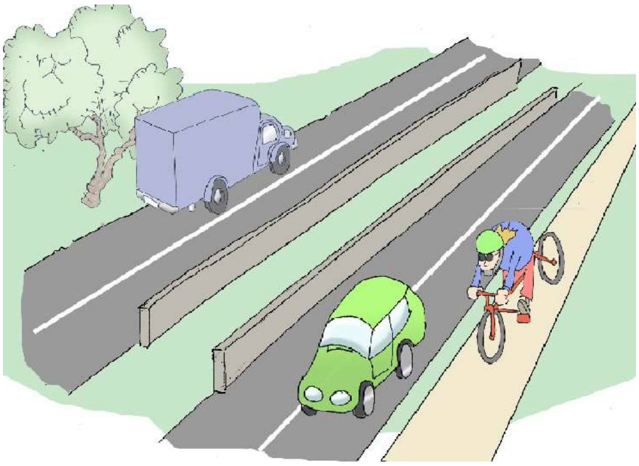
AT is developing a Resilience Action Plan which is expected to inform additional initiatives during the period covered by this AMP.

Key options	The key assets at risk in an extreme event are the stormwater network and bridges. Renewals of stormwater assets (especially catchpits, leads and minor culverts) and of bridges need to be prioritised and meet modern standards, including seismic standards and those for resilience to extreme events. Further work on chronic stresses, including sea-level rise, and on other aspects of resilience is included in the AMP improvement plan, detailed in Chapter 14.
Benefits	Better preparedness and investment in resilience improvements will mean that customers can safely complete their journeys, even in extreme weather events. In an extreme event, such as an earthquake or volcanic eruption, lives will be saved. Resilience improvements will also enhance AT’s organisational strength and resilience in the face of chronic stress.
Consequences	The consequences of not being prepared, either for extreme events or chronic stress, can far outweigh the costs of being prepared.
Asset management actions	Resilience is taken into account in all of AT’s asset management actions. Specific actions that we undertake where resilience is the primary factor include: • working with Auckland Council to implement proactive life cycle management of stormwater assets, based on shared data-sets • redirecting the stormwater renewals programme away from kerb and channel, towards catchpits, leads and culverts • increasing the allocation for bridge renewals.

6.3 Amenity

6.3.1 Background

Within the ONRC, amenity is defined as travel quality and aesthetics (37). The ONRC framework goes on to describe in some detail what travel quality means from the perspective of drivers. For AT's network, it is also important to consider travel quality for road users who are not drivers, and to consider aesthetics as experienced by local residents and businesses, as well as by road users. This leads to two problem statements for amenity, which are addressed in detail below.

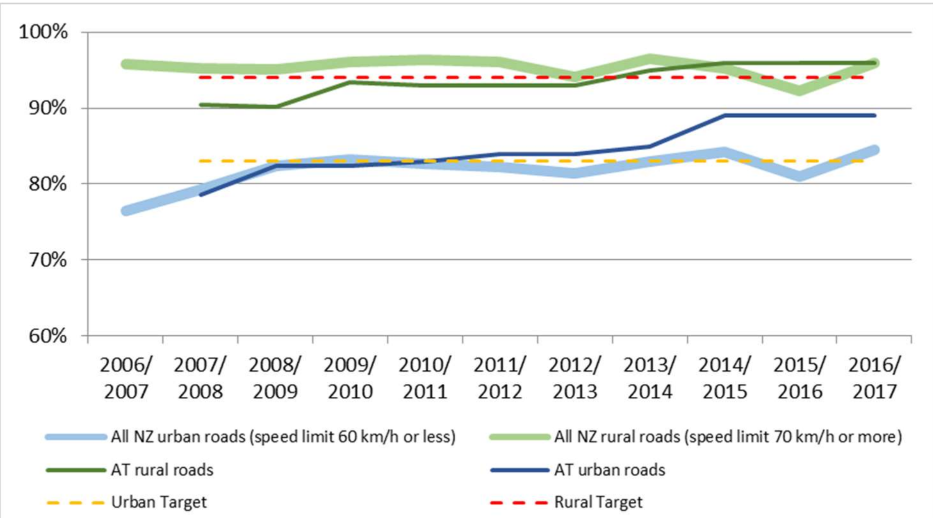


6.3.2 Quality of roads, as experienced by drivers

Problem statement	Inconsistent quality of roads, not aligned with a fit-for-purpose level of service, leads to inefficient use of resources, especially funding.
Problem description and evidence	Drivers' experience of roads is affected by the standard to which road surfaces are maintained. Smooth surfaces are usually more comfortable to travel on and can save considerable wear and tear on vehicles.

The main measure of road quality is 'smooth travel exposure', which is the proportion of all vehicle travel that is on roads that meet nationally agreed definitions of 'smooth'. By this measure, the quality of AT local roads is better than the New Zealand average, especially for urban roads. Around 90 per cent of all travel on the Auckland network is on smooth roads, as shown in Figure 6-6.

Figure 6-6: Smooth travel exposure (ONRC customer outcome 1)



Source: NZ Transport Agency (38)

Problem description and evidence

On the above evidence, road smoothness is not currently a problem for drivers, although it would rapidly become a problem if AT did not continue to maintain and renew carriageways.

The problem is that the high quality of Auckland local road pavements comes at a high cost, which is only partly funded by those who benefit from them. Although most damage to road pavements is attributable to traffic (especially heavy-vehicle traffic), most of the funding for the maintenance and renewal of AT roads currently comes from rates levied on residents and businesses.

AT strategy

AT uses the ONRC system to set priorities for local road maintenance. Regional and arterial roads will be maintained and renewed to the current level of service. However the level of service for collector and access roads will be set at a fit-for-purpose level, consistent with their lower level of use.

Key options

AT could:

- continue to deliver the current high level of service for local road pavements
- maintain levels of service for regional and arterial roads, but spend less (and achieve a lower level of service) on less busy roads. (This is the recommended option.)

There is no ‘do nothing’ option for this problem. Failure to maintain and renew local roads would go against AT’s legislative purpose to provide an effective, efficient and safe land transport system in the public interest (4).

Benefits

The benefits of the recommended option will be:

- aligning the quality of road surfaces with national standards. For Auckland’s busiest roads, which make up 18 per cent of the network, but carry three-quarters (73 per cent) of all traffic, smoothness will be maintained at current levels. On less busy roads, the surfaces will, over time, become less smooth
- reducing road rehabilitation costs by around $30 million each per year, in each of the first three years of this AMP, relative to the 2015 AMP
- achieving better alignment between AT and the NZ Transport Agency on priorities, and as a consequence of this, a more equitable division of costs between road users and ratepayers.

Consequences

The recommended option will defer renewals on lower classification roads.

The short-term consequences of this will be to deliver a cost saving. Whether there is a long-term cost saving depends on how risk is managed through asset management actions.

Asset management actions

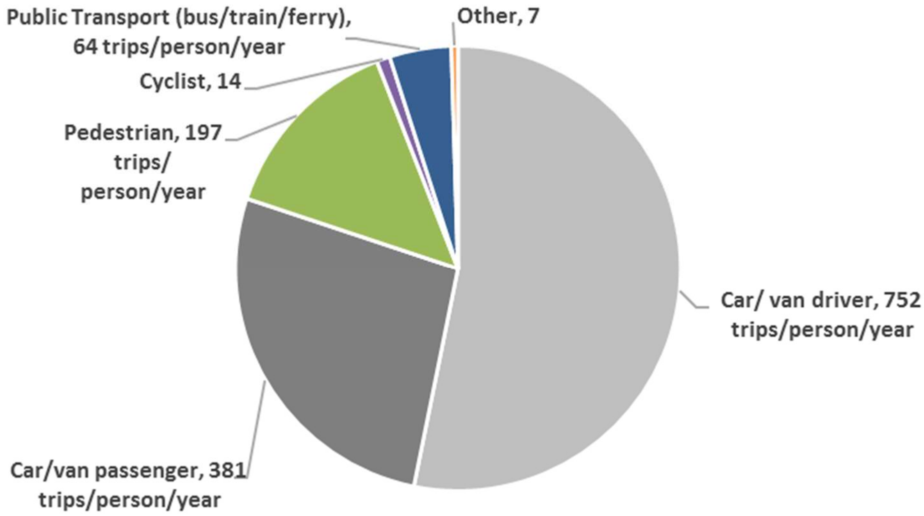
Asset management actions to address this problem are set out in the section on options and choices for the carriageway (Section 7.1) and are summarised below.

- Maintain road rehabilitation levels of service for regional and arterial roads, but spend less (and achieve a lower level of service) on less busy roads.
- Continue with the reseal and maintenance programme at current levels, but target a higher proportion of activities to busy roads

6.3.3 Quality of streets, as experienced by residents and road users

Problem statement	Increasing demands on roads and streets are making it more difficult to balance the needs of through movement against the quality and enjoyment of local places (31).
Problem description and evidence	As Auckland grows, everyone wants different things from roads and streets (31). Roads and streets must provide multi-modal transport choices and better access for people of all ages and cultures. The increasing pressure on Auckland's roads and streets demands a new approach to how we manage the network. This new approach is set out in AT's Roads and Streets Strategy Framework (31). Most relevant to this problem statement is the 'living' component of the strategy, which aims to make Auckland's roads and streets welcoming and inclusive places for all, and places that support vital economic and community activities. AT's agreed measure for this aspect of amenity is to count pedestrians and cyclists. The logic is that creating welcoming and inclusive streets, supported by good land use planning that provides a mix of local places to live, work and play, will mean more people chose to walk or cycle for local trips, and to walk or cycle to public transport for longer trips. AT is launching a Make Walking Count initiative, which will help close the significant gap in our knowledge of where people walk in Auckland, and in what numbers. For now, the best available data is from the Ministry of Transport's household travel survey for 2015 to 2017, shown in Figure 6-7. The survey showed that, in Auckland, 14 per cent of trips were by walking and a further 1% by cycling (39). Nationally, the average amount of time spent walking each day has fallen from 10 minutes per day in the late 1980s to 6.4 minutes per day currently (40). This low level of active transport creates multiple problems. More short car trips add to congestion and air pollution. Low levels of physical activity contribute to a wide range of health problems, from diabetes to depression. Public transport services are less effective, because people are less willing to walk to bus and train stations. And while people are confined in a car, they are not shopping locally, contributing to their community or meeting their neighbours.

Figure 6-7: Proportion of all trips in Auckland 2015 to 2017 which were by walking and cycling



Source: Ministry of Transport continuous household travel survey (39)

AT strategy

AT's strategy to improve the amenity of local roads, and to provide safe and separate facilities for walking and cycling on busy roads, is set out in its Roads and Streets Strategy Framework.

Many of these actions will require new capital improvements, but there is also an important role for maintenance and renewals activities in relation to footpaths and cycleways, traffic systems, bridges and structures, and carriageways.

Key options

The options available to AT are to:

- continue to plan renewals in isolation from capital improvements, with a focus on like-for-like replacement of assets
- increase the proportion of renewals that are integrated with and delivered alongside the capital improvement works required under AT's Roads and Streets Strategy Framework.

Benefits

The amenity outcomes of implementing the Roads and Streets Framework will be (31):

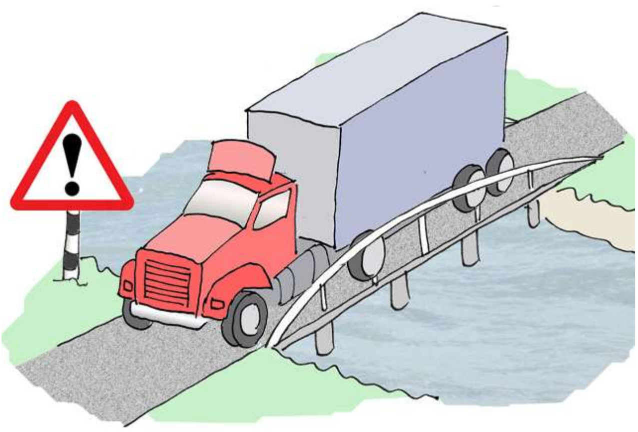
- streets that are welcoming and accessible for everyone
- reduced reliance on vehicle travel for short local trips
- revitalised and new city destinations
- vibrant, accessible and inclusive town centres, main streets and local centres
- more active and flexible streets
- reduced severance and increased cohesion of communities
- improved health outcomes
- places for children to play and focal points for communities to interact.

Consequences	Moving away from like-for-like replacements will add complexity to the planning process for renewals, with inevitable changes and compromises.
Asset management actions	For carriageways • Increase the proportion of reseals and rehabilitation works that integrate with the delivery of improvements required to meet the standards set in the Roads and Streets Strategy Framework. For footpaths and cycleways • Treat footpath renewals as an opportunity to improve amenity and safety, including de-cluttering, and providing good quality surfaces and appropriate footpath widths. For streetlights • Manage LED lighting levels to provide better lit footpaths and crossings that improve personal safety. For traffic systems • Implement the road-user priorities set in the Roads and Streets Strategy Framework in our operations and renewals for intersections, signs, road markings and traffic systems. For vegetation • Continue to maintain urban street trees and gardens. For public transport • Maintain public transport assets to a high level of service to create a safe, welcoming environment that builds patronage and enhances the surrounding community.

6.4 Accessibility

6.4.1 Background

Accessibility is defined in the ONRC as land access and road network connectivity (37). The customer outcome for accessibility is that bridges and roads are not restricted in their ability to carry heavy vehicles.



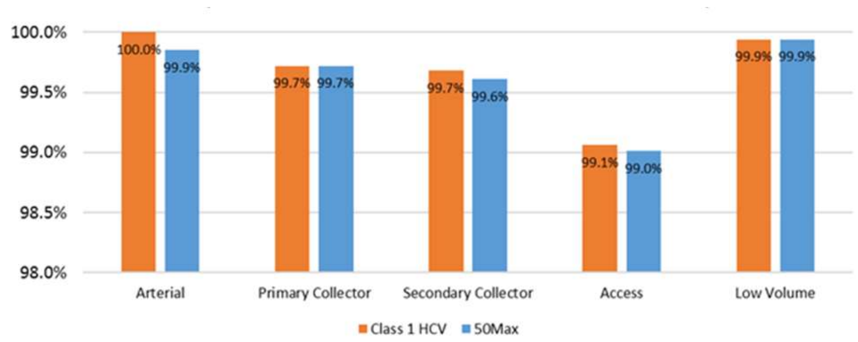
AT also uses the word accessibility to describe the function of the transport network as a whole. The network provides accessibility by linking people to jobs, education and social opportunities, and linking businesses to potential employees and customers. This second definition of accessibility expresses why people live in cities, and measures the extent to which the transport network supports residents and businesses to take advantage of what the city has to offer.

These two definitions of accessibility give rise to two separate problem statements.

6.4.2 Accessibility of the network to heavy trucks

Problem statement	Weight restricted roads and bridges mean that trucks cannot always access the roads they need to (30).
Problem description and evidence	Figure 6-8 shows that 99.56 per cent of the network is accessible to 50MAX heavy commercial vehicles, and 99.62 per cent to Class 1 heavy commercial vehicles. Where access is restricted, this is principally due to weight restricted bridges.

Figure 6-8: The proportion of the network accessible to Class 1 and 50MAX vehicles



Source: ONRC performance reporting tool

The parts of the network that are inaccessible due to weight restricted roads and bridges tend to be access roads, and are generally not on the routes requested in high-productivity motor vehicle and overweight vehicle permits.

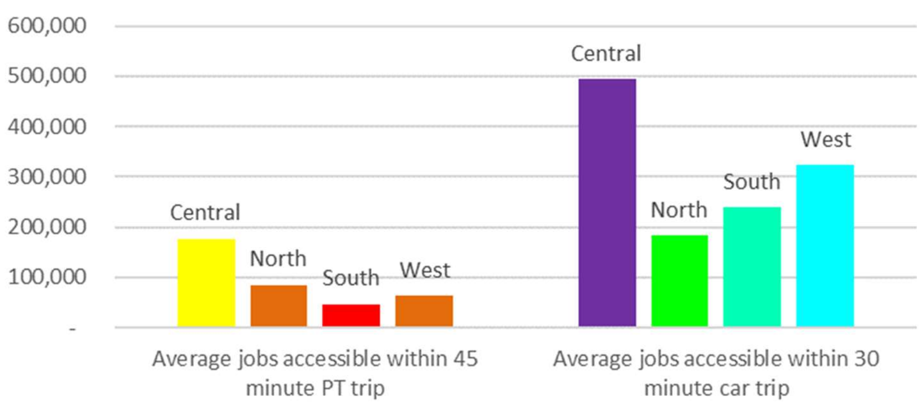
As a result, it can be concluded that, overall, the AT network does achieve the customer outcome that ‘trucks that want to use the roads can do so’.

AT strategy	AT regularly inspects bridges, and reviews the traffic loadings they can withstand safely and without sustaining damage. Weight restrictions are often a temporary measure while renewals work is scheduled, designed and procured.
Key options	Continuing the current bridge renewals programme will adequately provide for the small number of bridges that are currently preventing heavy vehicles from accessing a limited length of the road network. In most cases, the bridges will re-open to trucks once renewals are complete. On some local roads ongoing weight restrictions will be a more cost-effective option than upgrading the bridge.
Consequences	The lack of access by heavy vehicles to limited areas of the network does not appear to have any significant economic or social consequences. AT will continue to monitor access to weight restricted roads and bridges on these routes. We will also monitor the general increase in heavy vehicle traffic and axle weights across the network overall, in order to inform future decision-making.
Asset management actions	Continue to maintain and renew bridges, and consider the ONRC category of the road when setting priorities for renewals. Further details of the options and choices for bridges, walls and structures are set out in Section 7.3.

6.4.3 Access to jobs and opportunities

Problem statement	Increased congestion and longer travel times mean less access to jobs for people living in North, West and South Auckland.
Problem description and evidence	One impact of traffic congestion is that residents in some parts of Auckland have fewer jobs available within a reasonable commute time. Residents on the central isthmus can access around twice as many jobs within a 45 minute PT trip or a 30 minute car trip, compared with residents of North, .South or West Auckland, as shown Figure 6-9.

Figure 6-9: Average number of jobs accessible by area



Figures 6-10 and 6-11 show detailed maps of how many jobs are accessible within these commute times. Places with better access to jobs are also likely to have better access to education, leisure and social opportunities.

Figure 6-10: Number of jobs accessible within 30 minutes travel by car during the morning peak

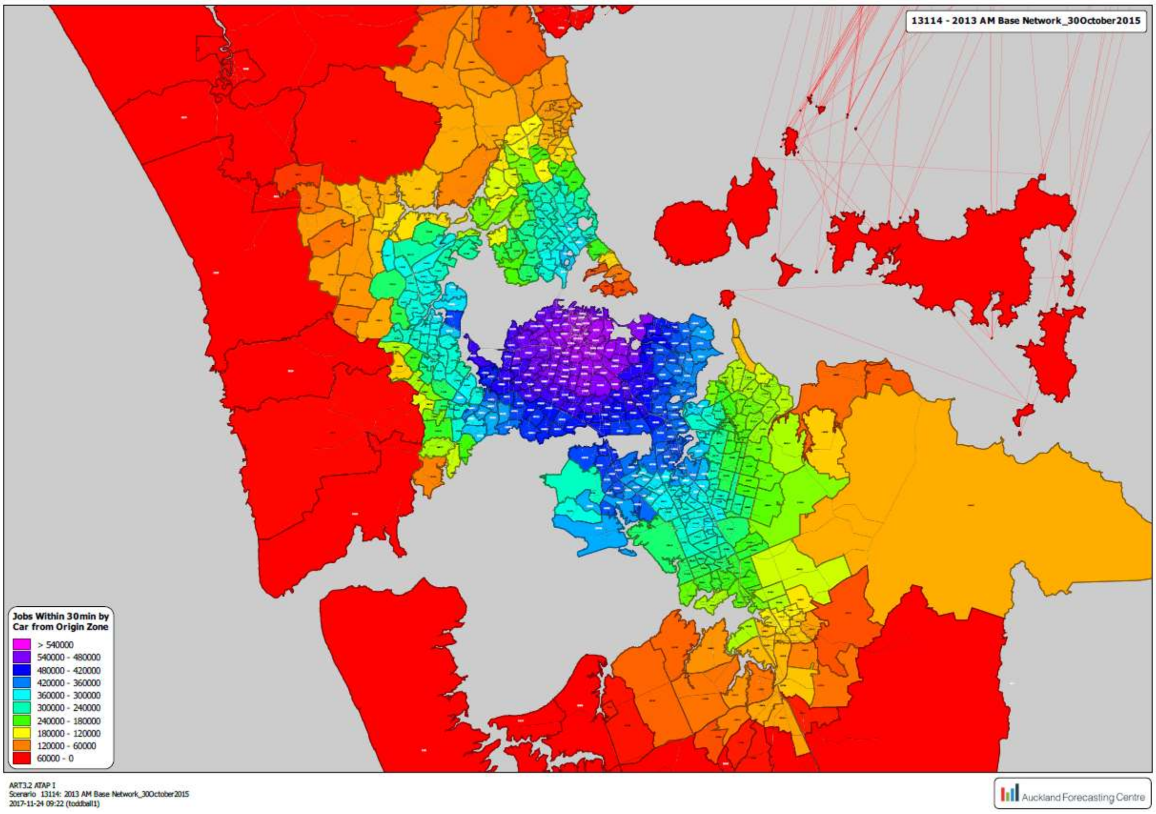
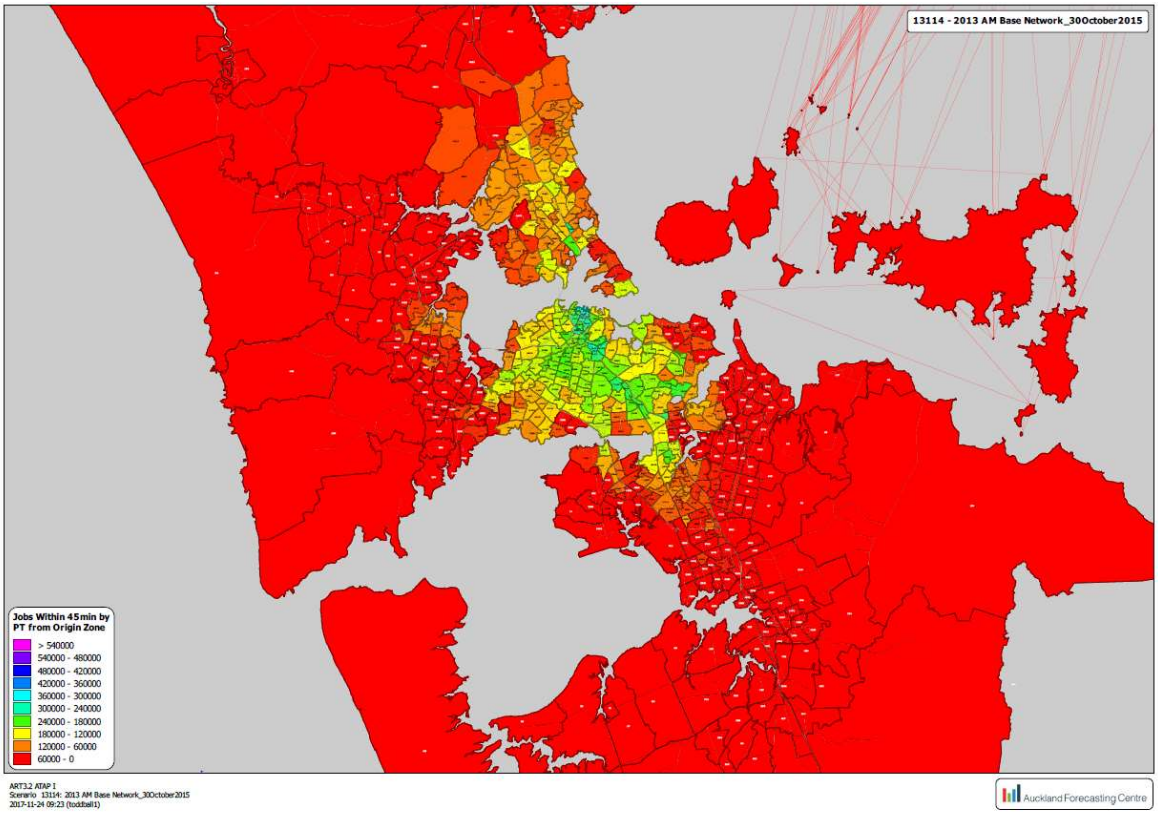


Figure 6-11: Number of jobs accessible within 45 minutes travel by public transport in the morning peak



Source: Auckland Forecasting Centre

Under current (2015) transport plans, access to employment in West Auckland and some parts of South Auckland is projected to barely change over the next 30 years. In these areas, the benefits of Auckland's employment growth will be cancelled out by the increase in car travel times (3).

AT strategy

The agreed strategy to address Auckland's growing transport needs is set out in the recommendations of the Auckland Transport Alignment Project. Under the indicative package, the west achieves the greatest improvement in employment access, with around 280,000 more jobs being accessible (3). Key projects to achieve this are the Northwestern Busway, and improved road and bus links from Westgate to Albany, as well as smarter transport pricing.

The success of these major investments relies on also making better use of existing networks. This strategy is given the same emphasis as building more infrastructure or managing demand.

Key options

Asset management actions to support improved accessibility that have been agreed through the Auckland Transport Alignment Project include:

- reallocation of road space to public transport, walking and cycling
- smarter road management through more traffic systems, smart signs and markings
- improved monitoring and optimisation of traffic conditions.

Implementing these actions will, over time, shift the balance of AT's asset management activities. Although the road carriageway will continue to be important, other assets, including public transport, walkways and cycleways, and smart technology assets will comprise a greater proportion of the value of AT's assets.

Benefits

Making it easier and more affordable for people to get to work, school or training is particularly important for increasing economic productivity and everyone's prosperity. A transport system that offers reasonable commuting times to a wide range of jobs has multiple benefits:

- it enhances the ability of employers to find suitable workers
- it boosts job satisfaction and business productivity
- it reduces the vulnerability of workers to long-term unemployment in the event of (unforeseen) employment change or job loss. (41)

Consequences

The consequence of not taking action to provide more travel choices, to manage congestion and to prioritise road use will be an overall negative impact on travel times, levels of service and public satisfaction. This burden is expected to fall disproportionately on residents of West and South Auckland.

Asset management actions

- Prioritise renewals expenditure in areas that enable better use of existing transport networks.
- Reduce, over time, the proportion of total investment which is dedicated to road carriageway renewals. In the 2016/2017 year, allocations for carriageway renewals made up 69 per cent of total renewals. This will fall to 52 per cent in

2028. Conversely, streetlights, traffic systems, public transport assets, footpaths and cycleways will all have an increasing allocation for renewals. This will reflect both the changing asset base and this AMP’s direction of prioritising those assets that enable better use of existing transport networks.

6.5 Travel time reliability

6.5.1 Background

With sustained growth in Auckland, congestion continues to be a significant concern. The ONRC framework does not aim to solve traffic congestion. Rather it sets a goal to reduce the variability of travel time, which is one of the most annoying symptoms of traffic congestion. Travel time reliability is important, particularly for business travel, where time is money.

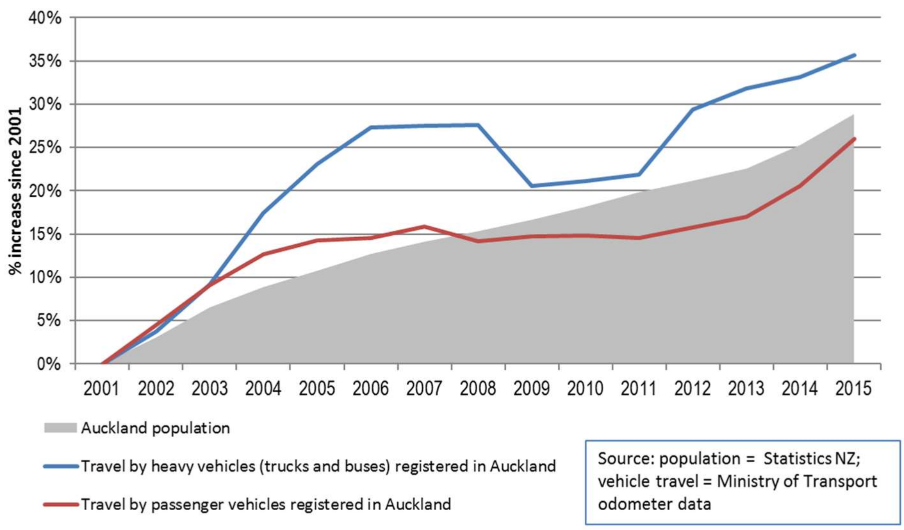
In Auckland, customers clearly have concerns about travel times overall (as discussed in Section 4.5), not only with travel time reliability. In this AMP, the focus is on improving travel times through providing better transport options and encouraging smarter travel choices.

6.5.2 Increasing traffic congestion

Problem statement	Rapid growth in private vehicle travel has exceeded AT's and the NZ Transport Agency's ability to increase road network capacity or address demand, leading to increases in congestion.
Problem description and evidence	The cost of Auckland's congestion, compared to the network operating normally, was calculated in 2003 as $250 million. Higher estimates of the cost of congestion exist, but are generally less robust (3).

Travel demand varies year on year, affected by a range of demographic and economic factors, but the long-term trend is one of significant growth as shown in Figure 6-12. In this AMP, future traffic growth is estimated as 2.4 per cent per year, in line with transport modelling (1).

Figure 6-12: Growth in travel by vehicles registered in Auckland 2001 to 2015

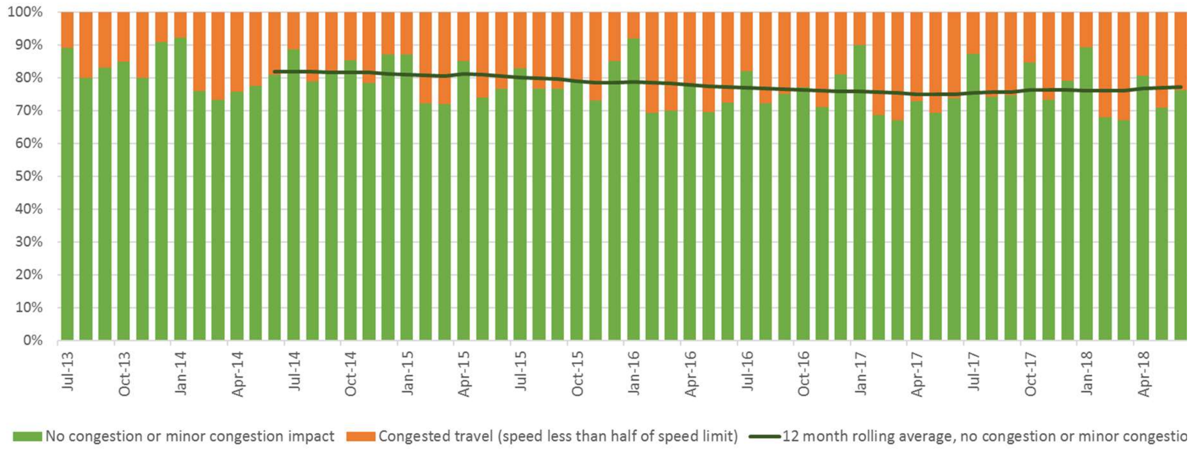


Source: Ministry of Transport data, AT analysis

Problem description and evidence	Prior to this year, AT has measured a decline in travel speeds on Auckland's arterial road network. There is significant variation from month to month, but the annual trend between July 2015 and July 2017 was for around 2 to 3 per cent more of the arterial network to become congested in the morning peak each year, as shown in Figure 6-13.

Congestion levels were two percentage points better in June 2018 than in June 2017, as shown in Figure 6-13. In the 12 months to June 2018, 77% of the arterial network was operating efficiently (with actual travel speeds of half the speed limit or better) during the AM Peak. More detailed analysis has shown that routes impacted by the opening of the Waterview Tunnel are responsible for the positive impact on travel times (42).

Figure 6-13: Proportion of morning peak travel on the arterial network by level of service (orange = congested)



Source: AT analysis of in-vehicle GPS data, published in Monthly Monitoring Report

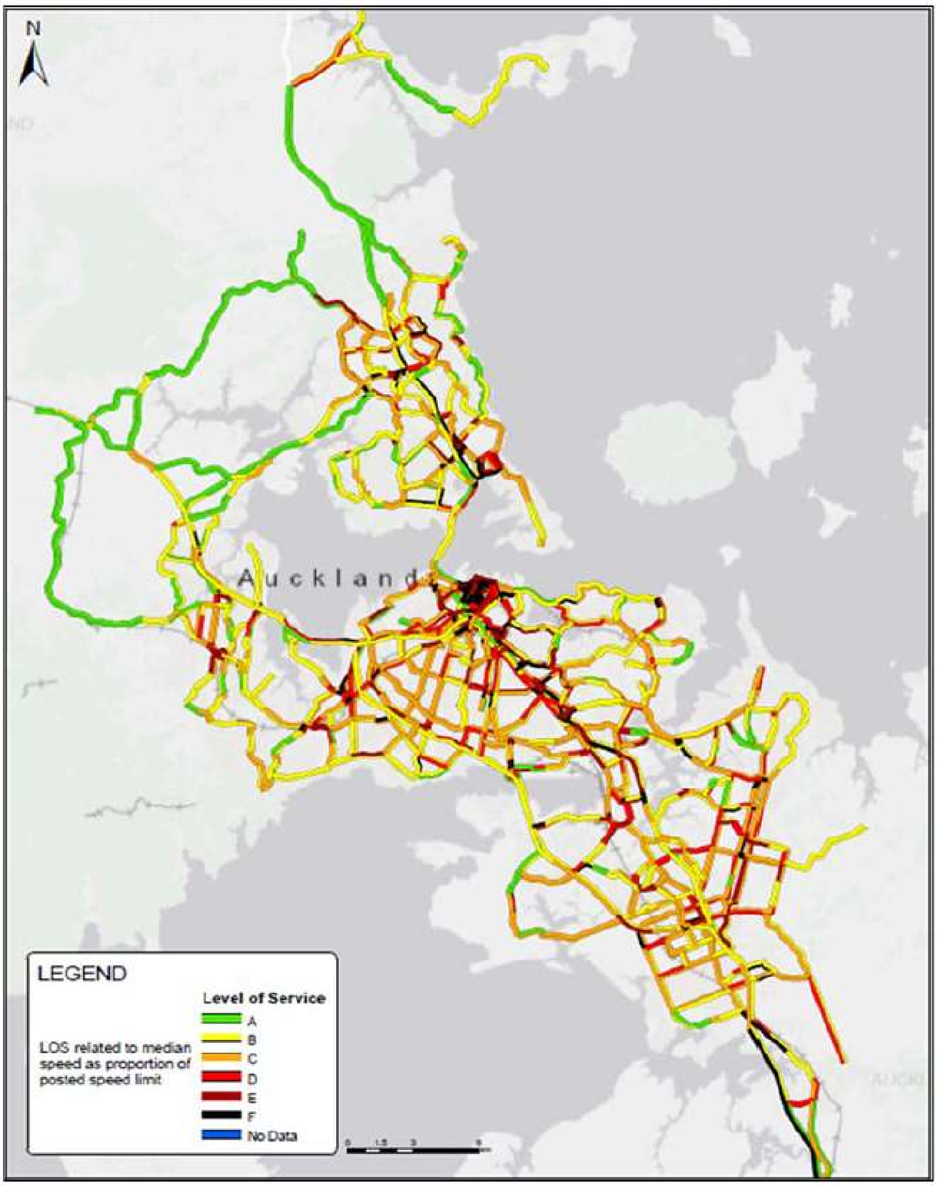
Auckland's most congested roads are shown in Figure 6-14 and include the city centre, local road links on to the isthmus from the South and West along with links to Devonport, the Airport, Howick and Papakura. These roads have in common that they are in built up, constrained places with very limited opportunities to provide new or wider roads without significant land acquisition, extremely high costs and potentially major amenity impacts

AT Strategy	AT's strategy to address congestion is best expressed by its overall strategic themes, which are:

- **Prioritise rapid, high frequency public transport** to achieve the Auckland Plan outcome of moving to outstanding public transport.
- **Transform and elevate customer focus and experience** by delivering road, public transport, cycling and walking services which are user friendly, customer oriented, and meet the needs of the people of Auckland.
- **Build network optimisation and resilience** to get better value out of our existing services and assets and be resilient against future shocks, changing travel patterns and demands and natural events.

- **Ensure a sustainable funding model** to create certainty for maintaining and renewing our assets, improving service levels incrementally and adding additional capacity to the transport system to meet the needs of future growth.
- **Develop creative, adaptive, innovative implementation** of Auckland Transport's services, programmes and new projects. (10)

Figure 6-14: Morning peak travel speeds for September 2017 (red and black = congested)



Source: AT analysis of in-vehicle GPS data, published in Monthly Monitoring Report

Key options

The AT strategic themes, the Auckland Transport Alignment Project, Council's Auckland Plan and the NZ Transport Agency Long-Term Strategic View all call for traffic management and network optimisation to play an increased role in managing Auckland's increasingly busy and complex transport network.

The only asset management option consistent with this strategy is the continued expansion of network optimisation, by providing a high level of service through the maintenance and renewals of AT's traffic management assets, including traffic signals, CCTV and information systems.

Also included in this AMP is a strategic case for low-cost, low-risk capital investments, on the basis that small changes can lead to significant improvements in the level of service for priority road users.

Traffic management is also key to securing the full benefits of planned investment in major infrastructure and in demand management. These investments are set out in the Regional Land Transport Plan.

Benefits	Key benefits of the ongoing expansion of investment in traffic systems are: • improved journey time reliability on key roads and for high-value trips • a safer environment and reduced delays and risk-taking by pedestrians and cyclists • more reliable travel times for public transport services.
Consequences	The negative consequences of not addressing issues with travel time reliability would be: • higher congestion across the network and decreasing public confidence in travel times • the continued dominance of traffic flows by single occupant vehicles, making inefficient use of limited road space • higher carriageway deterioration rates, due to stopping and starting by heavy commercial vehicles • unreliable public transport and loss of public transport patronage.
Asset management actions	• Maintain road carriageways to a level of service suitable to the speed limit of the road. • Maintain traffic signals, CCTV and information systems to a high level of service consistent with their importance to the network. • Actively manage traffic signals 24/7 to optimise travel times and travel time reliability. • Expand AT's network of bus and high-occupancy vehicle lanes – both the physical extent and the hours of operation – where this will improve the overall productivity of congested roads; that is, the amount of people and freight moved at peak • maintain safe, connected walking and cycling links, so fewer people choose to travel by car for short journeys • enforce special vehicle lanes and widely communicate their benefits. These asset management actions will be combined with capital investments in network optimisation projects, as set out in Chapter 13.

6.6 Value for money

6.6.1 Background

Over half of Auckland's future transport investment will need to be in maintaining, operating and renewing existing and future assets. Improving value for money from these activities can result in significant savings to ratepayers and road users.

The focus of AT's value for money activities is on road carriageways, because these make up the majority of our total spending.

Over the past four years, there has been a steady reduction in AT's operational budgets for road maintenance (as distinct from renewals) activities. These are now at, or below, national benchmarks as shown in Section 7.1. However, AT's renewals costs for road carriageways are significantly higher than other urban networks and New Zealand averages.

Using 3-year annual averages, AT's subsidised cost for carriageway maintenance and renewals is:

- 2.2 times the national average per kilometre
- 2.1 times the national average per lane kilometre
- 0.9 times the national average per vehicle kilometre travelled.

For other assets, including traffic systems, stormwater and streetlights, AT's costs are in line with national benchmarks, as shown in Chapter 7.

6.6.2 Efficient asset management

Problem statement	AT needs to continuously seek out and implement efficiencies in the management of its assets.
Problem description and evidence	The question of value for money for road maintenance and renewals activities was the subject of a major national review in 2012 (43). The Road Efficiency Group was set up to oversee the implementation of the review's findings and has developed a suite of best practice tools and advice, including the ONRC. Using these tools, AT has been able to demonstrate that almost all its activities represent value for money.
AT strategy	AT's strategy to achieve best value for money is to reprioritise its renewals programme based on the ONRC. The aim is to direct renewals funding to the right solution, in the right part of the network, at the right time and the right life cycle cost. How this strategy is applied differs by asset, as explained in Chapter 7. The most significant value-for-money-related changes recommended in this AMP are in relation to road rehabilitation projects, which are reduced significantly.

AT is also taking into account renewals that are completed as part of capital improvements.

Value for money is considered at every stage of the asset management process, by:

- optimising whole-of-life asset costs, from initial purchase to final disposal
- setting fit-for-purpose levels of service
- prioritising renewal and maintenance activities to the right assets at the right time
- taking a strategic approach to procurement
- using an approved procurement procedure
- allocating and managing risk appropriately
- proactively managing contract delivery
- monitoring performance.

Benefits	Around a quarter of all transport investment over the next decade will be on maintaining, operating and renewing existing assets. Improving value for money from these activities could contribute to closing the funding gap for new transport infrastructure (3).
Consequences	The adverse consequence of not addressing this problem will be poor value for money investments, which do not make best use of limited funding.
Asset management actions	For most assets and types of expenditure, the conclusion has been that AT expenditure already represents value for money, given the size and complexity of the network. The exception is road rehabilitation, where AT has agreed with the NZ Transport Agency position that it would be appropriate to provide a lower level of service, and accept a higher level of managed risk, in relation to sealed road rehabilitations of lower classification roads. The impact of this agreement is a reduced expenditure forecast for road renewals, as set out in Section 7.1.

6.7 Life cycle management

6.7.1 Background

In addition to the customer levels of service identified in the ONRC, AT has identified a separate customer level of service entitled 'life cycle management'.

Life cycle management is the concept of planning and analysing all asset needs and activities that will be required to achieve the full life of an asset, from its current status to its replacement (31).

Life cycle cost is defined as the total cost of an asset throughout its life, including planning, design, construction, acquisition, operation, maintenance, rehabilitation and disposal costs (44).

6.7.2 Delivering a fit for purpose level of service

Problem statement	Transport assets have a finite life and must be continuously maintained and renewed, so the network as a whole will continue to deliver a fit-for-purpose level of service for current and future generations, while managing the loss of service potential.
Problem description and evidence	The Local Government Act 2002 (45) requires local authorities to describe how they will prudently manage community assets in the public interest. Audit NZ has reviewed AMPs from New Zealand local authorities and has concluded that "Most discuss renewals. Very few discuss this in the context of a strategy for their assets' entire lifecycle" (46). Modelling is a key tool for effective life cycle management of a complex asset network. AT has good modelling tools, but the NZ Transport Agency has rated the quality of AT's asset data as an amber (medium) risk. The more closely the modelled network reflects reality, the more useful the modelling results are to inform decision-making.
Problem description and evidence	To date, most modelling effort has focused on renewals. In order to measure and demonstrate effective life cycle management, accurate information is required at each stage of the asset life cycle. True life cycle asset management optimises maintenance, renewals, major rehabilitation and new capital investment decisions, based on performance, risk and cost (44). • Performance includes community satisfaction, asset output, services level, etc. • Risk includes risk to the asset user, risk of failure, risk of service interruption, safety risk, reputation, etc. • Cost includes cost of ownership, operations and maintenance, profit, financial return, net present value, etc.

Underpinning all of these decisions is a requirement for good data, good systems and good processes.

AT strategy

AT applies the principles set out in the International Infrastructure Management Manual (9) and ISO55001 (47) to its asset management decisions.

Key options

- Continue to improve asset management systems (especially data collection and data analysis systems) to support optimised life cycle decision-making.
- Progress towards an enterprise asset management approach, incorporating best practice as defined in the International Infrastructure Management Manual and ISO 55000.

Benefits

The benefits of optimised life cycle decision-making include:

- corporate priorities are incorporated into decision-making
- formal decision-making techniques are applied to major projects and programmes
- critical assumptions and estimates are tested for sensitivity to results
- asset management objectives and targets are set based on formal decision-making techniques, which are supported by the estimated costs and benefits of achieving targets
- projects and programmes are optimised across all activity areas.

Consequences

AT is responsible for billions of dollars of public assets, so even small departures from best practice in asset management can lead to very large costs and risks.

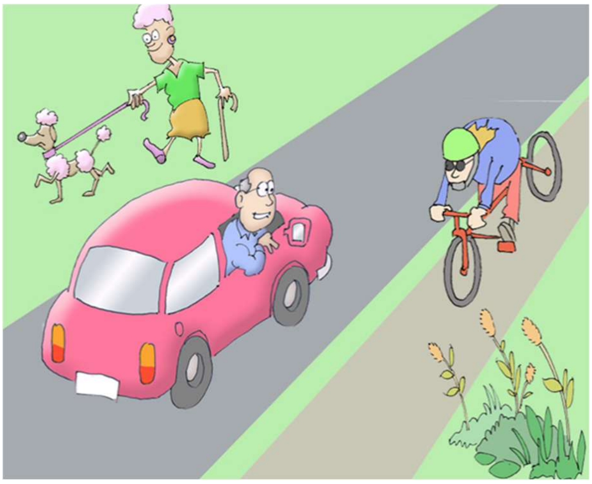
Asset management actions

- Continue to optimise life cycle management, based on whole-of-life costs and benefits.
- Continue to improve asset management information and systems, and implement the AMP improvement plan set out in Chapter 14.

6.8 Sustainability

6.8.1 Background

Infrastructure, such as roads and footpaths, and services, such as public transport, road safety, walking, cycling and travel plan initiatives, help shape Auckland's travel choices.



AT's legislative purpose is to contribute to an effective, efficient and safe Auckland land transport system in the public interest. The Government Policy Statement on Land Transport 2015–2025 defines public interest as "where it supports economic, social, cultural and environmental wellbeing".

Over time, transport systems can positively shape and catalyse improvements in these four well-beings to create liveable, sustainable cities.

6.8.2 Effective, efficient and enduring

Problem statement	Existing transport infrastructure falls short of AT's aspiration to provide an effective, efficient and enduring transport solution for a growing city, while maintaining those things about Auckland that we value as Aucklanders.
Problem description and evidence	Emissions from transport are 40 per cent of Auckland's total greenhouse gas emissions and have been relatively static since 2006. The land area required for transport is already significant and increasing. Active transport modes (cycling and walking) are not yet the norm, and there is an increasing trend towards physical inactivity across the population.
AT strategy	AT has developed a sustainability framework (48). The framework expresses our sustainability vision as four over-arching goals, which demonstrate how sustainability contributes to environmental, social, economic and cultural outcomes:. These goals are: • conserve and enhance the natural environment • meet the social and health needs of Aucklanders • foster jobs, growth and economic productivity • celebrate Auckland's unique identity.

Key options	Looking after what we have is the core responsibility of asset management. This includes successful suburbs that already have a compact city design and whose residents make a high proportion of trips by walking, cycling and public transport. Maintenance and renewals projects need to take into account what already works well in these successful suburbs, and ensure that these features are retained and valued over time. Asset management needs to support the expansion of the public transport network, safety programmes, speed management, and the walking and cycling networks. This will require a more flexible approach to what constitutes a renewal. The definition of a renewal is not necessarily to replace like with like, and there is flexibility to support AT's other initiatives by incorporating minor improvements within renewals projects. Renewals projects can be managed in a more sustainable way, for example by using suitable recycled materials, reducing sediment and toxic runoff, and incorporating good urban design features. Partnering with capital projects to achieve urban renewal offers the chance to re-design and re- prioritise the street environment for better social interaction and pedestrian accessibility. Transport infrastructure itself can be used as a banner to celebrate our unique cultural identity. New projects or significant renewals can incorporate designs that reflect the history and culture of a local area, into both their design and their signs.
Benefits	The benefits of implementing AT's sustainability framework will be measured in terms of our progress towards achieving the framework's four goals, as described above. The benefits of increasing the contribution that our maintenance and renewals programmes make to the strategy will be faster, more cost-effective progress towards these goals.
Consequences	The adverse consequence of not addressing Auckland's future environmental, social, economic and cultural needs would be a stagnant Auckland, which would see a decline in the quality of life for Aucklanders and give rise to a multitude of issues that could increase costs for all communities and the environment.
Asset management actions	• Increase the proportion of renewals projects that deliver sustainability improvements, rather than simply replacing like with like. This has the greatest impact for carriageway renewals (see Section 7.1), but has some impact on all asset management actions. • Increase renewals and maintenance budgets in line with the expansion of traffic systems, walking and cycling, and public transport infrastructure. • Continue the roll-out of energy efficient LED lighting.

7. Options and recommendations

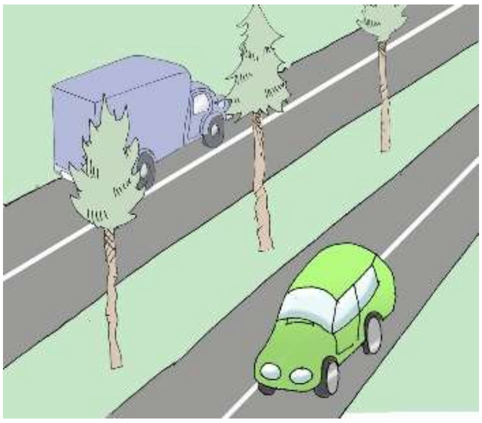
This chapter sets out, for each of the seven classes of assets that AT manages, our recommended actions to deliver the strategic priorities set out in Chapters 1 to 6. This includes:

- the specific aspects of the strategy that our asset management activities address
- the performance and levels of service measures and targets we will use
- how we propose to manage the asset class and prioritise the activities and investment relating to it in order to meet these measures and targets.

The seven asset management classes are:

- carriageway
- stormwater
- bridges, walls and structures
- footpaths and cycleways
- streetlighting
- traffic systems, signs and marking
- public transport.

7.1 Carriageway



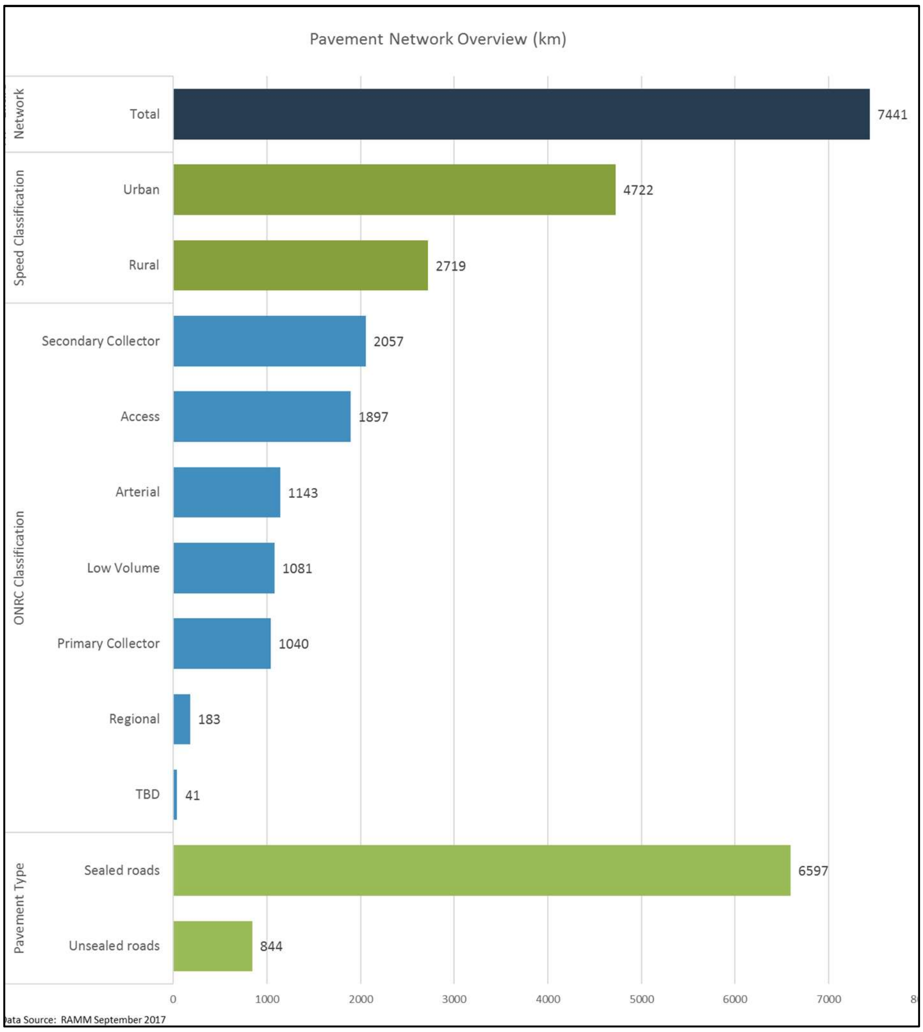
7.1.1 Asset inventory

AT is responsible for managing Auckland's local road network, which includes some of the busiest roads in New Zealand.

Figure 7-1 shows the major components and key statistics for this network. Some standout points from the data presented in this figure are:

- AT currently owns 7,391 kilometres of local roads, which it is responsible for maintaining and renewing to provide the outcomes its shareholders expect
- regional and arterial roads make up a small proportion of the network, but experience the majority of the network's travel demand (73 per cent).

Figure 7-1: Network overview



7.1.2 Links to the strategic case

This subsection sets out how our asset management activities for carriageways link to and deliver the strategic case.

Problem statement

AT's sealed road network is prone to damage and deterioration due to growth in its use by heavy vehicles, excessive traffic volumes, extreme weather events, intense utility corridors in urban areas, poor geology and thin pavements.

Addressing these issues will help achieve our strategic outcomes in the following areas.

Safety	Resilience	Amenity	Accessibility	Travel time reliability	Value for money	Lifecycle asset management	Sustainability
✔	-	✔	✔	✔	✔	-	✔

Benefits of addressing the problem

Ensures safety, and maintains amenity and travel time reliability, while optimising the life cycle management costs.

Consequences of not addressing the problem

Increased safety risks (due to faults in the road carriageway), poor response to growth requirements, low customer satisfaction, sub-optimal travel speeds, deteriorating network, and high maintenance and renewal costs over the expected life of the road carriageway.

7.1.3 Levels of service

The performance and asset service measures and targets for carriageways are listed in Section 15.1.

The most significant of these measures for the network are listed below. AT monitors these measures to diagnose the health of the network.

- ONRC Amenity CO1 – Smooth travel exposure: roughness of the road
- ONRC Amenity CO2 – Peak roughness
- ONRC Safety TO4 – Loss of control on wet roads
- ONRC Safety TO9 – Vulnerable road users
- ONRC Cost efficiency CE2 – Chipseal resurfacing
- ONRC Cost efficiency CE3 – Asphalt resurfacing
- NZ Transport Agency peer group charts – 3-year sealing rates and cost per unit
- LTP 1 Customer satisfaction
- LTP 2 Travel time and productivity – Congestion on the rise

7.1.4 Gap analysis

This subsection discusses how AT's carriageway assets are currently performing against the key measures identified in the previous subsection.

ONRC Amenity CO1 – Smooth travel exposure: roughness of the road

Smooth travel exposure is the amount of vehicle kilometres travelled on the local road network that are considered smooth.

AT has the best smooth travel exposure on its network amongst its metro peer group (Figure 7-3).

The standard measure of road roughness was developed in 1969 by the National Association of Australian State Road Authorities and is known as the NAASRA count. Seventy-five per cent of AT's sealed network has NAASRA values less than 115, while 95 per cent of the sealed network has NAASRA values less than 164 (Figure 7-2). It is considered that only 5 per cent of the network experiences a higher level of roughness.

As can be seen in the NAASRA values for low-volume and access roads (Table 7-1), a fairly small percentage of the network experiences high roughness.

ONRC

Regional

Arterial

Primary collector

Secondary collector

Access

Low-volume

Figure 7-2: Sealed network roughness distribution

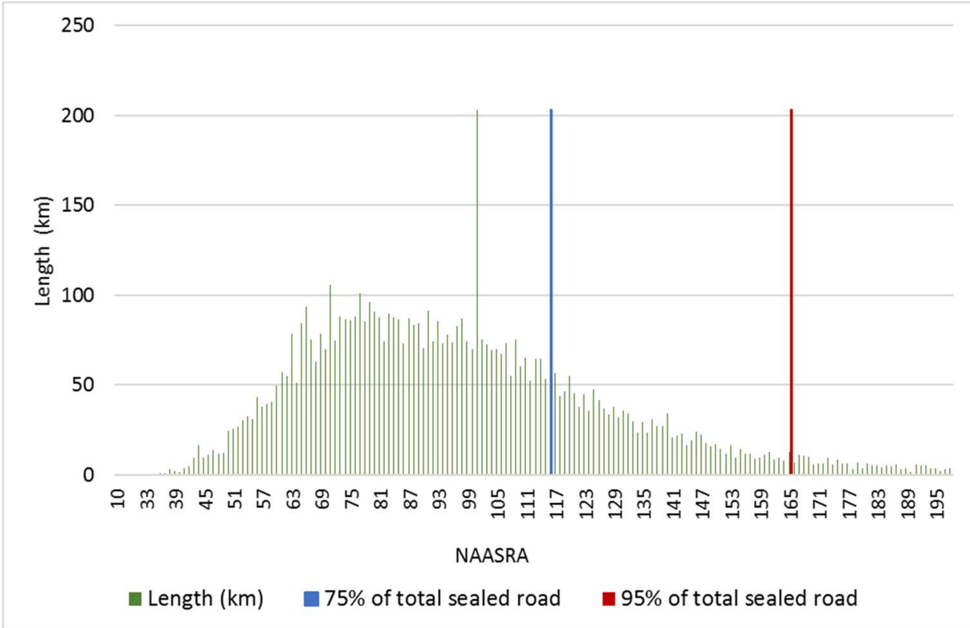
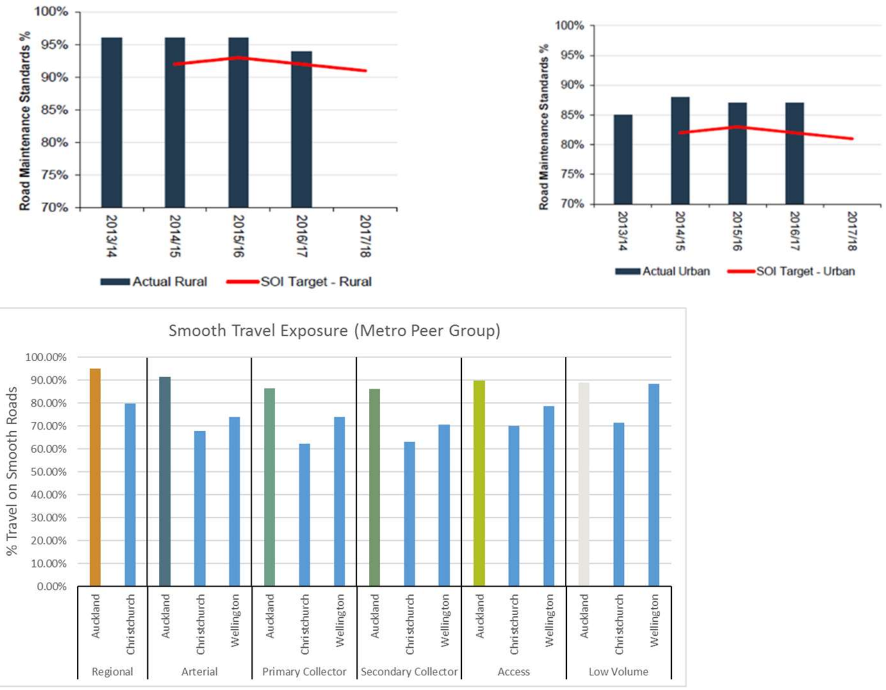


Table 7-1: Road smoothness by ONRC classification

ONRC classification	95th percentile NAASRA	Percentage of the network
Regional	98	0.14%
Arterial	122	0.87%
Primary collector	147	0.78%
Secondary collector	164	1.44%
Access	172	1.07%
Low-volume	226	0.70%

Conclusion: Smooth travel exposure across the network is stable. Auckland's busiest roads are performing well compared to other parts of the country. An opportunity exists to optimise renewal programmes to take advantage of the current fairly good roughness and smooth travel exposure distribution over the network.		
ONRC Amenity CO1 – Smooth travel exposure (continued)		*Figure 7-3: Smooth travel exposure*  *Source: ONRC reporting tool*

ONRC Amenity CO2 – Peak roughness

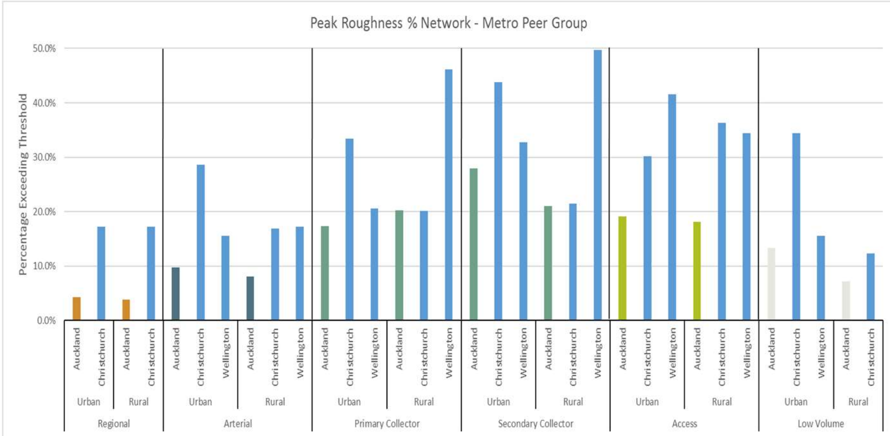
This measure checks that at least 95 per cent of the sealed roads in the network meet specified levels of ride comfort.

Figure 7-4 shows that Auckland has the lowest percentage of its network exceeding the 95 per cent threshold for roughness, when compared to its metro peer groups. This is true for both the rural and urban network, across all ONRC categories.

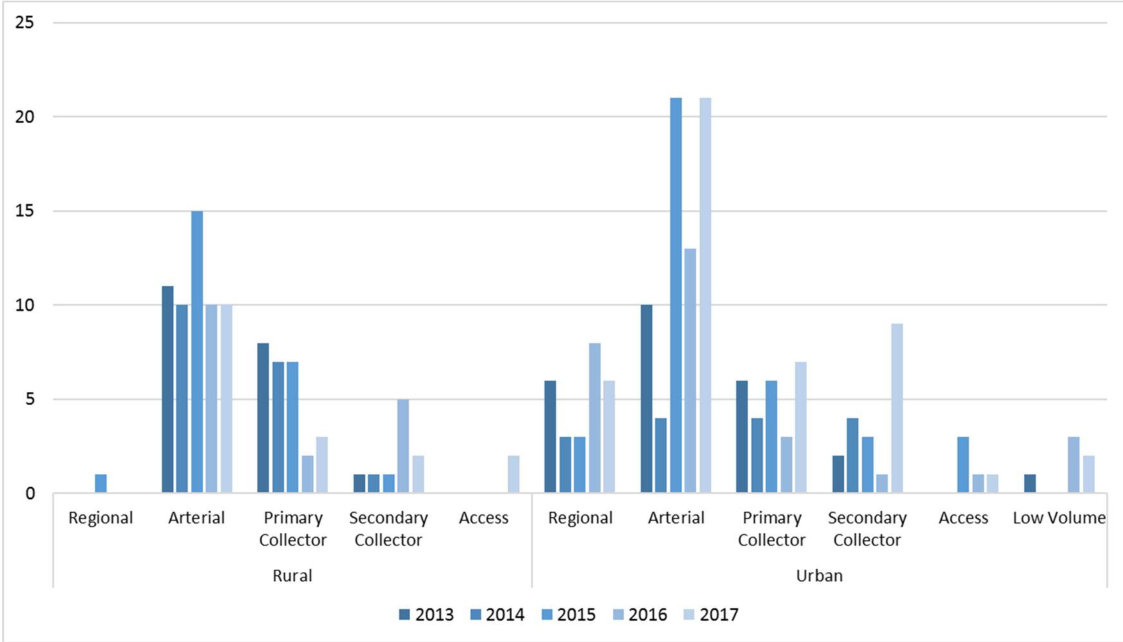
Conclusion: Comparatively, AT's network is performing well. However, there is a rising trend of increasing roughness on secondary collector and access roads.

ONRC	Urban	Rural
Regional		
Arterial		
Primary collector		
Secondary collector		
Access		
Low-volume		

Figure 7-4: Peak roughness by metro peer group



Source: ONRC reporting tool

ONRC Safety TO4 – Loss of control on wet roads This measure looks for trends in the number of serious and fatal injuries that are due to loss of control in wet conditions. The major proportion of crashes due to loss of control in wet conditions occurs on arterial roads. As can be seen from Figure 7-5, the crashes are almost equally split on the urban and rural network. **Conclusion:** There is a rising trend of deaths and serious injuries. Most of these crashes are on high-volume roads.	**Overall**	*Figure 7-5: Loss of control on wet roads*  Source: AT's road safety performance reporting tool, May 2018

ONRC Safety TO9 – Vulnerable road users

This measure looks for trends in the number of serious and fatal injuries of vulnerable road users. Vulnerable road users include motorcyclists, wheeled pedestrians, bicycle and moped users.

There is a rising trend of deaths and serious injuries of vulnerable users on the regional and arterial roads.

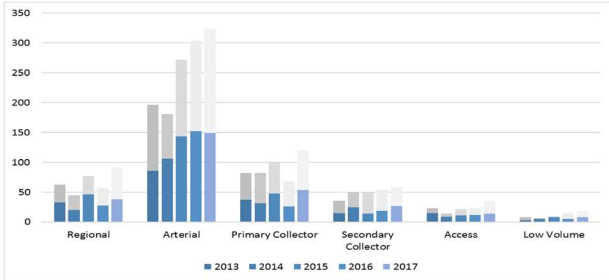
As can be seen from Figure 7-6, the majority of the road trauma for vulnerable users occurs on the urban network. This is due to the greater numbers of interactions between vulnerable users and vehicle traffic on this network.

Conclusion: There is a rising trend of deaths and serious injuries. Most of the crashes occur on high-volume roads.

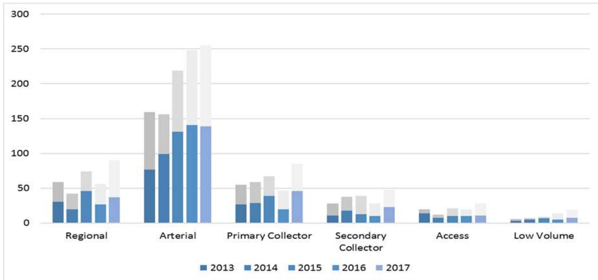
Overall

Figure 7-6: Vulnerable road users

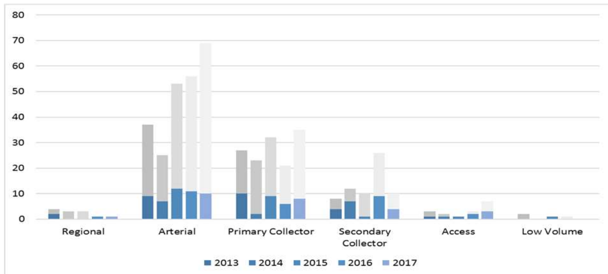
Total network



Urban



Rural



Source: Asset management team, May 2018

ONRC Cost efficiency CE2 – Chipseal resurfacing

ONRC Cost efficiency CE3 – Asphalt resurfacing

This measure looks at the average life achieved by chipseal and asphalt surfacing on the AT network.

Chipseal

AT is achieving a lower length of service for its chipseal network compared to the average life achieved by the national peer group (Figure 7-7).

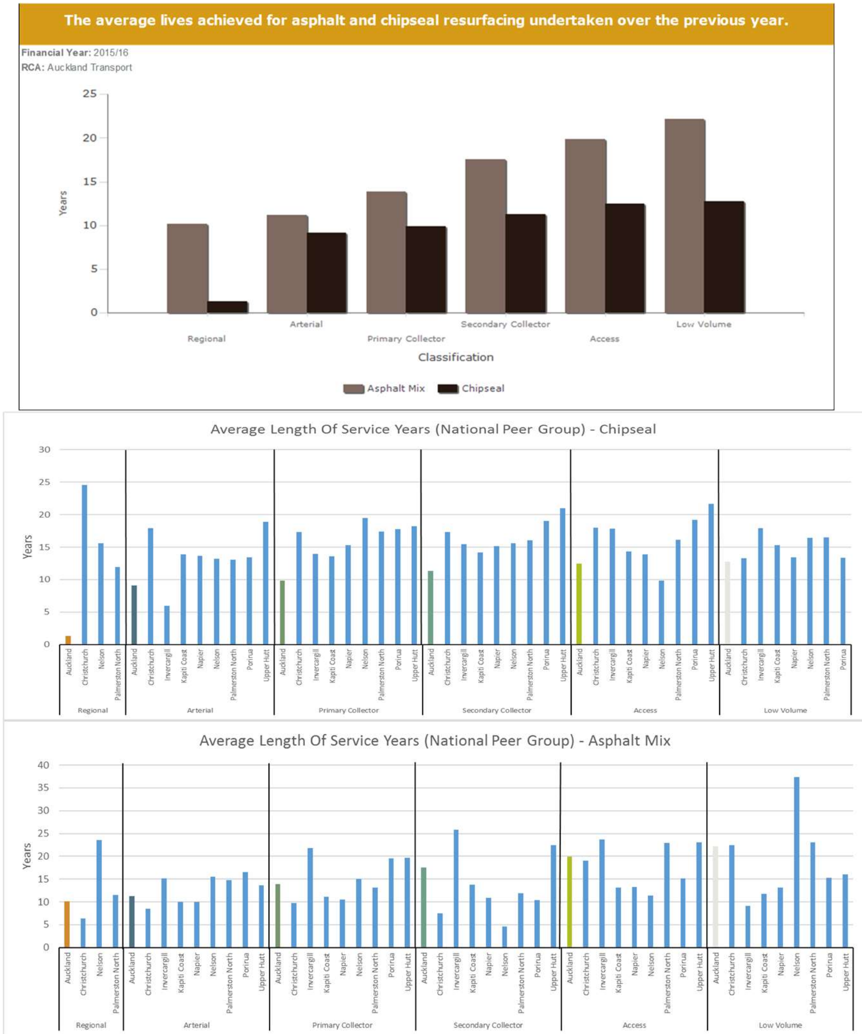
Asphalt

AT is achieving a similar length of service for its asphalt network compared to the average life achieved by the national peer group (Figure 7-7).

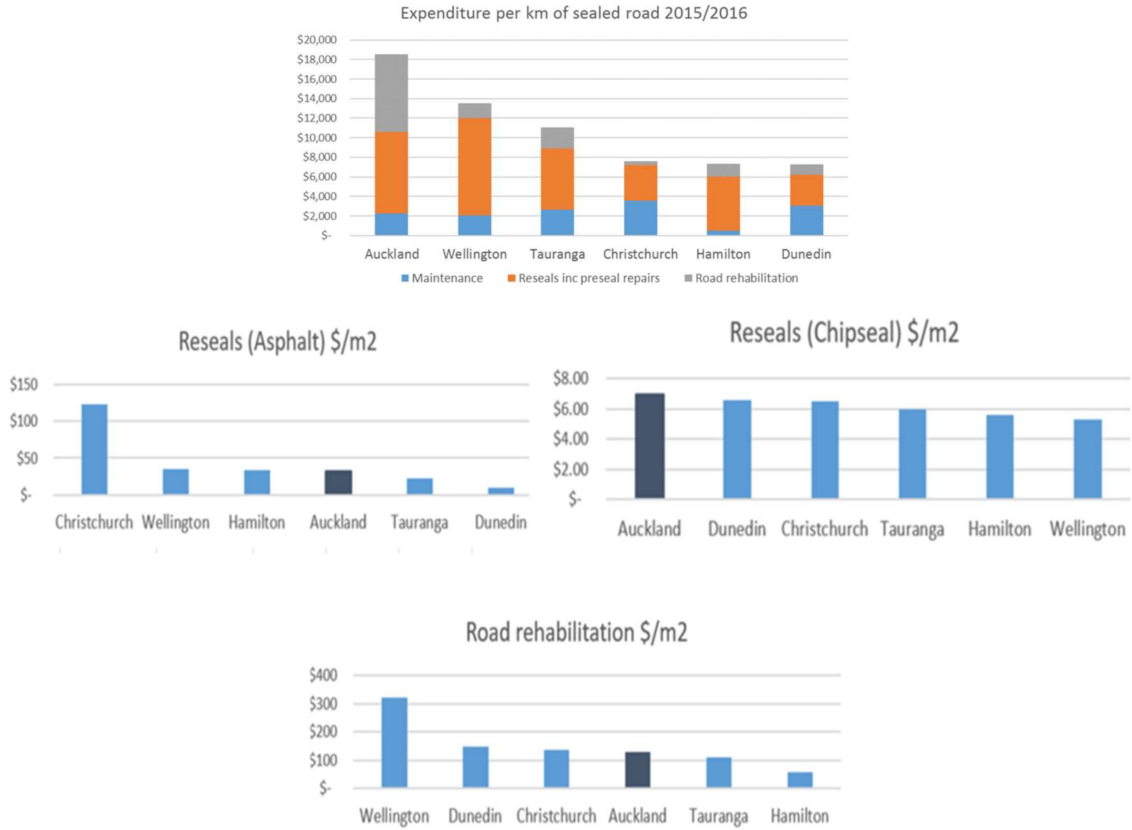
Conclusion: Roads experiencing higher traffic volumes have a lower service life. The chipseal network seems to perform poorly compared to the national average. However, the travel demand on AT chipseal roads is considerably higher than the national peer group.

ONRC	Chipseal	Asphalt
Regional	n/a	
Arterial	n/a	
Primary collector		
Secondary collector		
Access		
Low-volume		

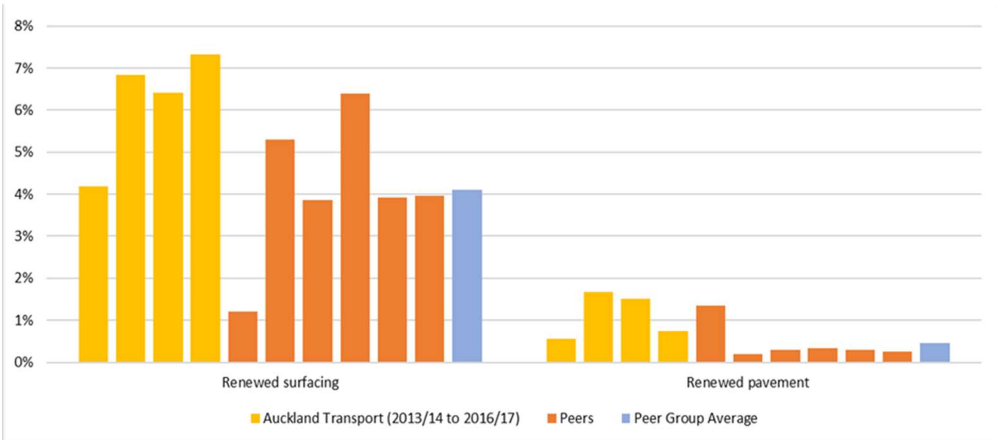
Figure 7-7: Average life of sealed surfaces

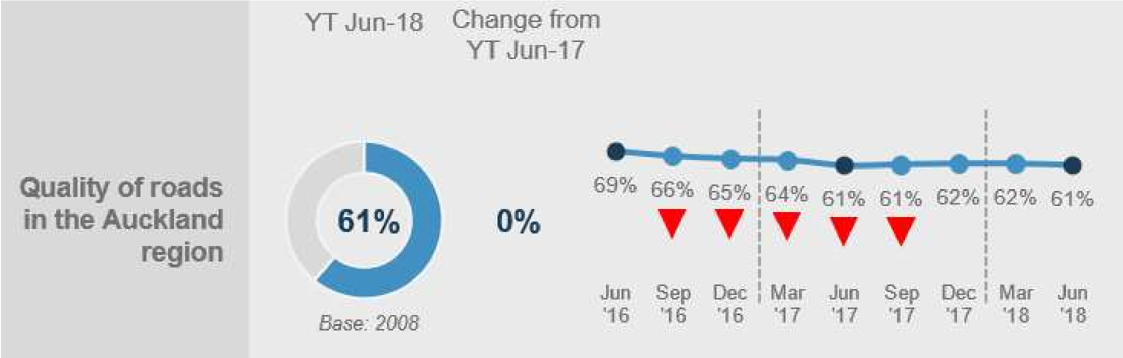


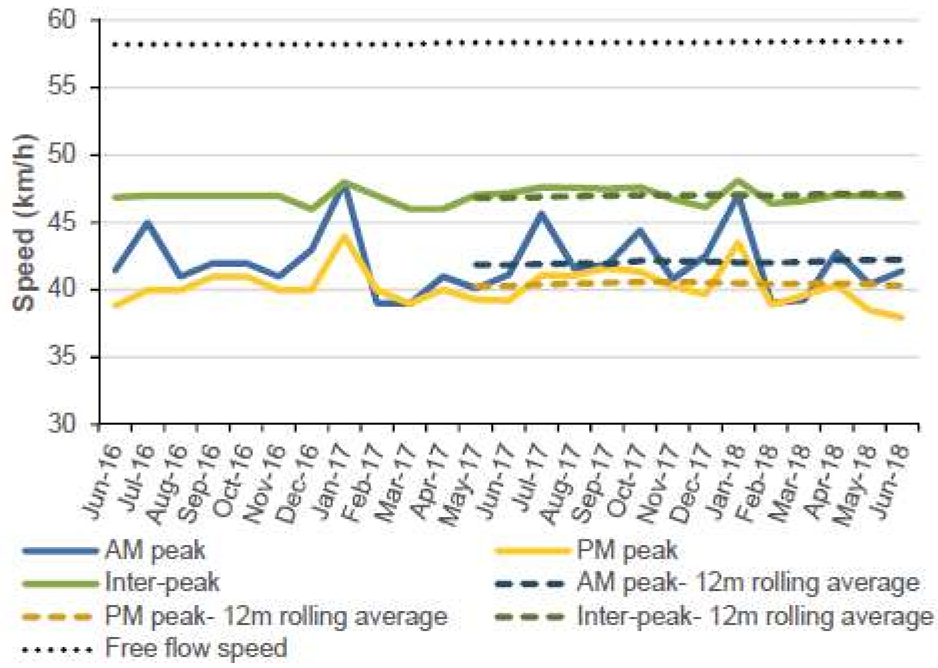
Source: ONRC reporting tool

NZ Transport Agency peer group charts – 3-year sealing rates and cost per unit AT is on average resealing 7 per cent of its network each year, compared to 3 per cent and 4.9 per cent for Christchurch and Wellington respectively (Figure 7-9). This is mainly due to the large number of vehicle kilometres travelled on the network, including heavy vehicles. A major concern is the 0.7 per cent of the network that is rehabilitated each year. As can be seen in Figure 7-8, rehabilitation expenditure per kilometre of sealed road is similar to the amount spent on reseals. The percentage of the network that is resealed and rehabilitated, when compared to the expenditure on each of the work categories, shows a clear value-for-money deficit that needs to be explored. Auckland's unit rates for reseals and rehabilitation, as delivered by contractors, demonstrate value for money. **Conclusion:** The level of road rehabilitation in the Auckland network	Overall resurfacing value for money Overall rehabilitation value for money	*Figure 7-8: Expenditure per kilometre of sealed road*  Source: NZ Transport Agency data and tools

needs to be reviewed to offer better value for money.		

NZ Transport Agency peer group charts – 3-year sealing rates and cost per unit (continued) AT also has a high renewal rate, which needs to be optimised.		*Figure 7-9: Percentage of network surfacing and pavement renewed annually* 

		Source: ONRC reporting tool
LTP 1 Customer satisfaction In June 2018, road user satisfaction with the quality of roads in Auckland was 61 per cent. During late 2016 and most of 2017, there was a trend of decreasing satisfaction (Figure 7-10). This is no longer the case, with customer satisfaction remaining stable (within the margin of error) since September 2017. **Conclusion:** Customer satisfaction levels are currently stable, but there was a recent negative trend.	**Overall**	*Figure 7-10: Percentage satisfaction of Auckland road users*  Source: AT

LTP 2 Travel time and productivity – Congestion on the rise Median travel speed figures are calculated across the entire urban arterial network. Over the past year, arterial network performance has been stable but remains well below free flow speeds (Figure 7-11). **Conclusion:** Arterial network speeds are currently stable but there is still significant delay relative to free flow speed, even outside of peak times.	**Overall**	*Figure 7-11: Median arterial speeds for the inter-peak and AM peak periods*  Source: AT's quarterly and monthly transport indicators

7.1.5 Impact of the gap analysis on levels of service

This subsection summarises how the issues identified in the gap analysis for carriageways will impact on levels of services, and sets out potential activities to alleviate these impacts.

Key customer outcomes affected	Level of service impacts and potential mitigating activities
Safety	The rise in road trauma in Auckland is a major concern. The main factors contributing to the rise are, for rural roads, loss of control, and for urban roads, travel mode conflicts, particularly with vulnerable users. Carriageway activities that can help alleviate these issues are: • providing adequate skid resistance • ensuring lines of sight, minimising obstructions and providing clear delineation • providing a uniform ride surface and minimising surface faults, such as potholes, scabbing and bleeding.
Travel time reliability	Growth in the Auckland region is leading to a significant decline in the reliability of peak travel times on the arterial network. Carriageway activities that can help alleviate this issue are: • allowing travel at appropriate speeds, by providing a uniform ride surface and minimising surface faults, such as potholes, scabbing and bleeding • providing appropriate maintenance and renewal activities that compensate for excessive wear and tear due to increased traffic, especially heavy commercial vehicles.
Amenity	The network performance is good, perhaps performing better than AT's metro peer group. Carriageway activities that can help achieve better value for money are: • providing maintenance and renewal activities to suit the network's fit-for-purpose levels of service • providing renewal activities that are better aligned with usage (especially for heavily trafficked arterial routes).
Life cycle management	AT needs to implement a renewal programme that mitigates for the loss of service potential of the network. Carriageway activities that can help alleviate this issue are: • undertaking rehabilitation to compensate for wear and tear of the road pavement

	• undertaking road resealing to maintain adequate levels of service for the ride surface and prevent water ingress into the road pavement.
Value for money	Taking into account the comparatively greater travel demands that the Auckland network experiences relative to its metropolitan peers, AT's renewal and maintenance activities (both the costs and the programme) are reasonable. However, new strategies could improve efficiency by: • increasing the seal age achieved from the network by reducing the resealing programme • focusing pavement rehabilitation works on the arterial and collector road network • directing maintenance and repair works towards extending pavement lives and minimising the need for more expensive pavement rehabilitation works • focusing on providing fit-for-purpose treatment types.

7.1.6 Options to address gaps in the network

AT has developed the following options to address the identified gaps in the network for its carriageway assets.

Option	Output	Benefits and consequences
Status quo Make no change to the current carriageway management approach, especially to maintenance, pavement rehabilitation and resealing activities.	The current regime is not optimised and business-as-usual continues. Carriageway activities will not deliver the major outcomes being sought through the strategic case.	Carriageway surface faults will contribute to travel delays, safety problems and vehicle operating costs. Decreased customer satisfaction with sealed road pavements. No improvement in congestion issues and the relatively high costs of carriageway activities will be borne by the public, despite deteriorating levels of service.
Optimisation without ONRC Optimise carriageway management activities, especially pavement rehabilitation, resealing, and maintenance,	Carriageway activities, especially the maintenance and renewal programmes and their related investment needs, are optimised. However, these activities are not fully aligned to address the issues and gaps in the network, and will struggle to	Improved safety for road users and reduced road trauma. The carriageway surface is of sufficient quality to support safe and efficient road use. Increased customer satisfaction with sealed road pavements. A more efficient transport system.

without applying the ONRC framework. Replace all assets when they fall into very poor condition, regardless of their ONRC category.	achieve the outcomes being sought through the strategic case.	Value for money is not realised for the agreed levels of service.
Optimisation with ONRC Optimise carriageway management activities, especially pavement rehabilitation, resealing, and maintenance, while applying the ONRC framework. Replace all assets when they reach the appropriate point on the levels of service scale, as aligned with the ONRC. This means renewing assets before they fail, but intervening later on less busy roads.	Carriageway activities, especially the maintenance and renewal programmes and their related investment needs, are optimised and aligned with the ONRC fit-for-purpose levels of service concept. These activities will start achieving the outcomes being sought through the strategic case. Efficiencies will be realised through this approach, as it is expected to reduce pavement rehabilitation and resealing activities.	Improved safety for road users and reduced road trauma. The carriageway surface is of sufficient quality to support safe and efficient road use. Increased customer satisfaction with sealed road pavements. A more efficient transport system. Value for money is realised for the agreed levels of service.
Run to failure Allow carriageway assets to run to failure before renewing.	This approach involves a minimum level of investment for maintenance, pavement rehabilitation and road resealing. There are no proactive renewals, but assets are replaced after they have failed. The approach is not sustainable in the long run, and will lead to a large backlog, poor levels of service, unhappy customers, and the need for substantial investment in the future to bring the network back to an acceptable level of service.	High requirement for investment in the future. An increase in road trauma (deaths and serious injuries). Carriageway surface faults contribute to travel delays, safety problems and vehicle operating costs. Decreased customer satisfaction with sealed road pavements. More congestion, and higher costs in the future borne by the public, despite deteriorating levels of service.

7.1.7 Recommended option

AT recommends adopting the 'optimisation with ONRC' option for the maintenance, operations and renewals of its carriageway assets, as it considers this the best option to deliver the strategic outcomes.

This option aims to deliver ONRC fit-for-purpose levels of service, and plans to renew assets before they fail, but with later intervention in relation to less busy roads.

7.1.8 ROM with ONRC

AT incorporates ONRC into its levels of service by managing its highest classification roads to the best appropriate standard and its lower classification roads to a lesser standard. This ensures that funding for renewals follows traffic volumes, user satisfaction and risk on a nationally accepted basis.

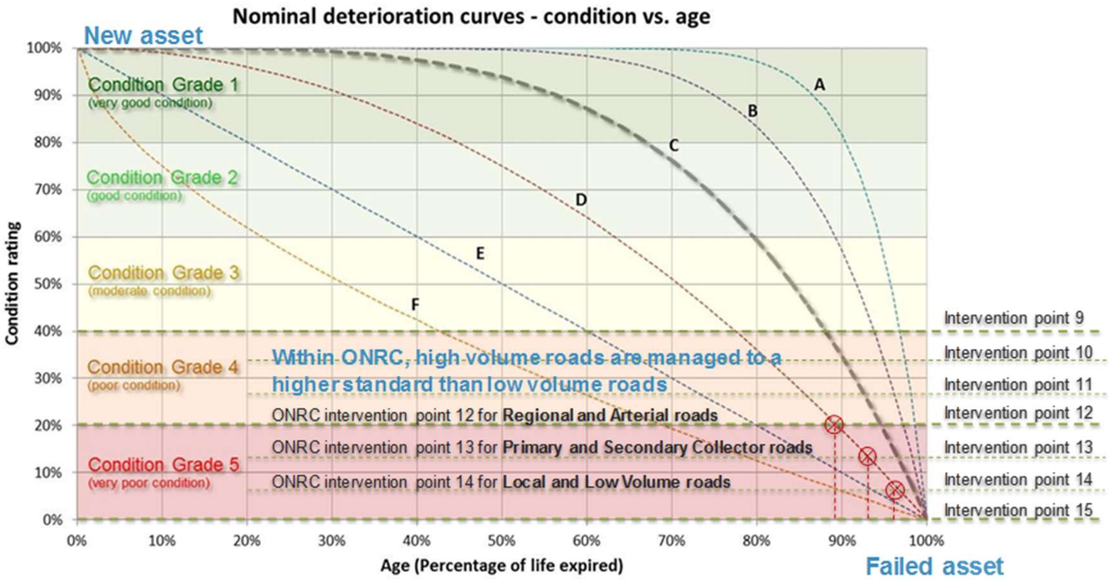
The renewals interventions required to deliver these ONRC outcomes are identified through AT's ROM. This model forecasts the expected future renewals needs of assets across the AT portfolio, based on the following asset-specific attributes and intervention policies.

- Asset attributes
  - Current measure and condition of the asset.
  - Expected life of the asset.
  - Rate at which the asset condition is expected to deteriorate over time.
  - Target condition profile to be achieved by the asset.
  - Planned growth of the asset.
  - Renewal cost rate of the asset.
- Intervention policies
  - Intervention point – the condition at which an asset is to be renewed, based on risk criteria.
  - Years to address backlog – time taken to clear assets that are currently in worse condition than the intervention point, i.e. assets with a condition that represents an unacceptable long-term risk.

All assets are assessed for condition based upon a number of deterioration criteria. The criteria are combined into a five-point grading scale, ranging from 1 (very good) through to 5 (very poor). These are interpolated into a 15-point scale within ROM. A deterioration curve and base life is also set for each asset classification and type. The interrelationship between asset life, deterioration, and intervention is shown in Figure 7-12.

Early renewals intervention minimises the risk of critical assets being in a poor condition. Delaying renewals for non-critical assets reduces costs, because the costs occur less frequently, but also creates additional risk, as a result of the assets being in poorer condition.

Figure 7-12: Asset life, deterioration and renewals intervention within ROM ONRC analysis



The ROM analysis uses ONRC outcome criteria to inform renewals intervention policies across key asset classes within the network, i.e. carriageway, bridges, stormwater, retaining walls and streetlighting. A subset of these assets (bridges and retaining walls) are considered to be high risk. All other assets are considered to be normal risk.

The intervention policies used in ROM reflect AT's tolerance for risk for each class and type of asset, and underpin the cost versus risk trade-off that occurs for all network assets, including those classified under the ONRC framework. This approach is summarised in Table 7-2.

Table 7-2: Risk versus intervention policy used within ROM

	ONRC category	Renewals intervention point for normal risk assets (carriageway, stormwater, streetlighting)	Renewals intervention point for high-risk assets (bridges and retaining walls)
ONRC categorised assets	Regional and arterial roads	Condition grade 12	Condition grade 9
	Primary and secondary collector roads	Condition grade 13	Condition grade 10
	Access and low-volume roads	Condition grade 14	Condition grade 11
Non-ONRC categorised assets (footpaths, public transport etc)	N/A	Condition grade 12	Condition grade 9

7.1.9 Recommended programme and investment plan

The recommended 'optimisation with ONRC' option will deliver safety, amenity, travel time, life cycle management and value for money outcomes by implementing:

- a reduced pavement rehabilitation programme
- a reduced road resealing programme
- a slightly increased road maintenance programme, which will take into the account the impact of growth in the region.

This approach is illustrated in the comparison of three-year investment requirements, shown in Table 7-3.

Table 7-3: Cost of the current and recommended maintenance and renewals programme for carriageway

Forecast Category ($ millions)	Current			AMP 2018-2021		
	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021
Maintenance and Operations (asset-based)	$37.7	$42.1	$43.2	$40.8	$41.5	$43.1
Renewals	$131.4	$150.7	$141.2	$98.4	$104.1	$118.6
Total	$169.1	$192.8	$184.3	$139.3	$145.5	$161.7

The details of these recommended programmes are given below.

Operations and maintenance

AT's strategy for the maintenance and operation of its carriageway assets includes continuing using the 2017/2018 actual investment as the base, but adding an additional investment to cater for the growth of the network and increased demand.

The consequential opex needed to cater for growth has been assessed as equal to the rate of growth of the sealed road network, which is currently approximately 40 kilometres per annum. This approach will result in the operations and maintenance investment programme shown in Figure 7-13 and Tables 7-4 to 7-6.

Figure 7-13: Carriageway maintenance and asset-based operations costs

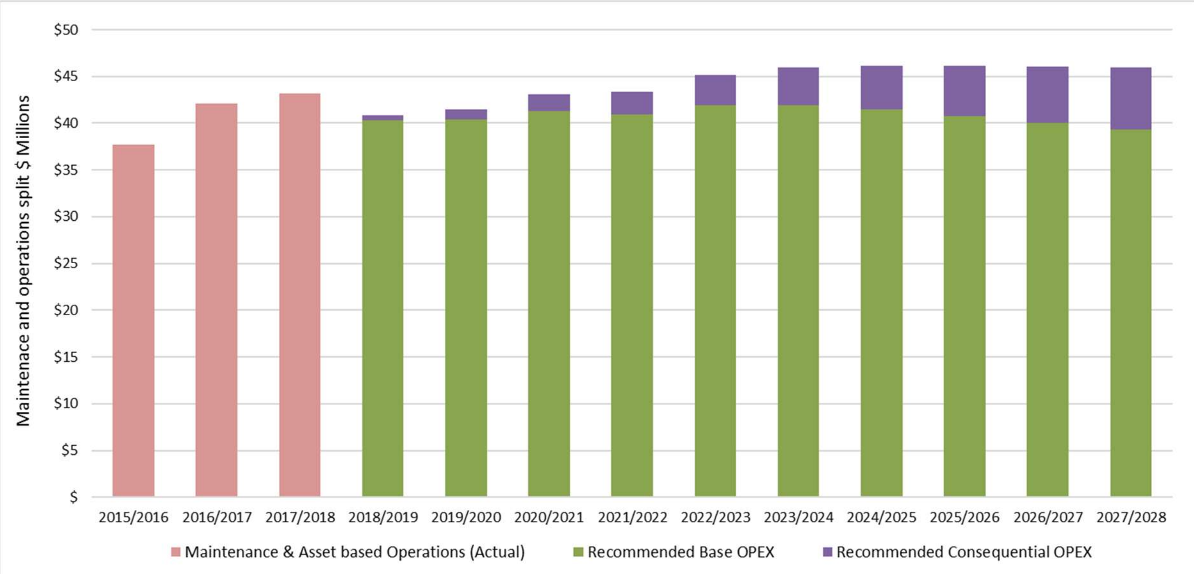


Table 7-4: Carriageway maintenance and asset-based operations costs

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	$31.8	$32.2	$29.8	$30.5	$32.1	$32.4	$34.1	$34.9	$35.1	$35.1	$35.0	$35.0
Asset based operations	$10.3	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0
Total	$42.1	$43.2	$40.8	$41.5	$43.1	$43.4	$45.1	$45.9	$46.1	$46.1	$46.0	$46.0

Table 7-5: Carriageway maintenance and asset-based operations costs: Baseline investment (existing assets)

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	$31.8	$32.2	$29.3	$29.4	$30.3	$30.0	$30.9	$30.9	$30.4	$29.7	$29.0	$28.3
Asset based operations	$10.3	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0	$11.0
Total	$42.1	$43.2	$40.3	$40.4	$41.3	$41.0	$41.9	$42.0	$41.4	$40.8	$40.0	$39.3

Table 7-6: Consequential opex needed to cater for the impact of growth

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Annual Plan)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	-	-	$.5	$1.1	$1.8	$2.4	$3.2	$4.0	$4.7	$5.3	$6.0	$6.6

Source: AT (SAP), August 2018

Key aspects of this investment programme are:

- operation and maintenance activities will be aligned with the ONRC hierarchy of roads, with more funds allocated to higher classes of roads due to the relatively higher levels of service they deliver
- the impact of growth will be catered for by using the consequential opex allocation.

Renewals

The recommended option for renewals is to adopt the delayed renewal intervention approach, which will reduce road rehabilitation and resealing. This will be achieved by adopting the approach described in Section 7.1.8.

This approach will result in a short-term reduction in renewals needs, as work will be delayed by sweating the asset. Over time, growth in the road network and the impact of past construction cycles will mean that renewals requirements will gradually increase.

The renewals programme has also been adjusted downwards to account for an estimated $15 million of renewals being delivered as part of capital projects every year. This approach will result in the renewal investment programme shown in Figure 7-14 and Tables 7-7 to 7-9.

Figure 7-14: Carriageway renewal costs

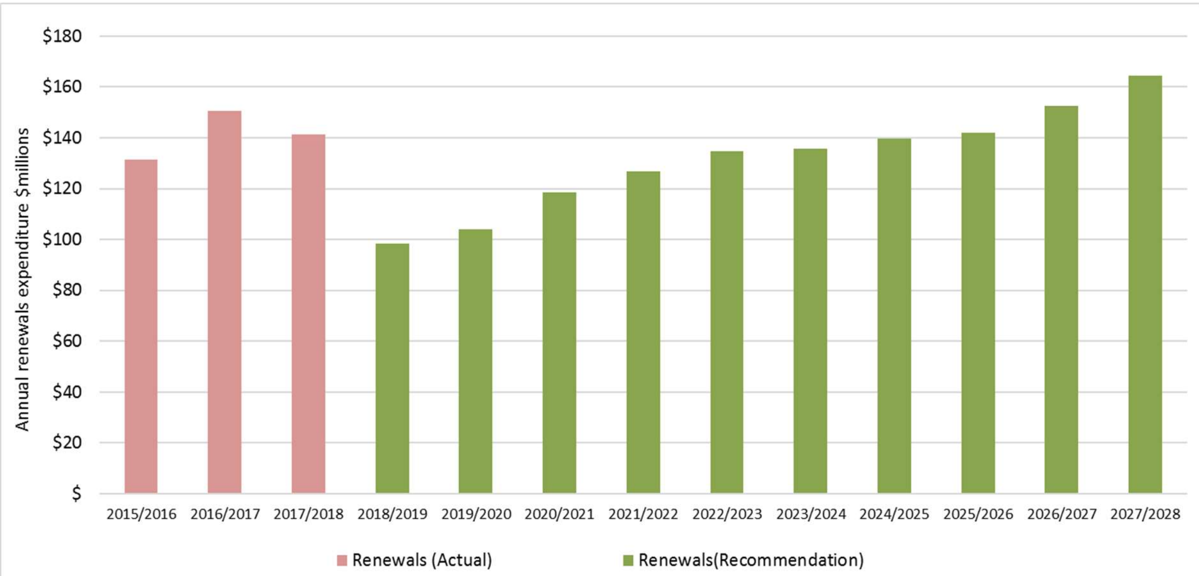


Table 7-7: Carriageway renewal costs

Forecast Category ($millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Renewals (Actuals)	$138.7	$158.8	$143.2										
Renewals (Recommended)				$98.4	$104.1	$118.6	$126.6	$134.6	$135.7	$139.6	$142.1	$152.7	$164.3

Table 7-8: Renewal programme cost details

Forecast Category ($ millions)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Pavement base renewals	$24.4	$26.8	$33.0	$36.5	$39.9	$40.4	$42.0	$43.1	$47.6	$52.6
Pavement surface asphaltic concrete renewals	$36.3	$38.5	$43.9	$46.8	$49.8	$50.2	$51.7	$52.6	$56.5	$60.9
Pavement surface chip seal renewals	$19.7	$20.8	$23.7	$25.3	$26.9	$27.1	$27.9	$28.4	$30.5	$32.8
Pavement pre-reseal repairs	$16.0	$16.0	$16.0	$16.0	$16.0	$16.0	$16.0	$16.0	$16.0	$16.0
Unsealed pavement renewals	$2.0	$2.0	$2.0	$2.0	$2.0	$2.0	$2.0	$2.0	$2.0	$2.0
Total	**$98.4**	**$104.1**	**$118.6**	**$126.6**	**$134.6**	**$135.7**	**$139.6**	**$142.1**	**$152.7**	**$164.3**

Source: AT (SAP), August 2018

Note: Includes costs for technical support services including design and project management

Using average indicators, this investment plan will facilitate completion of the renewals activities detailed in Table 7-9.

Table 7-9: Renewals investment plan

Asset class	Asset type	Unit (000)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	Annual average
Carriageway	Base	m2	235	258	319	348	376	377	392	403	449	501	366
	Asphaltic Concrete	m2	1,145	1,213	1,398	1,500	1,601	1,605	1,657	1,692	1,830	1,978	1,562
	Chipseal	m2	2,330	2,492	2,889	3,118	3,348	3,393	3,509	3,568	3,812	4,064	3,252

Financial Year (km)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Pavement base	15	17	21	23	26	26	27	28	31	34
Pavement Surface Asphaltic Concrete	122	129	149	159	170	171	176	179	193	209
Pavement Surface Chip seal	291	308	354	379	404	407	419	427	460	496
Total	428	454	524	561	600	604	622	634	684	739

Source: ROM, July 2017

Detailed investment plan and indicative programme per management is available in section 15.12.

Under this renewals programme and level of investment, the condition profile of the network will vary as indicated in Figure 7-15.

Figure 7-15: Impact of renewals recommendations on the condition of the road pavement base

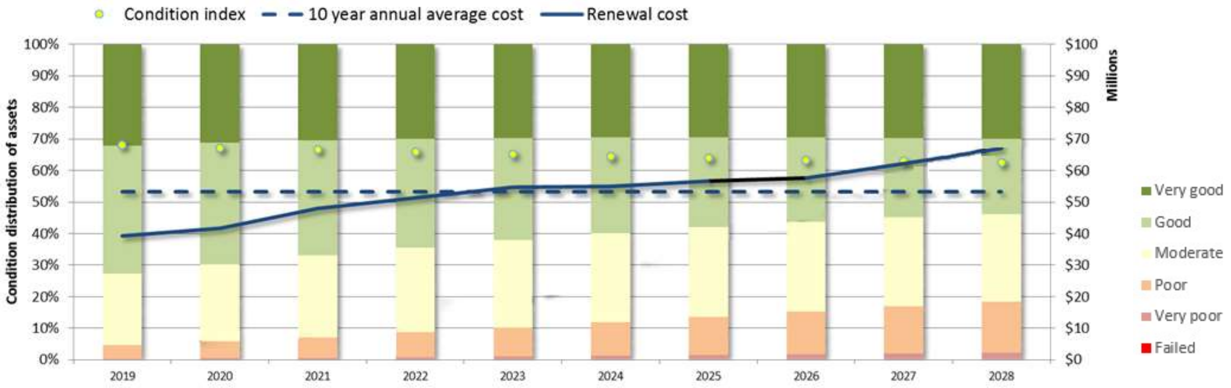


Figure 7-15b: Impact of renewals recommendations on the condition of asphalt pavement surfaces

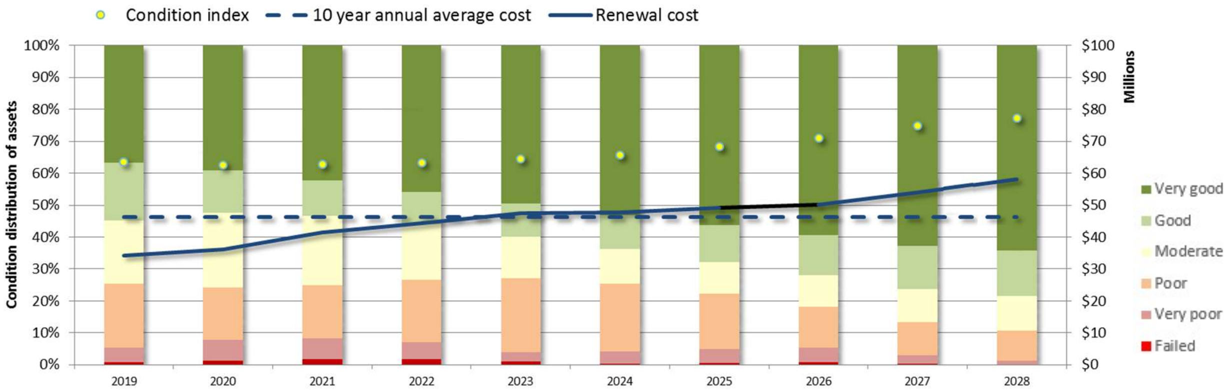
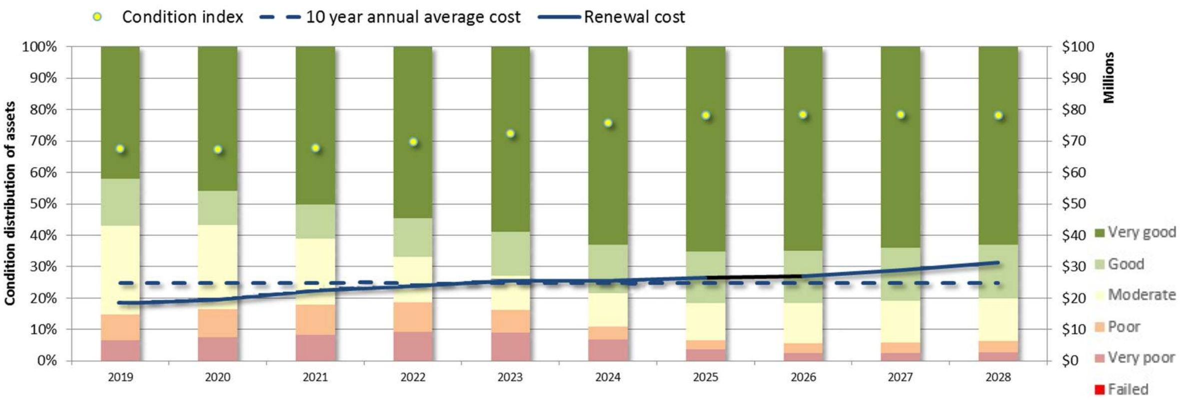


Figure 7-15c: Impact of renewals recommendations on the condition of chipseal surfaces



Percentage in very poor condition	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Carriageway	3.2%	4.1%	4.4%	4.5%	4.0%	3.4%	2.8%	2.7%	2.5%	2.6%

Source: ROM (July 2017)

As can be seen, the condition indexes for asphaltic concrete and chipseal pavement surfaces remain stable and will improve slightly over the next 10 years. This is essential to ensure all road surfaces remain waterproof, irrespective of their ONRC category, and will compensate for the significantly reduced pavement rehabilitation programme for the less busy roads.

The average seal lives of the road surfaces will also increase over the next three years from the current average of 14 years for asphalt surfaces and 12 years for chipseal surfaces, to approximately 16 years, as illustrated in Table 7-10.

Table 7-10: Seal lives (age of road surfaces resealed) under the recommended carriageway programme

	Average Life Achieved (Years) asphalt surfaces			
	Current (4-year avg to 2016/17)	2019	2020	2021
Regional	10	17	17	16
Arterial	11	17	16	15
Primary Collector	13	16	16	14
Secondary Collector	17	22	21	20
Access	19	18	17	14
Low Volume	22	20	20	17
Asphalt total	**14**	**18**	**18**	**16**

	Average Life Achieved (Years) Chipseal surfaces			
	Current (4-year avg to 2016/17)	2019	2020	2021
Regional	n/a	n/a	n/a	n/a
Arterial	n/a	n/a	n/a	n/a
Primary Collector	11	18	15	12
Secondary Collector	12	18	16	13
Access	14	19	16	13
Low Volume	15	17	16	14
Chipseal total	**12**	**17**	**16**	**14**

7.1.10 Monitoring carriageway performance and condition trends to manage risks

Under this AMP, the proposed programmes and investment levels for carriageway assets includes:

- maintaining a consistent level of activity for road sealing, compared both with the previous 3-year period of 2015 to 2018 and the next 3-year period of 2018 to 2021
- significantly reducing road pavement rehabilitation activities, when compared with both the previous 3-year period of 2015 to 2018 and the next 3-year period of 2018 to 2021.

There is an element of risk in this proposed approach, as it can potentially lead to an increase in road pavement maintenance needs due to the reduced rehabilitation programme. The modelled data suggests this is a highly unlikely event. However, this risk needs to be managed by implementing a monitoring regime to assess any unforeseen deterioration of pavement performance and trends. If necessary, the road pavement maintenance regime also needs to be able to address any unforeseen pavement faults.

7.1.11 dTIMS and AMP recommendations compared

The recommendations of this AMP were compared with those from Deighton Total Infrastructure Management System (dTIMS), a software application which is used nationally and internationally for multi-year programming of road works.

Tables 7-11 and 7-12 compare the annual average cost and programme recommended in this AMP with the outputs from running the dTIMS model for Auckland.

Table 7-11: Carriageway renewals programme costs, AMP and dTIMS recommendations

Renewals 10-year annual average renewals cost ($m)									
	Asset management recommendation	dTIMS optimised recommendation							
		Least Cost	Very Low	Low ($90m)	Normal ($100m)	High ($110m)	Very high ($120m)	Specified	Trigger
Rehab	$35.3 m	0	13.8	20.8	28.8	38	48	61.8	119.5
Asphaltic concrete	$46.2 m	11.4	48.9	51.7	53.5	54.2	54.1	42.4	35.9
Chipseal	$24.8 m	10.9	16.7	16.9	16.9	17	17	19.1	6.9
Total	**$106.3 m**	**22.3**	**79.4**	**89.4**	**99.2**	**109.2**	**119.1**	**123.3**	**162.3**

Table 7-12: Indicative programme for carriageway renewals

Renewals 10-year annual average renewals length (km)								
	Asset management recommendation	dTIMS recommendation						
		Least Cost	Very low ($80m)	Low ($90m)	Normal ($100m)	High ($110m)	Very high ($120m)	Trigger
Rehab	38 km	0	6.7	10.7	15.5	21	27.1	99.5
Asphaltic concrete	164 km	31	148.4	159.5	165.8	168	168.1	107.5
Chipseal	342 km	207.1	315.6	317.8	319.9	320	320	130.3

Points to note are:

- dTIMS rehabs exclude routine and pre-seal repairs; while the asset management recommendation includes pre-seal repairs as part of the road rehab cost
- the asset management recommended rehab cost and kilometres are comparable with the dTIMS normal to high recommendation range
- the asset management recommended asphaltic concrete cost is comparable with the dTIMS very low recommendation, but the kilometres are more aligned to the dTIMS high recommendation
- the asset management recommended chipseal cost and kilometres are higher than the dTIMS recommendation by approximately 7 per cent.

7.1.12 Forward works programme

AT creates its forward works programme for its carriageway assets in order to schedule works based on the recommended investment plan in this AMP. This plan aims to optimise network performance while meeting all key strategic goals.

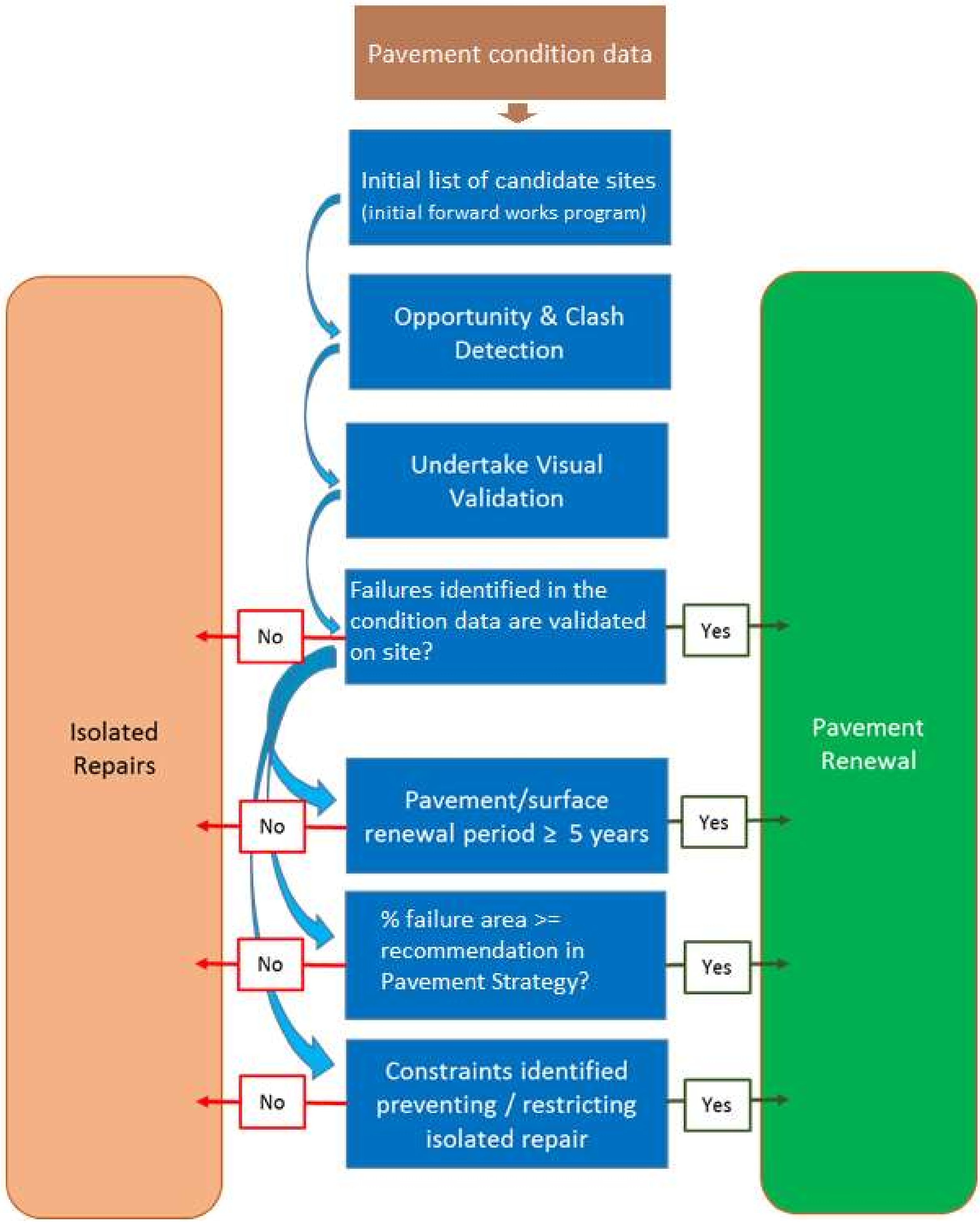
Projects for road renewals (pavements and reseals) are initially selected using dTIMS outputs, a treatment selection algorithm and the current forward works programme. These potential projects are then validated in the field and further refined based on local knowledge and project coordination needs. AT has also recently started using its pavement strategy and project justification reports to improve the robustness of its forward works programme.

Road carriageway renewals are programmed for up to three years in advance. The criticality of the renewal decreases with time, so that sites listed for renewal in year one are those considered most in need of repair.

Decisions about isolated repairs are typically based on ongoing network inspections by maintenance contractors. They are also informed by the observations of AT project managers and AT customers. Both pavement renewals and isolated repairs are condition-based decisions. However, pavement renewals are often proactive, while isolated repairs are generally more reactive decisions.

The pavement renewal decision process is documented in Figure 7-15. The project justification report template is included as a supplementary document, in Section 15.7.

Figure 7-16: Pavement renewal decision process



Source: AT pavement strategy

Table 7.13 summarises AT's current forward works programmes for carriageways. A detailed forward works programme project list can be found in AT's Asset Class Management Plan for Road Carriageway.

Table 7-13: Summary of carriageway Renewals Forward Works Programme

Programme year	Activity type	Proposed work ('000 sqm)	Estimated cost (millions)
2018/19	Renewal - Pavement Rehabilitation	107	$18
	Renewal - Thin Asphaltic Concrete	992	$32
	Renewal - Chipseal	2,641	$19
2018/19 Total		3,740	$68
2019/20	Renewal - Pavement Rehabilitation	445	$76
	Renewal - Thin Asphaltic Concrete	1,861	$57
	Renewal - Chipseal	3,125	$22
2019/20 Total		5,431	$154
2020/21	Renewal - Pavement Rehabilitation	151	$27
	Renewal - Thin Asphaltic Concrete	1,341	$42
	Renewal - Chipseal	2,252	$15
2020/21 Total		3,744	$83
Grand Total		12,916	$306

Source: Renewals forward works programme, July 2018

Note: The table includes an element of over-programming and details are still being finalised

7.2 Stormwater

7.2.1 Asset inventory

AT is responsible for those stormwater assets that are located in the road corridor, and that dispose of stormwater run-off from the road corridor. Table 7-14 provides an overview of AT stormwater assets.

Table 7-14: Stormwater asset overview

Asset Class	Asset_Type	Unit	Measurement
Stormwater	Catchpits	each	59,833
	Manholes	each	6,344
	Soakholes	each	2,487
	Kerb and Channel	km	8,627
	Minor Culverts	km	244
	Surface Water Channel	km	4,097

Source: RAMM, October 2017

Auckland Council is responsible for Auckland's reticulated stormwater network. Water supply and wastewater are the responsibility of Watercare, another of Auckland Council's council-controlled organisations.

7.2.2 Links to the strategic case

This subsection sets out how our asset management activities for stormwater link to and deliver the strategic case.

Problem statement

Transport functionality and safety are compromised when carriageways and pavements are adversely affected by stormwater run-off.

Addressing this issue will help achieve our strategic outcomes in the following areas.

Safety	Resilience	Amenity	Accessibility	Travel time reliability	Value for money	Lifecycle asset management	Sustainability
✓	✓	✓	✓	✓	x	-	✓

Benefits of addressing the problem

- Enables journeys that would otherwise be prevented or diverted because of weather events.
- Reduces or avoids risks to travellers from encountering flood damage or water on the carriageway.
- Protects assets, including the carriageway pavement and surface, from the adverse effects of stormwater.
- Minimises the flooding risk to properties.

Consequences of not addressing problem

Carriageway pavements and surfaces will deteriorate prematurely due to flooding, flood-borne debris, scour or slips. This will increase safety risks, and lead to low customer satisfaction, a risk of network restrictions, and high maintenance and renewal costs over the expected life of the assets.

7.2.3 Levels of service

The performance and asset service measures and targets for stormwater are listed in Section 15.1.

AT monitors these measures to diagnose the health of the network.

- ONRC Safety TO2 – Temporary hazards
- ONRC Safety TO7 – Hazardous faults
- ONRC Safety TO9 – Vulnerable users
- ONRC Safety TO10 – Roadside obstructions
- ONRC Resilience CO1 – The number of journeys impacted by unplanned events
- ONRC Resilience CO2 – The number of instances where road access is lost
- ONRC Cost efficiency CE5 – Overall network cost
- LTP 1 Life-cycle management – Proportion of assets in poor and very poor condition

7.2.4 Gap analysis

This subsection discusses how AT's stormwater assets are currently performing against the key measures identified in the previous subsection.

<table>
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ONRC Safety TO2 – Temporary hazards

ONRC Safety TO7 – Hazardous faults

ONRC Safety TO9 – Vulnerable users

ONRC Safety T10 – Roadside obstructions

Conclusions: Storm events pose high safety risks. AT's operations and renewals investment needs to be reviewed to attain an optimal risk mitigation and asset conservation strategy.

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As discussed in Section 6.2, a storm event in March 2017 caused a major culvert blockage and subsequent washout of an embankment on Great North Road in New Lynn, which undermined the footpath areas. A second event in April resulted in further collapse of the part of the carriageway that formed a slip lane.

The NZ Transport Agency co-funds repairs for storm damage, with additional funding available where the costs of storm damage exceed 10 per cent of the annual maintenance budget. For Auckland, this would need to exceed $21 million in any one year before AT would qualify for this funding. Table 7-15 shows storm damage costs over the past five years. The five-year average is $4.6 million a year.

Table 7-15: Costs related to storm damage

Emergency works $000s	2013	2014	2015	2016	2017
Operations (initial response)	$2,503	$3,517	$2,404	$1,126	$9,759
Renewals (repairs)			$3,730	$124	$265
Total	**$2,503**	**$3,517**	**$6,134**	**$1,250**	**$10,024**

When storms occur, AT reprioritises its maintenance and renewals programme in order to fund storm damage repairs. However, allocating a budget in the region of $5 million a year for storm damage seems prudent.

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ONRC Resilience CO1 – The number of journeys impacted by unplanned events **ONRC Resilience CO2** – The number of instances where road access is lost **Conclusions:** Inundation of stormwater assets causes high disruption to journeys and travel time irregularities.	Stormwater and drainage contributes to network resilience, and failure of these assets can cause flooding, road collapse and road closures, along with increased risk and significant levels of customer dissatisfaction. This was evidenced in the Great North Road example, as discussed in Section 6.2 and above. Closer collaboration with Auckland Council's Healthy Waters team has shown many synergies, which we can apply when analysing the AT stormwater network.

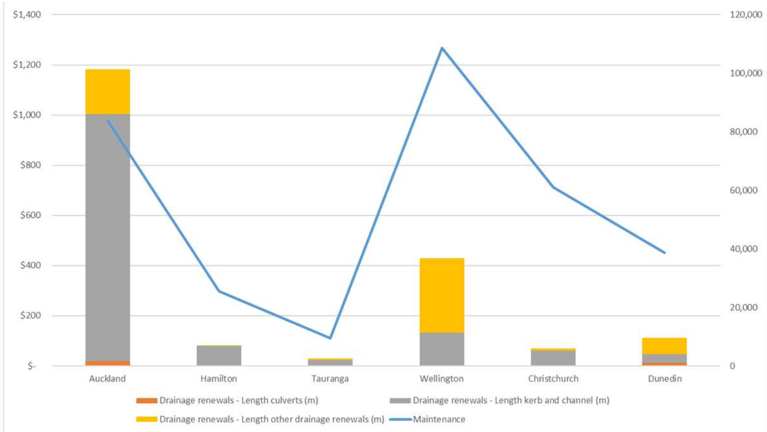
ONRC Cost efficiency CE5 – Overall network cost

Conclusions: Maintenance and emergency works demonstrate good value for money. Outcomes from the renewals strategy are required to demonstrate better value for money.

The cost of AT's stormwater drainage is higher than for others in its metro peer group, particularly in relation to renewals (Figure 7-17). Renewals work must be tested to see if it provides the benefits associated with the problem statement, by asking whether it:

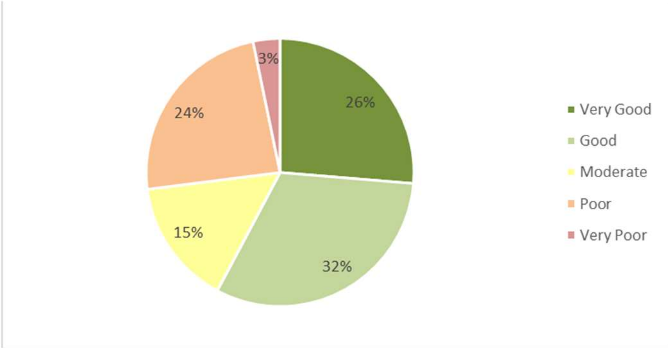
- enables journeys that would otherwise be prevented or diverted because of weather events?
- avoids or limits risks to travellers from encountering flood damage or water on the carriageway?
- protects pavement assets against deterioration caused by water ingress?

Figure 7-17: Expenditure on drainage per kilometre of sealed roads in network



Source: NZ Transport Agency transport data and tools

AT drainage investment in 2016 was greater than $20 million. This investment was partly co-funded by the NZ Transport Agency. The total cost of drainage has been gradually declining. This was initially due to lower maintenance costs, then later due to a reduction in renewals investment.

LTP 1 Life cycle management – Proportion of assets in poor and very poor condition (including those in unknown condition) **Conclusions:** Taking into account the current condition profile, the majority of stormwater assets are in very good to moderate condition.	RAMM data suggests a small percentage of the stormwater network is in poor condition (Figure 7-18). Ongoing data improvement will enable AT to predict where and when critical assets may fail. *Figure 7-18: Asset condition profile*  Source: RAMM, July 2017 At present, 40 per cent of stormwater assets are due for condition reassessment. Of those assets whose current condition is known, 73 per cent are in very good to moderate condition. AT is currently working to update its RAMM data tables in collaboration with Auckland Council's Healthy Waters team. This will give a more robust overview of the network and enable more informed decision-making in future.

7.2.5 Impact of the gap analysis on levels of service

This subsection summarises how the issues identified in the gap analysis for stormwater will impact on levels of services, and sets out potential activities to alleviate these impacts.

Key customer outcomes affected	Level of service impacts and potential mitigating activities
Safety	Storm events in Auckland can pose a significant safety risk to road users and may cause loss of life and damage to property. Activities that can help alleviate these issues are: • undertaking an appropriate inspection and monitoring regime to assess current issues and the condition of catchpits, leads and culverts, and using the information to develop robust programmes • managing, prioritising and regulating appropriate maintenance and renewal programmes for stormwater assets.
Accessibility and resilience	Stormwater asset failure can lead to parts of the network not being accessible. Activities that can help alleviate these issues are: • developing and implementing better asset condition monitoring strategies • developing and maintaining a risk register of critical assets, with identified mitigation measures • working with Auckland Council's Healthy Waters group to better understand each organisation's asset inventory, and network overlaps and restrictions.
Life cycle management	The current network condition is acceptable. However, AT needs to implement an appropriate renewal programme that will mitigate the loss of service potential of the network. An activity that can help alleviate this issue is undertaking appropriate maintenance and renewal of catchpits, culverts and leads, to prevent assets deteriorating beyond very poor condition.
Value for money	AT's maintenance strategies for its stormwater assets demonstrate value for money when the extent of the stormwater network in the Auckland region is compared to its metro peers. However, new strategies that could further improve efficiency include: • prioritising funding for subsoil drains, catchpits, leads and minor culverts, over kerb and channel • directing maintenance and repair works in a manner that will extend the asset lives and minimise the need for more expensive renewal works • focusing on providing fit-for-purpose treatment types.

7.2.6 Options to address gaps in the network

AT has developed the following options to address the identified gaps in the network for its stormwater assets.

Option	Output	Benefits and consequences
Status quo Make no change in the current approach.	The current regime is not optimised and business-as-usual continues. Maintenance and renewal activities will not deliver the major outcomes being sought through the strategic case.	A reactive approach to maintenance, renewals and unplanned events. Potential loss of accessibility and no improvements in the resilience of the network. Decreased customer satisfaction, as access may be impeded. Increasing safety risk over time. Value for money not realised.
Optimisation without ONRC Optimise stormwater management activities, especially renewals, without applying the ONRC framework. Replace all assets when they fall into very poor condition, regardless of their ONRC category.	Stormwater activities, especially the maintenance and renewal programmes and their related investment needs, are optimised. However, these activities are not fully aligned to address the issues and gaps in the network, and will struggle to achieve the outcomes being sought through the strategic case.	Reduced risk of asset failure for the overall network. Reduced number of journeys that are impacted by stormwater events and the number of instances where road access is lost on key routes. The risk of potential loss of service potential is mitigated. Better value for money is not demonstrated.

Optimisation with ONRC Optimise stormwater management activities, especially renewals, while applying the ONRC framework. Replace all assets when they reach the appropriate point on the levels of service scale, as aligned with the ONRC framework. This means renewing assets before they fail, but intervening later on less busy roads.	Stormwater activities, especially the maintenance and renewal programmes and their related investment needs are optimised, and aligned with the ONRC fit-for-purpose levels of service concept. These activities will start achieving the outcomes being sought through the strategic case. Efficiencies will be realised through this approach, as it will direct programmes at busier roads in the network.	Reduced risk of asset failure for the overall road network. Reduced number of journeys that are impacted by stormwater events and of instances where road access is lost on key routes. Better value for money is demonstrated by directing programmes towards busier and higher-risk roads. The risk of potential loss of service is mitigated.
Run to failure Allow assets to run to failure before renewing.	This is the closest regime to providing a minimum level of programmes and investments for maintenance and renewals activities. There are no proactive renewals, but assets are replaced after they have failed. This approach is not sustainable in the long run and will lead to a large backlog, poor levels of service, especially in relation to safety, unhappy customers and the need for substantial investment in the future to bring the network back to an acceptable level.	Extreme risk of loss of access, plus a high risk of safety-related crashes in wet conditions. High requirement for investment in the future. Decreased customer satisfaction. More congestion, and large portions of the network and surrounding assets inundated with stormwater and stormwater debris.

7.2.7 Recommended option

AT recommends adopting the ‘optimisation with ONRC’ option for the maintenance, operation and renewal of its stormwater assets, as it considers this the best option to deliver the strategic outcomes.

This option aims to deliver ONRC fit-for-purpose levels of service, and plans to renew assets before they fail, but with later intervention in relation to less busy roads.

See Section 7.1.8 for a brief explanation of the ROM, which has been used along with the ONRC framework to develop AT’s renewal programmes for its stormwater assets.

7.2.8 Recommended programme and investment plan

The recommended 'optimisation with ONRC' option will deliver safety, resilience, accessibility, travel time reliability, life cycle management and value for money by implementing:

- an optimised renewals programme that focuses on assets in poor condition
- a slightly increased maintenance programme that takes into the account the impact of growth in the region.

This approach is illustrated in the comparison of three-year investment requirements in Table 7-16.

Table 7-16: Cost of the current and recommended maintenance and renewals programme for stormwater

Forecast Category ($ millions)	Current			AMP 2018-2021		
	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021
Maintenance and Operations (asset-based)	$9.0	$9.1	$10.8	$9.4	$9.6	$9.8
Renewals	$14.9	$13.0	$16.1	$14.0	$14.8	$16.8
Total	$23.9	$22.1	$26.9	$23.4	$24.4	$26.6

The details of these recommended programmes are given below.

Operation and maintenance

AT's strategy for the maintenance and operation of its stormwater assets includes continuing using the 2017/2018 actual investment as the base, but adding an additional investment to cater for the growth of the network and increased demand.

The consequential opex needed to cater for growth has been assessed as equal to the rate of growth of the sealed road network, which is currently approximately 40 kilometres per annum (0.5 per cent). Base opex remains around $9 million, with consequential opex steadily increasing as growth-related new assets are added to the network.

This approach will result in the operations and maintenance investment programme shown in Figure 7-19 and Tables 7-17 and 7-18.

Figure 7-19: Stormwater maintenance and asset-based operations cost

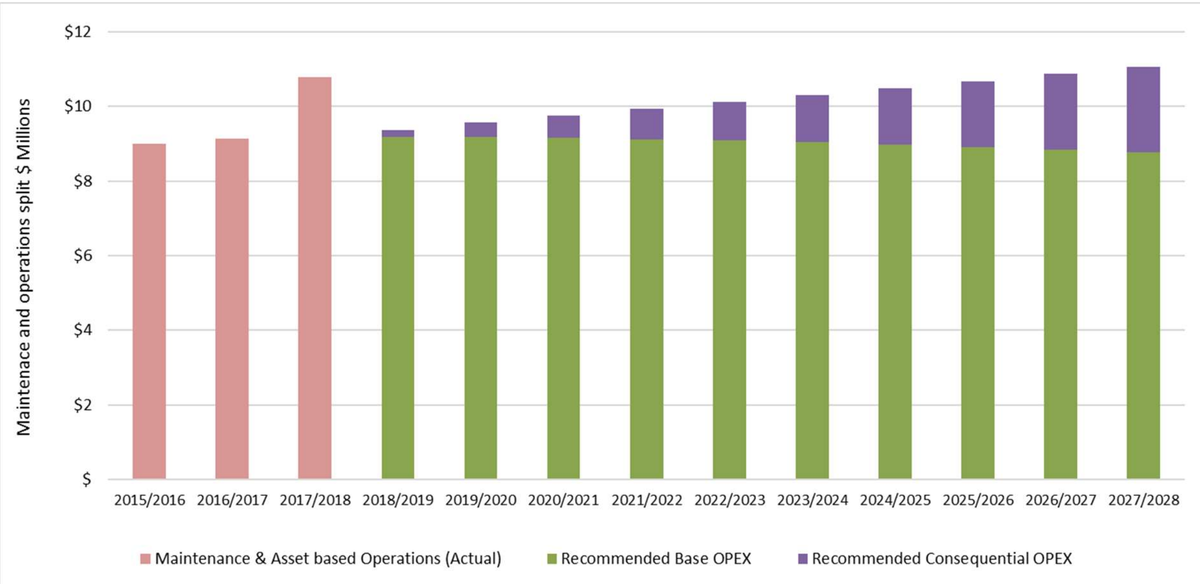


Table 7-17: Stormwater maintenance and asset-based operations cost

Forecast Category ($ millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance (Actuals)	$9.0	$9.1	$10.8										
Maintenance (Recommendation)				$9.4	$9.6	$9.8	$9.9	$10.1	$10.3	$10.5	$10.7	$10.9	$11.1
Total	$9.0	$9.1	$10.8	$9.4	$9.6	$9.8	$9.9	$10.1	$10.3	$10.5	$10.7	$10.9	$11.1

Table 7-18: Stormwater baseline and consequential operations cost

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Baseline Investment	$9.1	$10.8	$9.2	$9.2	$9.2	$9.1	$9.1	$9.0	$9.0	$8.9	$8.8	$8.8
Consequential OPEX	-	-	$.2	$.4	$.6	$.8	$1.0	$1.3	$1.5	$1.8	$2.0	$2.3
Total Investment	$9.1	$10.8	$9.4	$9.6	$9.8	$9.9	$10.1	$10.3	$10.5	$10.7	$10.9	$11.1

Source: AT (SAP), August 2018

Renewals

The recommended option for stormwater renewals is to adopt an optimised renewal intervention approach, which will direct investment to those sections of the network that are likely to experience higher demand. This will be achieved by adopting the approach described in Section 7.1.8.

The stormwater renewals programme has also been adjusted downwards to take into account the estimated $15 million of renewals that are being delivered as part of capital projects every year.

This approach will result in the renewal investment programme shown in Figure 7-20 and Tables 7-19 and 7-20.

Figure 7-20: Stormwater renewal costs

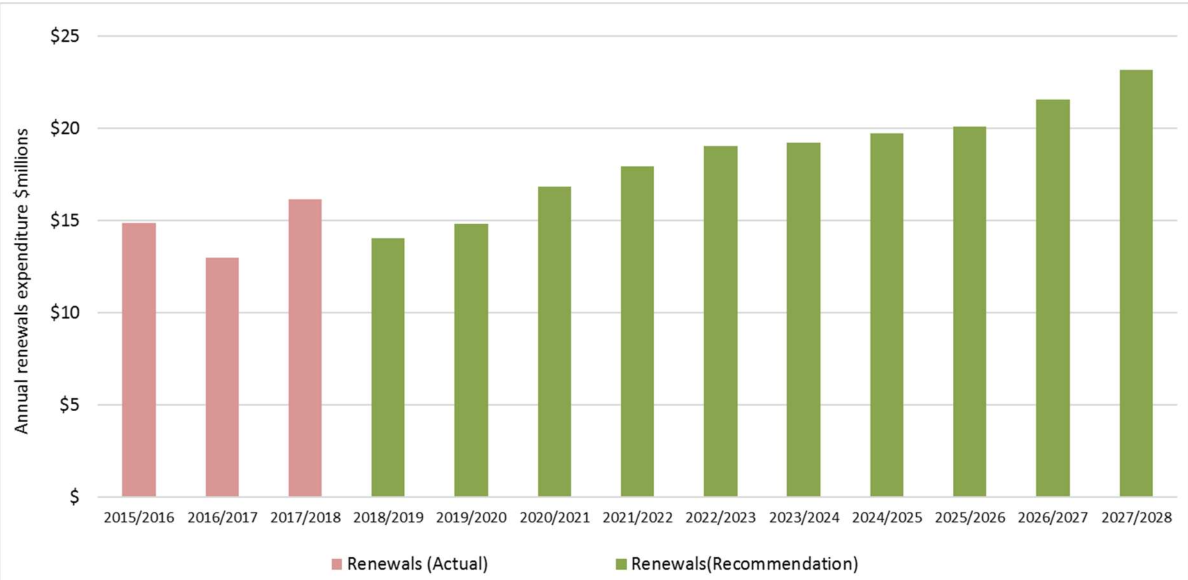


Table 7-19: Stormwater renewal costs

Forecast Category ($millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Renewals (Actuals)	$14.9	$13.0	$16.1										
Renewals (Recommended)				$14.0	$14.8	$16.8	$17.9	$19.0	$19.2	$19.7	$20.1	$21.5	$23.2
Total	$14.9	$13.0	$16.1	$14.0	$14.8	$16.8	$17.9	$19.0	$19.2	$19.7	$20.1	$21.5	$23.2

The increase in renewals is due to improvements in catchpits, leads and surface water channels, and is offset by a reduction in spending on kerbs and channels, as shown in Table 7-20.

Table 7-20: Detail of stormwater renewals costs

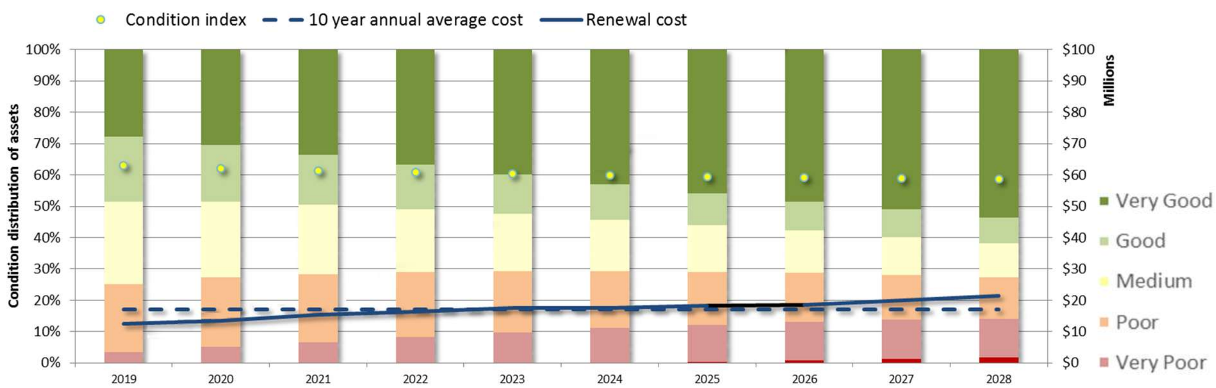
Forecast Category ($ millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Catchpits and leads	$1.4	$2.1	$2.1	$4.5	$4.5	$4.5	$4.6	$4.6	$4.7	$4.7	$4.7	$4.8	$4.8
Kerb and channel	$12.3	$9.7	$12.8	$8.4	$8.9	$10.2	$10.6	$11.1	$10.8	$10.8	$10.7	$11.4	$12.2
Minor culverts	$1.1	$1.1	$1.3	$1.1	$1.4	$2.1	$2.8	$3.3	$3.8	$4.2	$4.7	$5.4	$6.1
Total	**$14.9**	**$13.0**	**$16.1**	**$14.0**	**$14.8**	**$16.8**	**$17.9**	**$19.0**	**$19.2**	**$19.7**	**$20.1**	**$21.5**	**$23.2**

Source: AT (SAP), August 2018

Records for the past five years show that the average cost of weather-related damage to road network assets was about $4.6 million, while the annual cost varied from $1.2 million to $10 million. The key way to manage this risk is to ensure the stormwater network has adequate capacity and is kept in good condition.

As a result of this investment plan, the condition profile of the stormwater assets in the network will vary, as indicated in Figure 7-21. The proposed renewal programme is expected to result in a small, increase in the proportion of assets in very poor condition in the first three years of this AMP. Most assets in very poor condition will be on roads in the lower end of the ONRC classification – low volume and access roads.

Figure 7-21: Impact of renewals recommendation on condition of stormwater assets



Percentage of assets in very poor condition	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Stormwater	3.5%	5.1%	6.6%	8.2%	9.7%	11.1%	12.2%	13.2%	13.8%	14.1%

Source: ROM, July 2017

7.2.9 Forward works programme

AT creates its forward works programme for its stormwater assets in order to schedule works based on the recommended investment plan in this AMP. This plan aims to optimise network performance while meeting all key strategic goals.

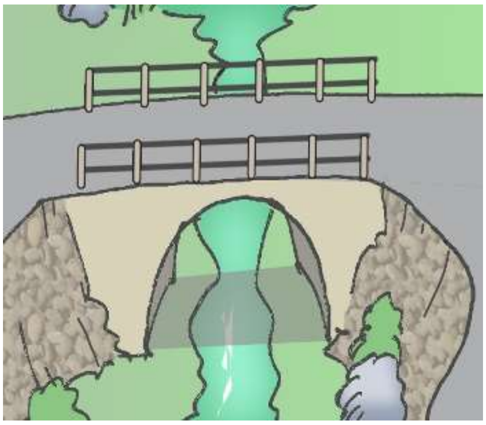
The plan will enable the programme of works outline in Table 7-21 to be completed.

Table 7-21: Forward works programme for stormwater

Asset class	Asset type	Unit	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	Annual average
Stormwater	Catchpits	Unit	2,874	2,984	3,227	3,225	3,232	3,033	2,895	2,710	2,671	2,613	2,946
	Kerb and Channel	km	7	9	13	17	20	23	28	32	39	48	23
	Manholes	Unit	112	135	161	175	194	205	219	229	248	264	194
	Minor Culverts	km	0	1	1	1	1	1	1	1	2	2	1
	Soak Holes	Unit	4	4	6	7	8	9	11	12	14	17	9
	Surface Water Channel	km	11	14	21	28	34	39	44	48	55	62	36

Source: ROM, July 2017

Detailed investment plan and indicative programme per management is available in section 15.12.



7.3 Bridges, walls and structures

7.3.1 Asset inventory

AT is responsible for managing Auckland's local bridges, walls and structures asset portfolio. This portfolio has a variety of asset sub-categories, as shown in Table 7-22. The most significant of these sub-categories are bridges, retaining walls and major culverts.

Table 7-22: Bridges, walls and structures asset overview

Asset Class	Asset_Type	Unit	Count	Measure
Bridges & major culverts	Bridges	m2	860	184,770
	Major Culverts	m	400	11,369
Retaining walls	Retaining walls	m2	3,635	271,474
	Sea walls	m2	192	49,214
Corridor fixtures	Bollard	each	3,334	3,334
	Seat	each	1,068	1,068
	Bench	each	587	587
	Speed bump	each	226	226
	Roundabout	each	94	94
	Weigh Station	each	1	1
	Other	each	2,514	2,514
Corridor structures	Fences	m	3,417	189,935
	Barriers	m	1,762	94,157
	Traffic islands	each	1,078	1,078
	Gantries	each	20	20

Source: Asset management team, October 2017

7.3.2 Links to the strategic case

This subsection sets out how our asset management activities for bridges, walls and structures link to and deliver the strategic case.

Problem statement

AT needs to ensure the that the network's bridges and retaining structures are fit for purpose, in order to maintain network connectivity.

At present, there are 12 bridges on the AT network that can't carry Class 1 (44 tonne) vehicles due to weight restrictions.

The consequences of bridges and retaining walls and structures failing are significant. Prudent asset management practices are needed to avoid such events. Inappropriate practices can have a significant impact on safety, accessibility, travel time reliability and resilience.

Addressing these issues will help achieve our strategic outcomes in the following areas.

Safety	Resilience	Amenity	Accessibility	Travel time reliability	Value for money	Lifecycle asset management	Sustainability
✔	✔	x	✔	✔	x	-	-

Benefits of addressing the problem

Ensures safety, and maintains travel time reliability, accessibility and resilience, while optimising the asset life cycle management practices that will help achieve value for money. This will result in fit-for-purpose bridges, retaining walls and culverts that provide consistent and suitable levels of service across the network.

Consequence of not addressing the problem

Increasing safety risks (due to load-bearing asset failure), negative impacts on economic productivity, low customer satisfaction, higher risk of network access restrictions, a deteriorating network, and high maintenance and renewal costs over the expected life of the assets.

7.3.3 Levels of service

The performance and asset service measures and targets for bridges, walls and structures are listed in Section 15.1.

The most significant of these measures for the network are listed below. Service level gaps for these measures will need to be addressed and monitored.

- ONRC Accessibility CO1 – Proportion of the network not available to heavy vehicles
- LTP 1 Life cycle management – Proportion of assets in very poor condition (by asset type)
- LTP 2 Life cycle management – Proportion of assets in very poor condition (by ONRC)
- ONRC Cost efficiency CE5 – Overall network cost and cost by work category: for bridges, walls and minor structures by ONRC

7.3.4 Gap analysis

This subsection discusses how AT's bridges, walls and structures assets are currently performing against the key measures identified in the previous subsection.

<table>
<tr>
<td>ONRC Accessibility CO1 – Proportion of the network not available to heavy vehicles

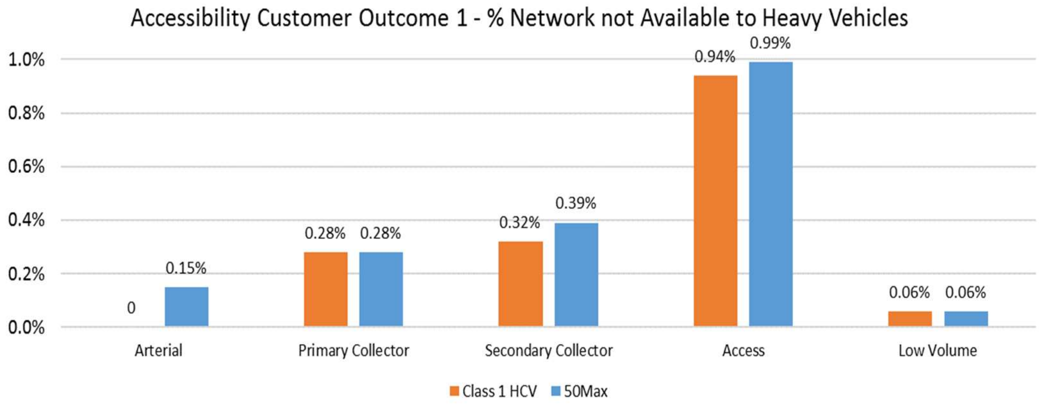
Conclusion:
Accessibility is not a major concern as the vast majority of the network can be accessed by heavy vehicles (Figure 7-22).</td>
<td>Regional

Arterial

Primary collector

Secondary collector

Access

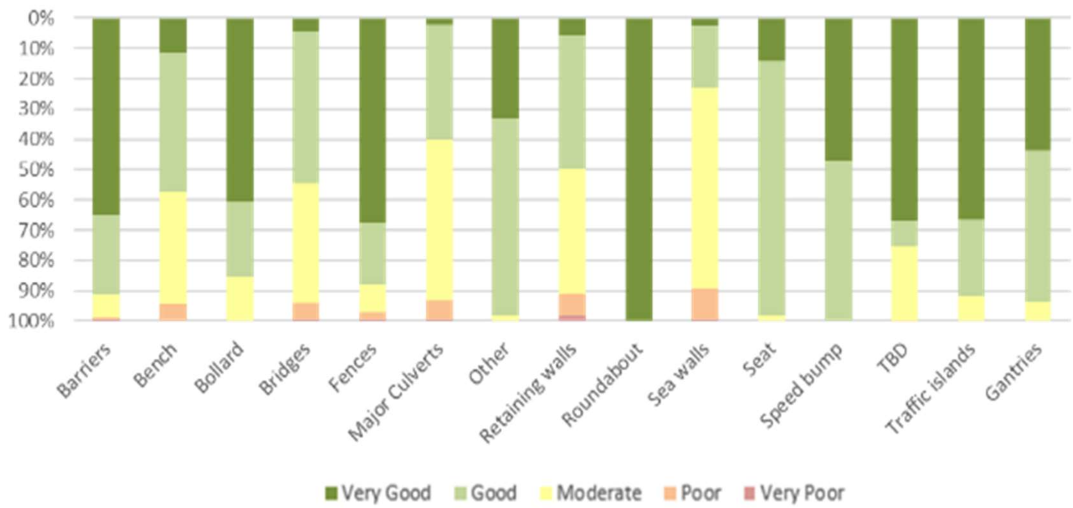
Low-volume</td>
<td>Figure 7-22: Accessibility CO1 – Percentage of network not available to heavy vehicles


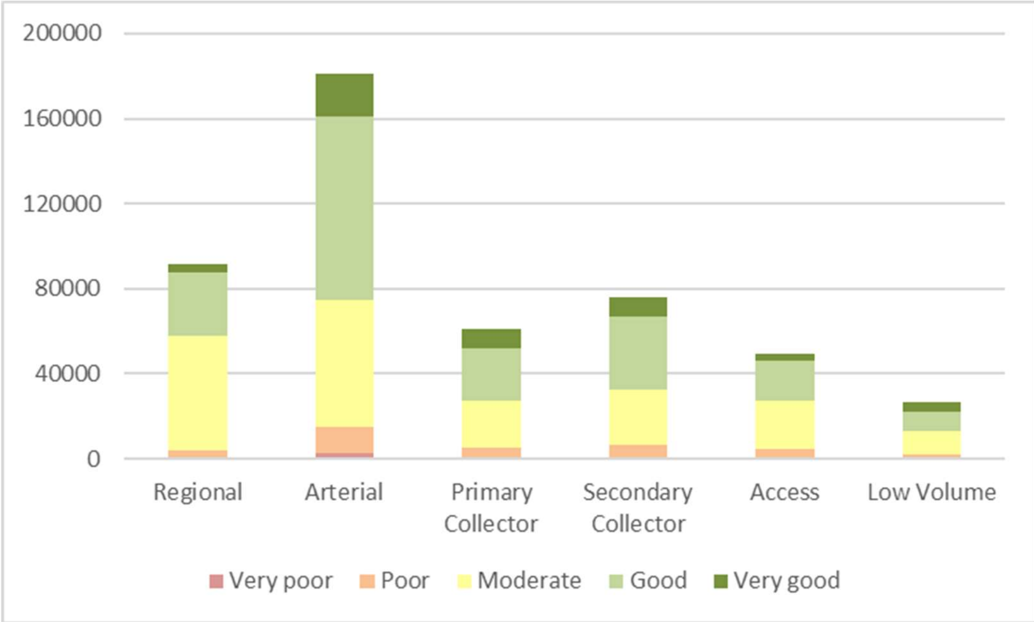
Source: ONRC performance reporting tool

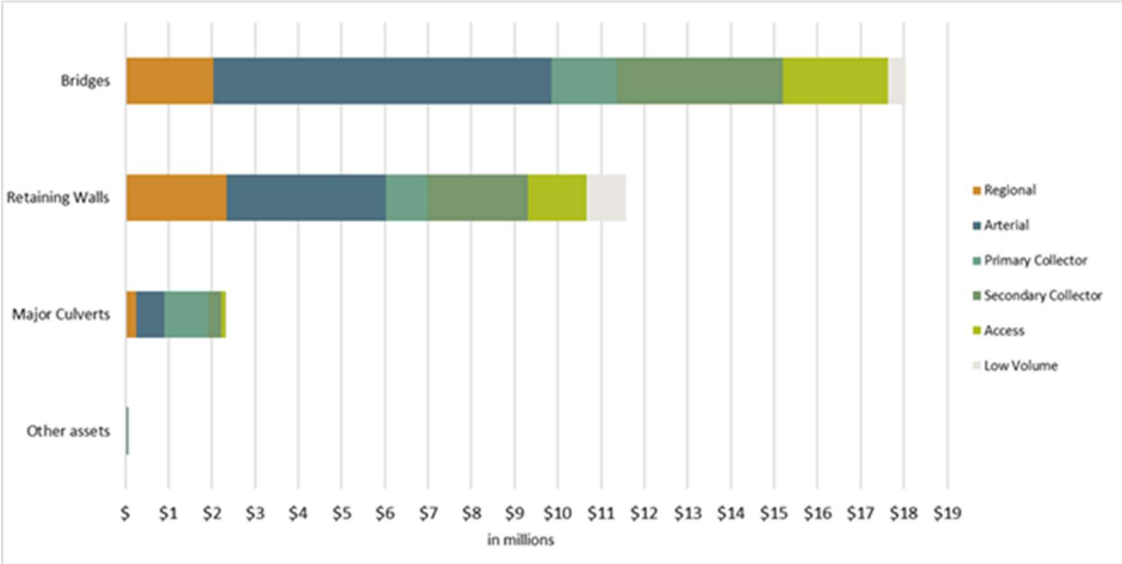
There are 1,262 bridge structures within the Auckland region. These include 579 road bridges, 283 foot bridges, 385 major culverts and 15 underpasses.

Of the 579 road bridges on the network, there are 12 that cannot carry Class 1 (44 tonne) vehicles. The majority of these weight-restricted bridges are on access roads.</td>
</tr>
</table>

Key to levels of service: Fit for purpose Could improve Must improve

LTP 1 Life cycle management – Proportion of assets in very poor condition (by asset type) **Conclusion:** The retaining walls and sea walls sub-categories have a higher number of assets in poor condition, compared to other asset types (Figure 7-23). This issue needs to be addressed.	Bridges Walls Minor structures	*Figure 7-23: Condition by asset type*  Source: RAMM, March 2017

LTP 2 Life cycle management – Proportion of assets in very poor condition (by ONRC) **Conclusion:** Overall, assets are in an acceptable condition as shown in Figure 7-24. However, the majority of the poor and very poor condition assets are associated with arterial roads and this needs to be addressed.	Regional Arterial Primary collector Secondary collector Access Low-volume	*Figure 7-24: Asset condition by ONRC*  Source: RAMM, March 2017 Figure 7-24 shows the condition profile for bridges (including vehicle and foot bridges, major culverts and underpasses), walls (sea walls, retaining walls and noise walls) and minor structures (corridor fixtures and structures) by ONRC category.

ONRC Cost efficiency **CE5** – Overall network cost and cost by work category: for bridges, walls and minor structures by ONRC **Conclusion:** A large portion of the planned forward works programme for the next three years is on bridges and assets associated with arterial and secondary collector roads.	Overall	*Figure 7-25: AT's forward works programme for asset classes by ONRC*  Source: Asset roading team, June 2017 Figure 7-25 shows that the largest proportion of the forward works programme budget is allocated to bridges, and of this, the greatest amount is allocated to bridges on arterial routes.

7.3.5 Impact of the gap analysis on levels of service

This subsection summarises how the issues identified in the gap analysis for bridges, walls and structures will impact on levels of services, and sets out potential activities to alleviate these impacts.

Key customer outcomes affected	Level of service impacts and potential mitigating activities
Safety	Failure of any bridge, major culvert or retaining wall in Auckland could pose a significant safety risk to users, and may cause loss of life and damage to property. Activities that can help alleviate these issues are: • undertaking an inspection and monitoring regime to assess the condition of, and any current issues with, bridges, retaining walls and major culverts • managing and regulating appropriate maintenance and renewal programmes for assets • implementing the recommendations in the seismic assessment study.
Accessibility and resilience	Asset failure could result in parts of the network not being accessible. Activities that can help alleviate this issue are: • developing and implementing resilience strategies, including alternative routes and travel options • developing and maintaining a risk register of critical assets, which includes measures to mitigate the identified risks.
Life cycle management	The current network condition is good. However, AT needs to implement a renewal programme that will mitigate the risk of potential loss of service for the network. Activities that can help alleviate this issue are: • undertaking an appropriate bridge maintenance and renewal programme that will prevent assets deteriorating beyond very poor condition.
Value for money	AT's current maintenance and renewals strategies for bridges, walls and structures demonstrate value for money, when the significantly larger travel and usage demand experienced by the Auckland region's transport network (compared to its metro peers) is taken into account. However, new strategies can improve value for money by: • prioritising renewal works, taking into account the ONRC, to focus more on busier assets

- directing maintenance and repair works in a manner that extends assets' lives and minimises the need for more expensive renewal works
- focusing on providing fit-for-purpose treatment types.

7.3.6 Options to address gaps in the network

AT has developed the following options to address the identified gaps in the network for its bridges, walls and structures assets.

Option	Output	Benefits and consequences
Status quo Make no change in the current approach.	The current regime is not optimised and business-as-usual continues. Maintenance and renewal activities will not deliver the major outcomes being sought through the strategic case.	Potential loss of accessibility and no improvements in the resilience of the network. Decreased customer satisfaction, as access may be impeded. Value for money not achieved.
Optimisation without ONRC Optimise bridges and structures management activities, especially renewals, without applying the ONRC framework. Replace all assets when they fall into very poor condition, regardless of their ONRC category.	Bridges and structures activities, especially the maintenance and renewal programmes and their related investment needs, are optimised. However, these activities are not fully aligned to address the issues and gaps in the network, and will struggle to achieve the outcomes being sought through the strategic case.	Reduced risk of asset failure for the network overall. Fewer journeys affected by unplanned events and fewer instances where road access is lost on key routes. Better value for money is not demonstrated. Loss of service potential is partly mitigated.
Optimisation with ONRC Optimise bridges and structures management activities, especially renewals, while applying the ONRC framework Replace all assets when they reach the appropriate point on the levels of service scale, as aligned with the ONRC framework. This means renewing assets before they	Bridges and structures activities, especially the maintenance and renewals programmes and their related investment needs, are optimised and aligned with the ONRC fit-for-purpose levels of service concept. These activities will start achieving the outcomes being sought through the strategic case.	Reduced risk of asset failure in the arterial road network. Fewer journeys affected by unplanned events and fewer instances where road access is lost on key routes. Better value for money is demonstrated by directing programmes towards the busier road network.

fail, but intervening later on less busy roads.	Efficiencies will be realised through this approach, as it will direct programmes towards the busier road network.	Loss of service potential is mitigated.
Run to failure Allow assets to run to failure before intervening with renewals.	This is the closest regime to providing a minimum level of investment for maintenance and renewals. There are no proactive renewals, but assets are replaced after they have failed. This approach is not sustainable in the long run and will lead to a large backlog, poor levels of service, especially in relation to safety, unhappy customers and the need for substantial investment in the future to bring the network back to an acceptable level.	Extreme risk of loss of life and property damage. High requirement for investment in future. Decreased customer satisfaction. More congestion, and reduced accessibility to large sections of the network.

7.3.7 Recommended option

AT recommends adopting the ‘optimisation with ONRC’ option for the maintenance, operation and renewal of its bridges, walls and structures assets, as it considers this the best option to deliver the strategic outcomes.

This option aims to deliver ONRC fit-for-purpose levels of service, and plans to renew assets before they fail, but with later intervention in relation to less busy roads.

See Section 7.1.8 for a brief explanation of the ROM, which is being used along with the ONRC framework to develop AT’s renewals programme for its bridges, walls and structures assets.

7.3.8 Recommended programme and investment plan

The recommended ‘optimisation with ONRC’ option will deliver safety, resilience, accessibility, travel time reliability, life cycle management and value for money by implementing:

- an optimised renewals programme focussed on the arterial roads network
- a slightly increased maintenance programme that takes into the account the impact of growth in the region.

This approach is illustrated in the comparison of three-year investment requirements in Table 7-23.

Table 7-23: Cost of the current and recommended maintenance and renewals programme for bridges, walls and structures

Forecast Category ($ millions)	Current			AMP 2018-2021		
	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021
Maintenance and Operations (asset-based)	$1.3	$1.7	$1.8	$1.7	$1.7	$1.7
Renewals	$10.0	$13.6	$27.8	$15.1	$16.0	$18.1
Total	$11.2	$15.3	$29.6	$16.8	$17.7	$19.8

The details of these recommended programmes are given below.

Operation and maintenance

AT's strategy for the maintenance and operation of its bridges, walls and structures assets includes continuing using the 2017/2018 actual investment as the base, but adding an additional investment to cater for the growth of the network and increased demand.

The consequential opex needed to cater for growth has been assessed as equal to the rate of growth of the sealed road network, which is currently approximately 40 kilometres per annum. This approach will result in the operations and maintenance investment programme shown in Figure 7-26 and Tables 7-24 and 7-25.

Figure 7-26: Bridges, walls and structures maintenance and asset-based operations cost

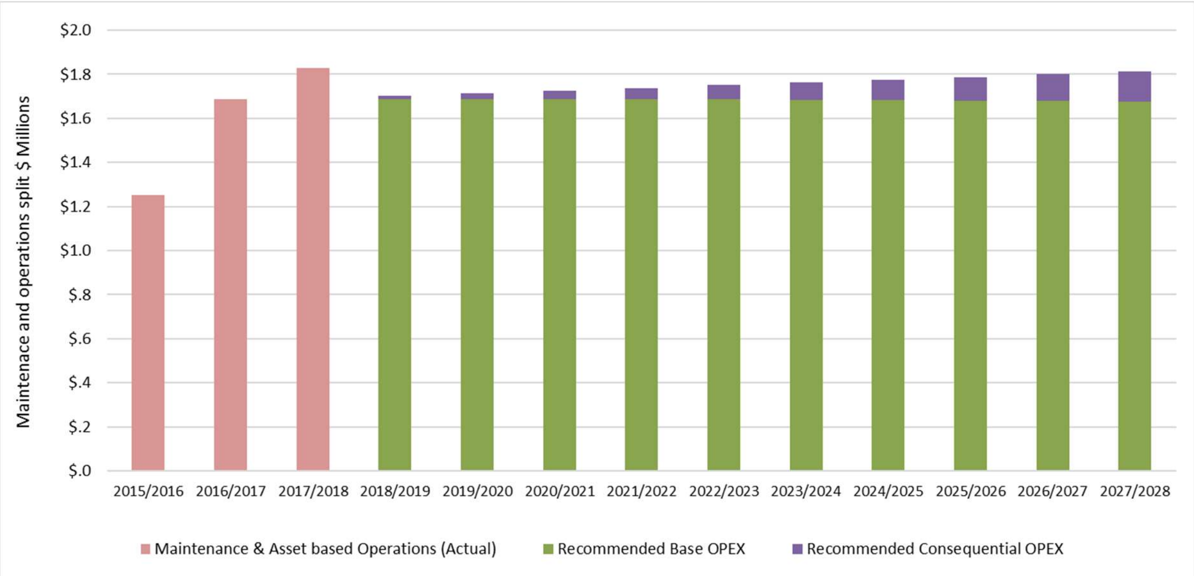


Table 7-24: Bridges, walls and structures maintenance and asset-based operations cost

Forecast Category ($ millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance (Actuals)	$1.3	$1.7	$1.8										
Maintenance (Recommendation)				$1.7	$1.7	$1.7	$1.7	$1.8	$1.8	$1.8	$1.8	$1.8	$1.8
Total	$1.3	$1.7	$1.8	$1.7	$1.7	$1.7	$1.7	$1.8	$1.8	$1.8	$1.8	$1.8	$1.8

Table 7-25: Baseline investment and consequential opex

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Baseline Investment	$1.7	$1.8	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7
Consequential OPEX	-	-	$.0	$.0	$.0	$.1	$.1	$.1	$.1	$.1	$.1	$.1
Total Investment	$1.7	$1.8	$1.7	$1.7	$1.7	$1.7	$1.8	$1.8	$1.8	$1.8	$1.8	$1.8

Source: AT (SAP), August 2018

Renewals

The recommended option for renewals is to adopt the optimised renewal intervention approach, which will direct investment towards busier roads.

This will be achieved by adopting the approach described in section 7.1.8. The renewals programme has also been adjusted downwards to account for an estimated $15 million of renewals being delivered as part of capital projects every year.

This approach will result in the renewal investment programme shown in Figure 7-27 and Table 7-26.

Figure 7-27: Bridges, walls and structures renewals

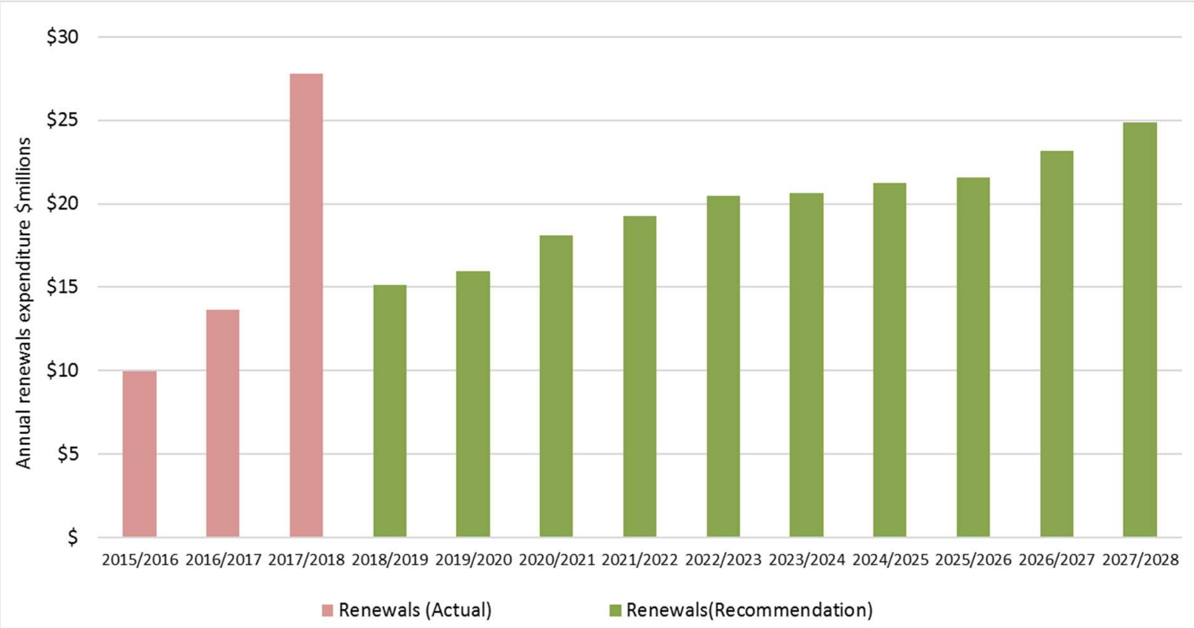


Table 7-26: Bridges, walls and structures renewals costs

Forecast Category ($millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Renewals (Actuals)	$10.0	$13.6	$27.8										
Renewals (Recommended)				$15.1	$16.0	$18.1	$19.3	$20.5	$20.6	$21.2	$21.6	$23.1	$24.9
Total	$10.0	$13.6	$27.8	$15.1	$16.0	$18.1	$19.3	$20.5	$20.6	$21.2	$21.6	$23.1	$24.9

Renewals provision increases over time, as shown in Table 7-27. This mainly due to bridge components reaching the end of their useful life and needing to be replaced. When a whole bridge is replaced, this is budgeted as new capital works.

Table 7-27: Detail of bridges, walls and structures renewals costs

Forecast Category ($ millions)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Bridge structures	$9.0	$9.5	$10.7	$11.3	$12.0	$12.1	$12.4	$12.6	$13.5	$14.4
Retaining walls	$5.2	$5.5	$6.3	$6.7	$7.2	$7.2	$7.4	$7.6	$8.1	$8.8
Corridor fixtures	$.2	$.2	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.4
Guardrails	$.7	$.7	$.8	$.9	$.9	$.9	$1.0	$1.0	$1.1	$1.2
Road furniture	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1
Total	**$15.1**	**$16.0**	**$18.1**	**$19.3**	**$20.5**	**$20.6**	**$21.2**	**$21.6**	**$23.1**	**$24.9**

Source: AT (SAP), August 2018

The indicative programme of renewals associated with the above recommended investment plan is given below:

Asset type	Unit	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Bridges	sqm	2,003	2,132	2,460	2,644	2,825	2,852	2,942	2,999	3,234	3,494
Major culverts	m	102	103	113	118	122	121	123	124	132	142
Retaining walls	sqm	4,360	4,544	5,140	5,421	5,700	5,675	5,787	5,846	6,261	6,729
Sea walls	sqm	323	414	559	682	806	880	963	1,026	1,144	1,265
Corridor fixtures	unit	134	142	163	174	186	187	193	196	211	228
Corridor structures	m	3,679	3,781	4,188	4,390	4,620	4,677	4,843	4,950	5,347	5,782

Source: ROM, July 2017

Detailed investment plan and indicative programme per management is available in section 15.12.

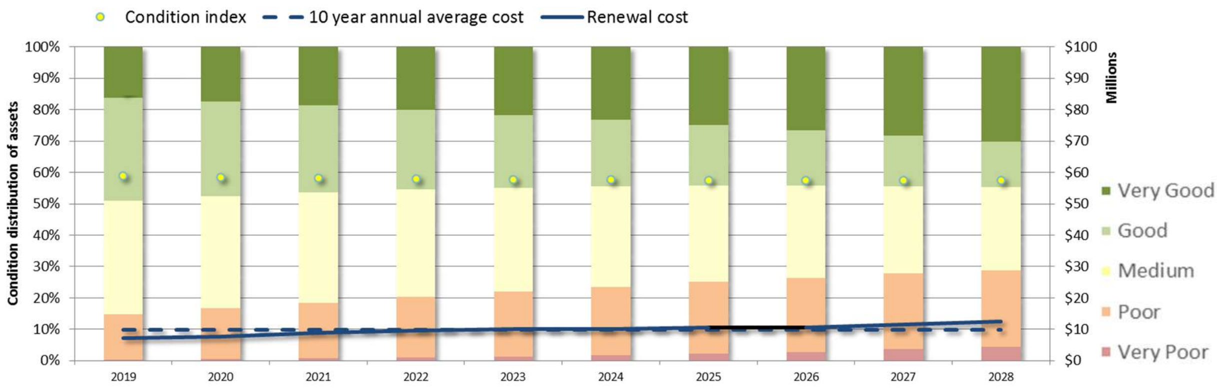
Bridges and other structures, including retaining walls and major culverts, are high-risk assets, which cannot be allowed to fail. This AMP increases investment in the renewals of bridges and structures, and will manage the risks facing bridges and structures in a manner consistent with the ONRC framework – fit for purpose levels of service.

Key features of AT's renewals programme for its bridge, walls and structures assets will include:

- Maintenance and renewals will focus on sustaining fit-for-purpose bridge and retaining wall assets that provide access for freight and high-productivity vehicles on key routes, as defined by the ONRC framework, including arterial, freight and detour routes
- Some bridges on roads in the lower end of the ONRC classification will have a higher percentage of assets in poor condition. This includes the 12 bridges that currently cannot carry Class 1 (44 tonne) vehicles, all of which are on low-volume access roads. This is considered a manageable risk as mitigation measures such as reactive maintenance and renewals will be able to rectify any foreseen failures.
- The walls (retaining walls, noise walls and sea walls) and minor corridor structures on these routes will be treated in the same way.

As a result of this investment plan, the condition profile of bridges and major culverts assets in the transport network will vary as indicated in Figure 7-28.

Figure 7-28: Impact of renewals recommendation on condition of bridges and major culverts



Source: ROM, July 2017

Percentage in very poor condition	2019		2020	2021	2022	2023	2024	2025	2026	2027	2028
Bridges and major culverts	0.4%		0.6%	0.7%	1.0%	1.3%	1.7%	2.2%	2.8%	3.6%	4.4%

The increase in the proportion of bridges and major culverts in poor and very poor condition shown in Figure 7-28 is the result of AT's strategy of taking a greater focus on the arterial network and intervening later for the less busy roads. This trend will be monitored and regular network condition assessments will identify any major concerns for attention in the future.

7.3.9 Forward works programme

AT creates its forward works programme for its bridges, walls and structures assets in order to schedule works based on the recommended investment plan in this AMP. This plan aims to optimise network performance while meeting all key strategic goals.

The process AT uses to develop the bridges, walls and structures forward works programme is as follows.

- All assets in the network (860 bridges, 400 major culverts, 3,685 retaining walls and 192 sea walls) are inspected by experienced inspectors every two years. These inspections are in addition to regular maintenance inspections, under AT's maintenance programme, which are undertaken by AT's road maintenance contractors
- The inspectors provide a report for each structure. Assets are given an overall condition rating on a five-point scale (ranging from excellent to very poor). These inspection reports are the primary source of information for AT's forward works programme.
- The medium-term forward works programme covers the next one to three years. This is prioritised by taking into account the impact of asset condition on the road network (e.g. traffic disruption, restrictions). Where structures are identified as requiring major maintenance or remedial works, this is verified through further special inspections and investigations, and re-prioritised on the programme as necessary.
- The scope and budget of major remedial works needs are confirmed in a project justification report. Where emergency or urgent works are identified, these are immediately reported to AT's road corridor delivery team to address or remedy as necessary.

Further details of AT's approach to developing its forward works programme is provided in the Asset Class Management Plan for Bridges, Walls and Structures. Table 7-28 shows the current investment plan for forward works for AT's bridges, walls and structures assets.

Table 7-28: Forward works investment plan for bridges, walls and structures renewals

Programme Year	Activity type	Proposed Work Count	Estimated Cost ($'000)
2018/19	Renewal - Bridges	66	$5,026
	Renewal - Retaining walls	92	$3,390
	Renewal - Major culverts	21	$1,241
	Renewal - Other assets	25	$1,152
2018/19 Total		**204**	**$10,808**
2019/20	Renewal - Bridges	55	$6,679
	Renewal - Retaining walls	76	$2,246
	Renewal - Major culverts	11	$289
	Renewal - Other assets	5	$683
2019/20 Total		**147**	**$9,896**

Source: Renewals forward works programme, July 2017
Note: The table includes an element of over-programming and details are still being finalised.

AT's indicative project-based forward works programme for bridges, walls and structures is included in the Asset Class Management Plan for Bridges, Walls and Structures

7.4 Footpaths and cycleways

7.4.1 Asset inventory

AT is responsible for footpaths and cycleways within the road corridor. The extent of these assets is shown in Table 7-29.

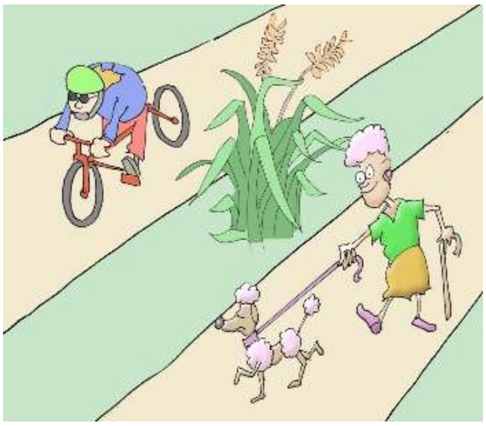


Table 7-29: Footpaths and cycleways asset overview

Asset Class	Asset Sub-Type	Area (sqm)
Cycleways	Off-road	228,419
	On-road	467,057
Footpaths		11,917,684

Source: Asset management team, October 2017

7.4.2 Links to the strategic case

This subsection sets out how our asset management activities for footpaths and cycleways link to and deliver the strategic case.

Problem statement

- AT's footpath and cycleway network is prone to damage and deterioration due to age, tree roots and ground condition, which can increase maintenance and long-term costs and pose a higher risk to users.
- Poor and inconsistent quality or condition of footpaths and cycleways can lead to trips, slips and falls, some of which involve serious injury.
- Customer satisfaction is low, due to safety and amenity concerns.

Addressing these issues will help achieve our strategic outcomes in the following areas.

Safety	Resilience	Amenity	Accessibility	Travel time reliability	Value for money	Lifecycle asset management	Sustainability
✔	x	✔	✔	✔	x	-	✔

Benefits of addressing the problem

A fit-for-purpose footpath and cycling network encourages increased use by pedestrians and cyclists.

Consequences of not addressing the problem

Footpath and cycleway usage will decrease, and there will be an increasing risk of incidents causing serious injuries or deaths, due to infrastructure deterioration. Vehicle use will increase, due to concerns over the safety of the footpath and cycleway network, increasing road congestion.

7.4.3 Levels of service

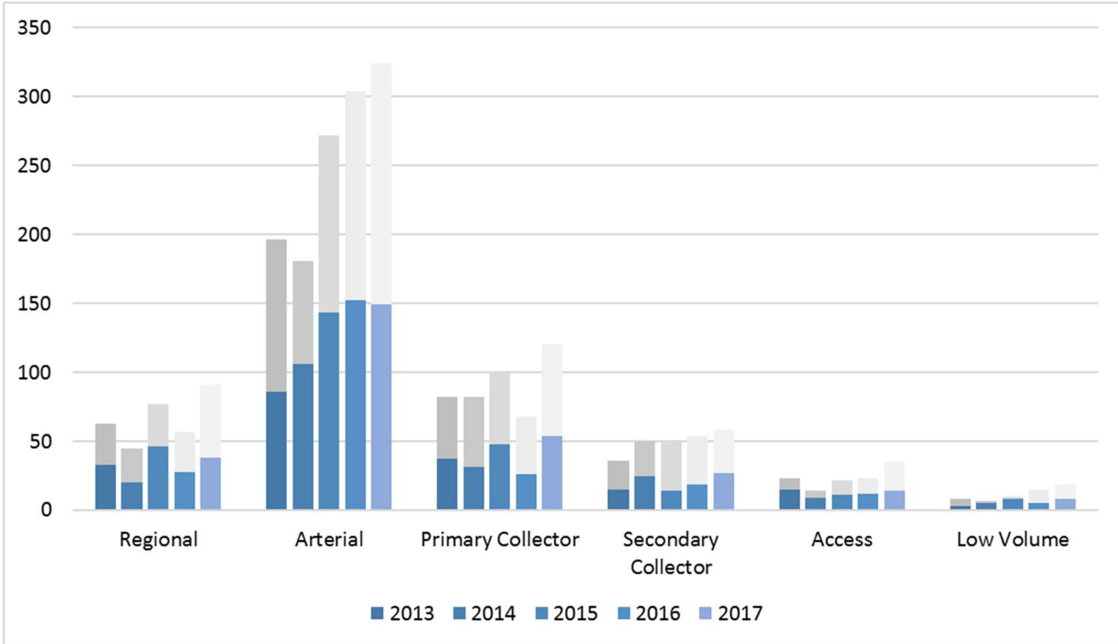
The performance and asset service measures and targets for footpaths and cycleways are listed in Section 15.1.

The most significant of these measures for the network are listed below. Service level gaps for these measures will need to be addressed and monitored.

- ONRC Safety TO9 – Vulnerable users
- LTP 1 Customer satisfaction footpaths – Safety, amenity and accessibility
- LTP 2 Customer satisfaction cycleways – Safety, amenity and accessibility
- LTP 3 Life cycle management – Network condition
- LTP 4 Effective – Trip distribution
- LTP 5 Effective – Cycleway demand

7.4.4 Gap analysis

This subsection discusses how AT’s footpaths and cycleways assets are currently performing against the key measures identified in the previous subsection.

ONRC Safety TO9 – Vulnerable users **Conclusions**: Safety is a major concern and the risk if death or serious injury for vulnerable road users is showing a rising trend on the arterial road network.	Regional Arterial Primary collector Secondary collector Access Low-volume	Safety of vulnerable road users on regional, arterial and low-volume roads is an issue, with increasing numbers of deaths and serious injuries, as shown in Figure 7-29. *Figure 7-29: Deaths and serious injuries – vulnerable road users*  Source: AT’s performance reporting tool – road safety, May 2018

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LTP 1 Customer satisfaction footpaths – Safety, amenity and accessibility

Conclusions: Customer satisfaction depends highly on safety and surface quality. Overall perception of the quality of footpaths is on the decline.

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64% of Aucklanders are satisfied with the overall safety of walking in the Auckland region. Safety is the main factor for improving the experience of walking in Auckland as shown in Figure 4-10 in Chapter 5. Satisfaction with the quality of footpaths, and with the amount and location of safe places to cross the road, have all declined over the past year, as shown in Figure 7-30.

Figure 7-30: AT roading customer satisfaction survey – footpaths

Source: AT roading customer satisfaction topline report, June 2018

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LTP 2 Customer satisfaction cycleways – Safety, amenity and accessibility

Conclusions: Customer satisfaction depends highly on safety and more separation from vehicular traffic. Overall perception of the quality of cycleways is stable.

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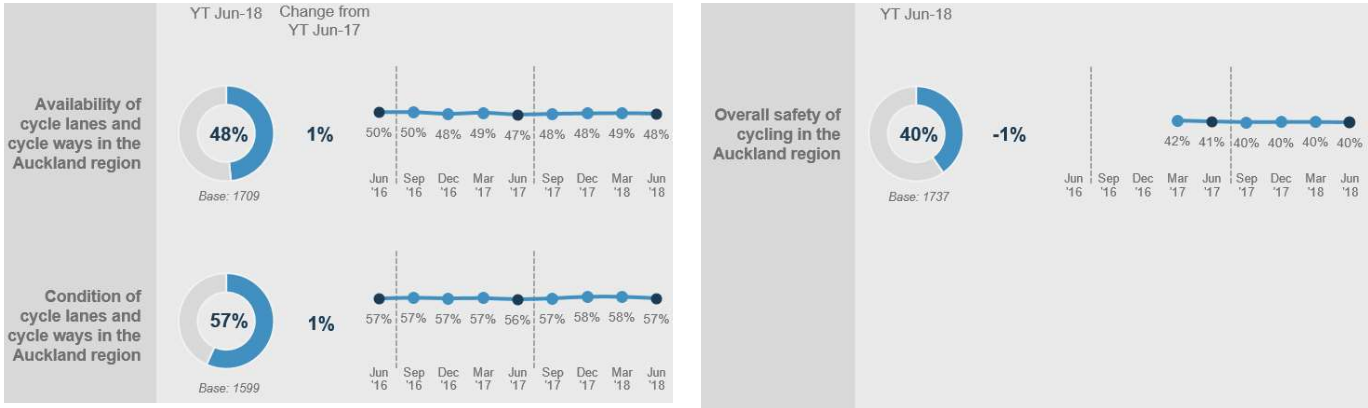
The most important priority for improving cycling in Auckland is safety, with this factor being mentioned by 42 per cent of Aucklanders who completed AT's roading customer satisfaction survey (Figure 4-11). Overall satisfaction with the availability and condition of cycleways has been stable over the past two years as shown in Figure 7-31.

Figure 7-31: AT roading customer satisfaction survey – cycleways



Source: AT roading customer satisfaction topline report, June 2017

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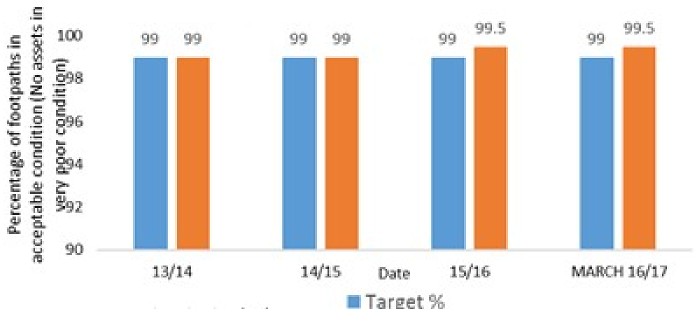
LTP 3 Life cycle management – Network condition is good with over 99 percent of the network at an acceptable level of service. There are between 20 and 50 calls to the AT contact centre each month in relation to footpaths, and these are followed up within standard timeframes.

Conclusions: The network is performing well and is above the target condition threshold.

The current condition profile shows that 99.5 per cent of footpath assets are in very good to moderate condition (Figure 7-32).

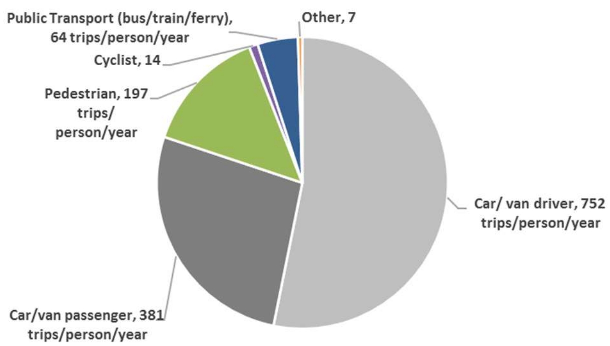
Figure 7-32: Footpath network condition

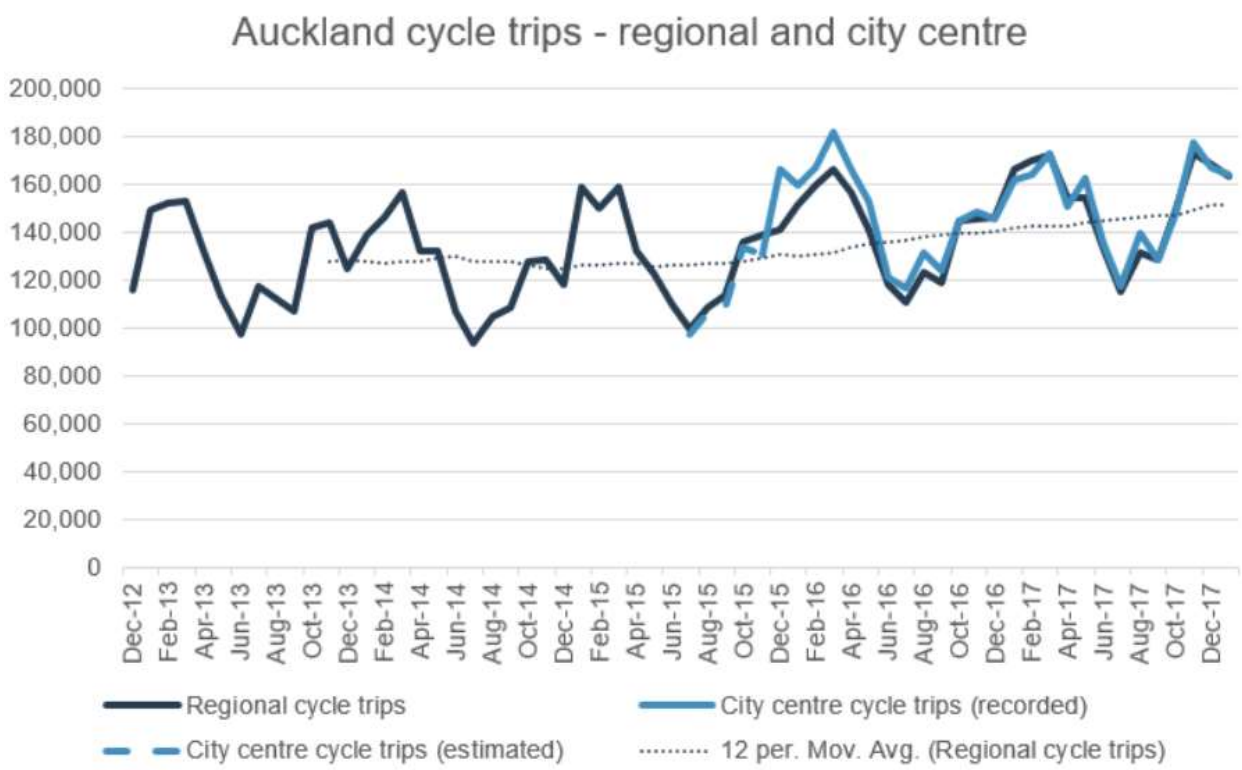


Source: Asset management team monthly KPI report

Figure 7-33: Customer relationship management cases related to footpath and cycleways

Source: AT customer relationship management database

LTP 4 Effective – Trip distribution **Conclusions:** A considerable percentage of trips are made by using the footpath and cycleway network	Overall	The Ministry of Transport conducts an ongoing survey of people's day-to-day travel patterns and choices in New Zealand. This helps to develop transport policy, including road safety, public transport, walking and cycling. The three-year survey shows that people made an average of 14 per cent of their trips by walking and cycling (Figure 7-34). *Figure 7-34: Proportion of all trips in Auckland 2015 to 2017 which were by walking and cycling*  Source: Ministry of Transport continuous household travel survey (39)

LTP 5 Effective – Cycleway demand	Overall	AT measures cycle movements at 14 key sites around the region and a further 13 sites in the city centre. (49). Results to January 2018 show a 6.8% annual increase in cycling at regional sites, and a 3.7% increase in cycling at the city centre count sites. 

7.4.5 Impact of the gap analysis on levels of service

This subsection summarises how the issues identified in the gap analysis for footpaths and cycleways will impact on levels of services, and sets out potential activities to alleviate these impacts.

Key customer outcomes affected	Level of service impacts and potential mitigating activities
Safety	Poorly performing cycleways and footpaths in Auckland can pose a significant safety risk to their users and may cause loss of life. Activities that can alleviate these issues are: • moving to a proactive maintenance regime for footpaths and cycleways, informed by a region-wide survey of asset condition • maintain a safe, connected walking and cycling network, so fewer people choose to travel by car for short journeys.
Accessibility and amenity	Failure of cycleway and footpath assets can lead to customer dissatisfaction, and shifts to other transport modes. Activities that can help alleviate these issues are: • developing and implementing strategies for better asset condition monitoring • providing a high level of service on walking and cycling networks – offering choices and improving system resilience • treating footpath renewals as an opportunity to improve amenity and safety, including de-cluttering, and providing good quality surfaces and appropriate footpath widths.
Life cycle management	The current network condition is good. However, AT needs to implement an appropriate maintenance and renewal programme that will mitigate the risks of loss of service potential for the network. Activities that can help alleviate this issue are: • increasing renewals and maintenance programmes in line with the expansion of walking and cycling networks.

7.4.6 Options to address gaps in the network

AT has developed the following options to address the identified gaps in the network for its footpath and cycleway assets.

Option	Output	Benefits and consequences
Status quo Make no change in the current approach.	The current regime is not optimised and business-as-usual continues. Maintenance and renewal activities will not deliver the major outcomes being sought through the strategic case.	Levels of service on cycleways continue to decline as static budgets fall short of the investment needed for a rapid cycleway building programme.. Safety risk increases over time. Customer concerns about amenity and accessibility continue to increase.
Optimisation Optimise management activities, especially renewals. Replace all assets when they reach the appropriate point on the levels of service scale. This means renewing assets before they fail, to achieve best value for money.	Increase cycleway maintenance budgets to ensure separate cycleways are regularly maintained and proactively swept (rather than responding to complaints). These activities will start achieving the outcomes being sought through the strategic case.	Reduced risk of asset failure. Levels of service on cycleways stabilise, as increasing budgets keep up with the rapid cycleway building programme. Reduced customer amenity and accessibility concerns. The full benefits of the cycleway construction programme are delivered, as cycleways are maintained to a high level of service consistent with the level of capital investment.
Run to failure Allow assets to run to failure before intervening with renewals.	This is the closest regime to providing a minimum level of investment for maintenance and renewals activities. There are no proactive renewals, but assets are replaced after they have failed. This approach is not sustainable in the long run and will lead to a large backlog, poor levels of service, especially in relation to safety, unhappy customers and the need for substantial investment in the future to bring the network back to an acceptable level.	Extreme risk of loss of accessibility, and a high risk of safety-related injuries and deaths. High requirement for future investment. Decreased customer satisfaction. Lack of confidence in the network, leading to a rise in trips on other modes of transport. Cost efficiency is not realized, as there are high maintenance and renewal costs over the assets' life cycle.

Note: There is no 'ONRC' option for footpaths and cycleways, as ONRC is a road classification system that does not apply to walking and cycling journeys.

7.4.7 Recommended option

AT recommends adopting the 'optimisation' option for the maintenance, operation and renewal of its footpaths and cycleways assets, as it considers this the best option to deliver the strategic outcomes.

See Section 7.1.8 for a brief explanation of the ROM, which AT has used to develop its renewal programmes for its footpaths and cycleways assets.

7.4.8 Recommended programme and investment plan

The recommended 'optimisation' option will deliver safety, resilience, accessibility, travel time reliability, life cycle management and value for money by implementing:

- an enhanced maintenance programme for cycleways to allow for the significant growth of this asset
- an optimised programme for maintenance and renewals that will take into the account the impact of growth in the region.

This approach is illustrated in the comparison of three-year investment requirements in Table 7-30.

Table 7-30: Cost of the current and recommended maintenance and renewals programme for footpaths and cycleways

Forecast Category ($ millions)	Current			AMP 2018-2021		
	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021
Maintenance and Operations (asset-based)	$2.3	$2.1	$1.7	$3.2	$3.3	$3.3
Renewals	$15.0	$16.6	$20.2	$16.2	$17.1	$19.7
Total	$17.3	$18.7	$22.0	$19.4	$20.4	$23.0

The details of these recommended programmes are given below.

Operations and maintenance

The recommended maintenance investment is based on the 2016/2017 actual spend on footpaths and cycleways, with an additional allowance to cater for the increased demand for maintenance and for consequential opex needed as a result of network growth.

The consequential opex need has been assessed based on the historic growth of the network and after consultation with the operational team regarding upcoming projects. The current growth rate applied to footpath assets is 1.1 per cent per annum and to cycleway assets 2.2 per cent per annum.

This approach will result in the operation and maintenance investment programme shown in Figure 7-35 and Tables 7-31 and 7-32.

Figure 7-35: Footpath and cycleways maintenance and asset-based operations costs

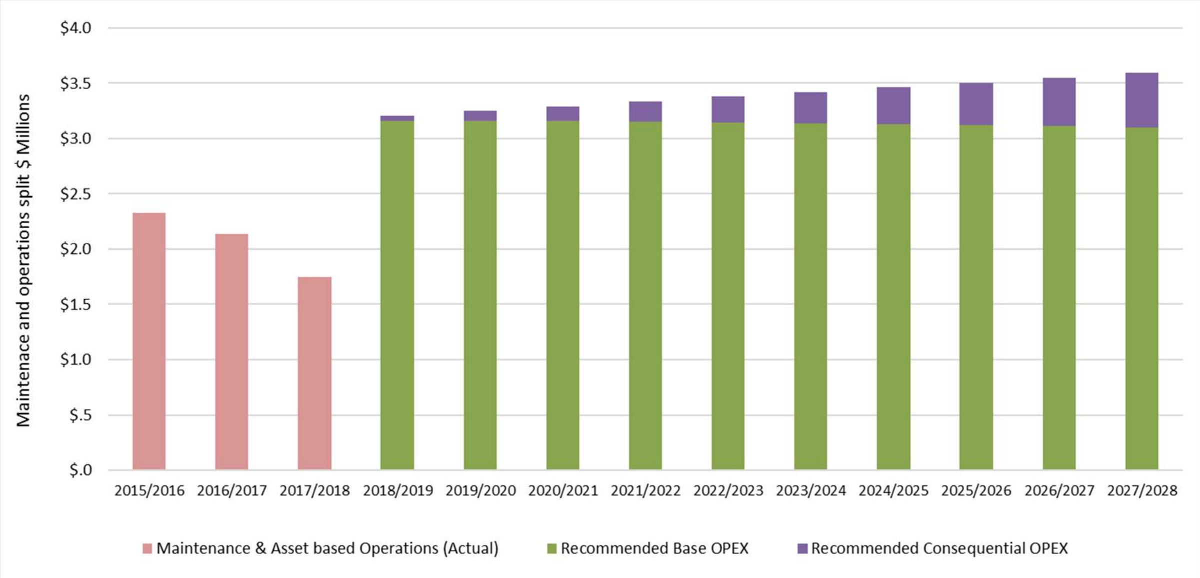


Table 7-31: Footpath and cycleways maintenance and asset-based operations costs

Forecast Category ($ millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance (Actuals)	$2.3	$2.1	$1.7										
Maintenance (Recommendation)				$3.2	$3.3	$3.3	$3.3	$3.4	$3.4	$3.5	$3.5	$3.6	$3.6
Total	$2.3	$2.1	$1.7	$3.2	$3.3	$3.3	$3.3	$3.4	$3.4	$3.5	$3.5	$3.6	$3.6

Table 7-32: Footpath and cycleways baseline and consequential opex investment

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Baseline Investment	$2.1	$1.7	$3.2	$3.2	$3.2	$3.2	$3.1	$3.1	$3.1	$3.1	$3.1	$3.1
Consequential OPEX	-	-	$.0	$.1	$.1	$.2	$.2	$.3	$.3	$.4	$.4	$.5
Total Investment	$2.1	$1.7	$3.2	$3.3	$3.3	$3.3	$3.4	$3.4	$3.5	$3.5	$3.6	$3.6

Source: AT (SAP), August 2018

Renewals

The recommended approach for footpath and cycleway renewals is to adopt a proactive approach to renewals across the region, in order to mitigate the risk of increased life cycle costs over time. The key asset management factors that will need to be considered when using this approach are:

- an asset-appropriate decay curve
- an optimum condition profile
- the level of acceptable risk
- the condition intervention point
- the consequential renewals due to growth
- the number of years to address any backlog
- an asset's base life and the unit rate for renewal.

This approach will result in the investment plan shown in Figure 7-36 and Table 7-33.

Figure 7-36: Footpaths and cycleways renewals costs

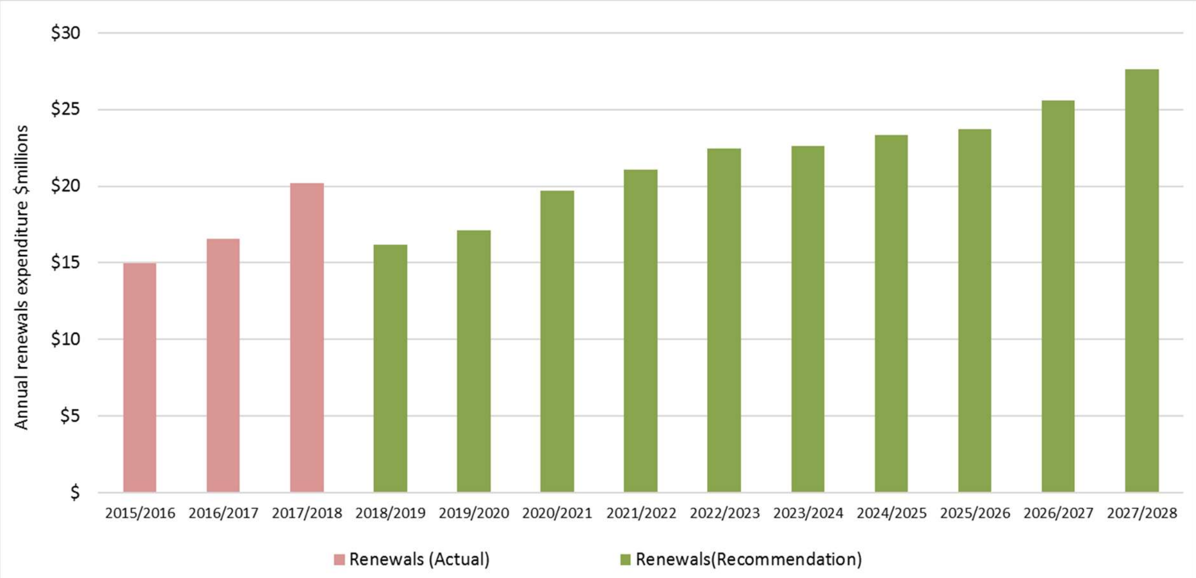


Table 7-33: Footpaths and cycleways renewals costs

Forecast Category ($millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Renewals (Actuals)	$15.0	$16.6	$20.2										
Renewals (Recommended)				$16.2	$17.1	$19.7	$21.1	$22.5	$22.6	$23.3	$23.7	$25.6	$27.6
Total	$15.0	$16.6	$20.2	$16.2	$17.1	$19.7	$21.1	$22.5	$22.6	$23.3	$23.7	$25.6	$27.6

Forecast Category ($ millions)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Footpaths	$16.0	$16.9	$19.4	$20.8	$22.2	$22.3	$23.0	$23.4	$25.2	$27.2
Cycleways	$.2	$.2	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.4

Source: AT (SAP), August 2018

The indicative programme of renewals associated with the above recommended investment plan is given below:

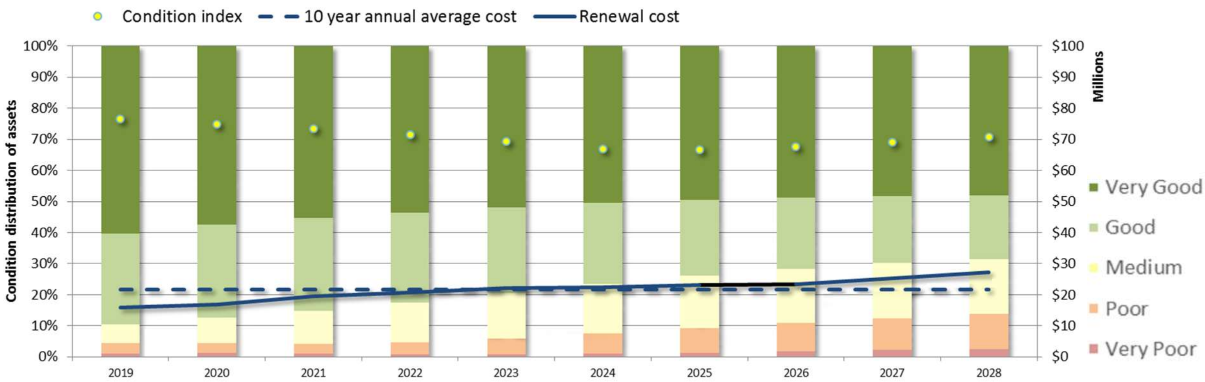
Asset type	Unit ('000)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Footpath	sqm	232	252	291	299	300	282	261	260	280	304
Cycleways	sqm	2	3	3	3	3	3	3	4	4	4

Source: ROM, July 2017

Detailed investment plan and indicative programme per management is available in section 15.12.

As a result of this investment plan, the condition profile of the footpaths and cycleways network will vary as indicated in Figure 7-37. Investment in renewals will increase, and a large portion of assets will remain in good or very good condition. However the proportion of footpath and cycleway assets in very poor condition is forecast to increase from just under 1 per cent currently, to 2.5 per cent in 2028.

Figure 7-37: Impact of renewals recommendations on condition of footpaths and cycleways



Percentage in very poor condition	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Footpath	1.0%	1.3%	1.1%	0.9%	0.7%	1.0%	1.4%	1.8%	2.1%	2.5%

Source: ROM, July 2017

7.4.9 Forward works programme

AT creates its forward works programme for its footpath assets in order to schedule works based on the recommended investment plan in this AMP. This plan aims to optimise network performance while meeting all key strategic goals.

Table 7-34 summarises the 2017 to 2020 renewals forward works programme for footpaths.

Table 7-34: Renewals forward works programme for footpaths

Programme Year	Proposed Work (km)	Estimated Cost ($'000)
2018/19	58	$9633

Source: RAMM, July 2018

Note that the above programme is for footpaths only. There is currently no renewal forwards works programme for cycleway assets. Instead, cycleways are renewed reactively, in response to faults identified during routine inspections and customer complaints.

A forward works programme for 2020/2021 for footpaths is currently being developed.

7.5 Streetlighting

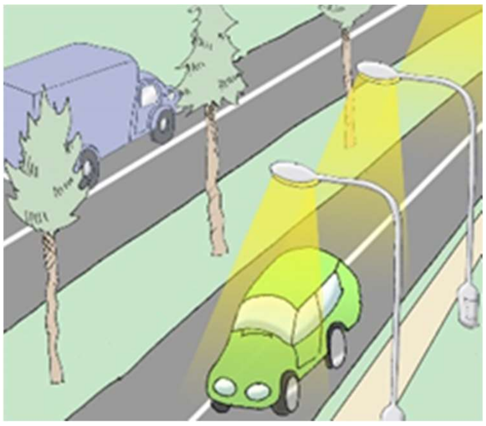
7.5.1 Asset inventory

AT is responsible for managing all streetlighting assets within the road corridor, as shown in Table 7-35.

Table 7-35: Streetlighting asset overview

Asset Class	Component	Count
Street lights	Brackets	36,513
	Columns	71,715
	Luminaires	111,739

Source: Asset management team, October 2017



7.5.2 Links to the strategic case

This subsection sets out how our asset management activities for streetlighting link to and deliver the strategic case.

Problem statements

- AT's streetlighting network is prone to damage and deterioration due to age, corrosion of poles, and car versus pole incidents adjacent to roads.
- Poor levels of illumination on the road or a lack of streetlights at an intersection can contribute to night-time crashes, including those causing death and serious injury.
- A lack of footpath lighting discourages walking at night.
- The designs of older streetlight poles can lead to death or serious injury when vehicles hit streetlight poles at speed.
- A high capital investment is required to adapt to technology changes by upgrading to more energy efficient lights.

Addressing these issues will help achieve our strategic outcomes in the following areas.

Safety	Resilience	Amenity	Accessibility	Travel time reliability	Value for money	Lifecycle asset management	Sustainability
✔	-	✔	-	-	✔	-	✔

Benefits of addressing the problem

Efficient and effective streetlighting will improve the safety and amenity value of the road network.

Consequences of not addressing the problem

Poor lighting and asset failures will compromise road user safety, reduce amenity value and contribute to night-time road incidents.

7.5.3 Levels of service

The performance and asset service measures and targets for streetlighting are listed in Section 15.1.

The most significant of these measures for the network are listed below. Service level gaps for these measures will need to be addressed and monitored.

- ONRC Safety TO5 – Loss of driver control at night
- ONRC Safety TO1 – Crashes on poles
- ONRC Safety TO9 – Vulnerable users
- ONRC Amenity TO2 – Aesthetic faults
- ONRC Cost efficiency CE5 – Overall network cost
- LTP 1 Life cycle management – Network condition
- LTP 2 Sustainability

7.5.4 Gap analysis

This subsection discusses how AT's streetlighting assets are currently performing against the key measures identified in the previous subsection.

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ONRC Safety TO5 – Loss of driver control at night

Safety at night on arterial roads is an issue, contributing to the increasing trend of deaths and serious injuries on arterial roads. Inadequate light level on the street can be a contributor to crashes and to the severity of crash outcomes.

Conclusions: Road safety at night time is a major concern on arterial roads (Figure 7-38).

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Regional

Arterial

Primary collector

Secondary collector

Access

Low-volume

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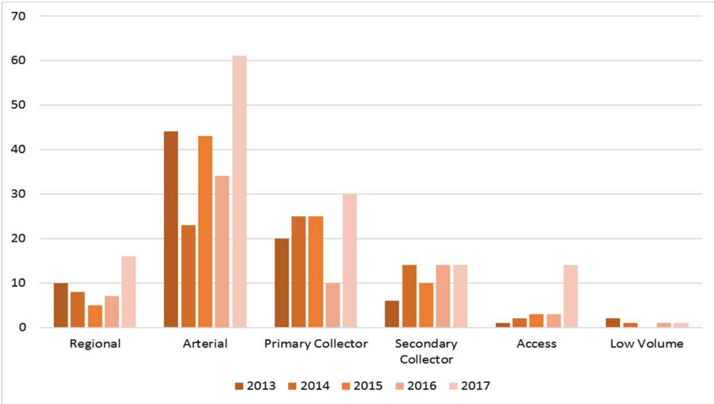
Figure 7-38: Night-time crashes



Source: AT's performance reporting tool – road safety, May 2018

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ONRC Safety TO1 – Crashes on poles

Safety on arterial and primary collector roads is an issue, and crashes involving poles are a contributor to the increasing trend of deaths and serious injuries (Figure 7-39).

Striking a pole can be the deciding factor in whether the outcome of a crash is a death or serious injury.

Conclusions: There is an increasing trend of car versus pole crashes on arterial roads, which are leading to deaths and serious injuries.

</td>
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Regional

Arterial

Primary Collector

Secondary Collector

Access

Low-volume

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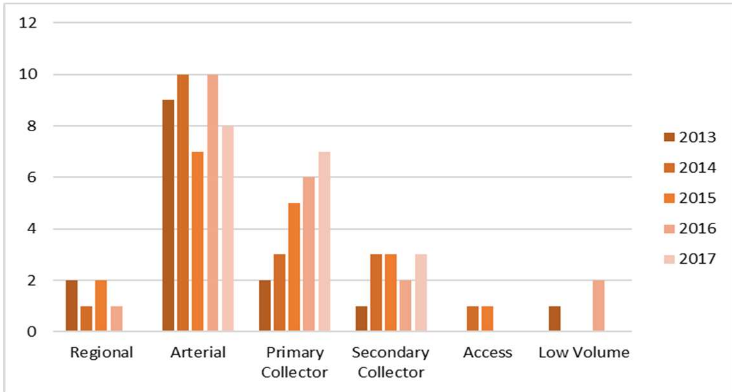
Figure 7-39: Crashes on poles



Source: AT's performance reporting tool – road safety, May 2018

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ONRC Safety TO9 – Vulnerable users

ONRC Amenity TO2 – Aesthetic faults

Lighting is an important contributor to personal safety, and was identified by 8 per cent of pedestrians who responded to AT's roading customer satisfaction survey as a priority for improvement (50) (Figure 7-40).

Conclusions: Better lighting and visibility on roads are important factors for pedestrians.

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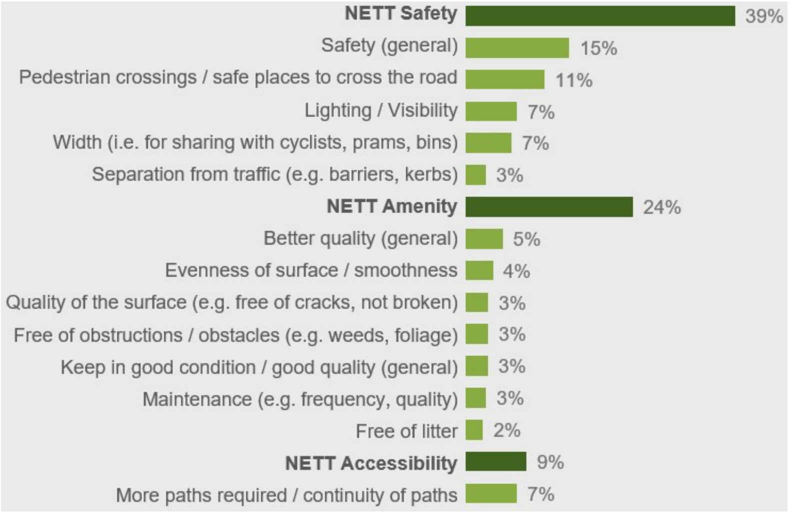
<td>Overall</td>
<td>

Figure 7-40: AT roading customer satisfaction survey – feedback on how to improve the experience of walking



Source: AT roading customer satisfaction survey top line report, June 2018

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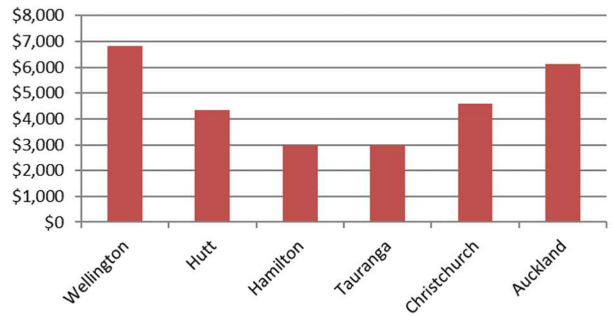
ONRC Cost efficiency CE5 – Overall network cost

AT has collaborated with Wellington, Hutt, Hamilton, Tauranga and Christchurch councils to benchmark the cost efficiency of its streetlight activity (Figure 7-41).

AT spent just over $6,000 on streetlight maintenance and renewals per lane kilometre of its urban road network, which is within the same spending range as other New Zealand urban councils.

</td>
<td>Overall</td>
<td>

Figure 7-41: 2015/2016 Streetlight maintenance and renewals spend per urban lane kilometre ($/km)



Source: Traffic services benchmarking, 2015/2016 outturn costs

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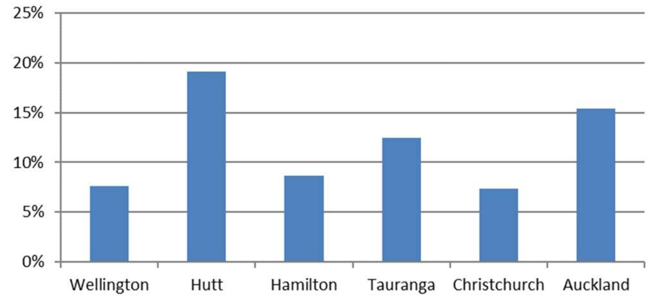
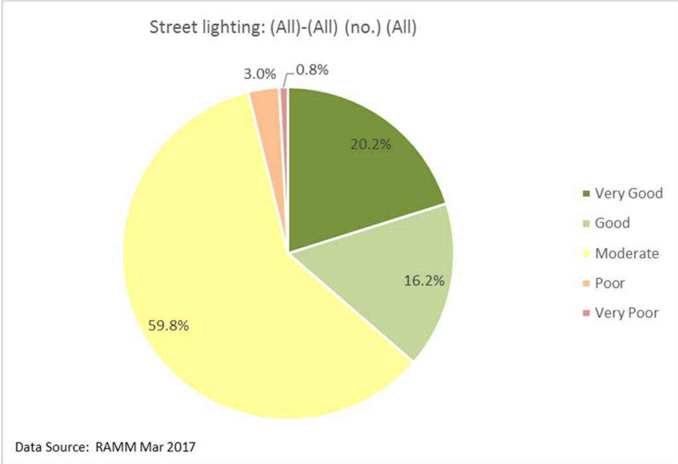
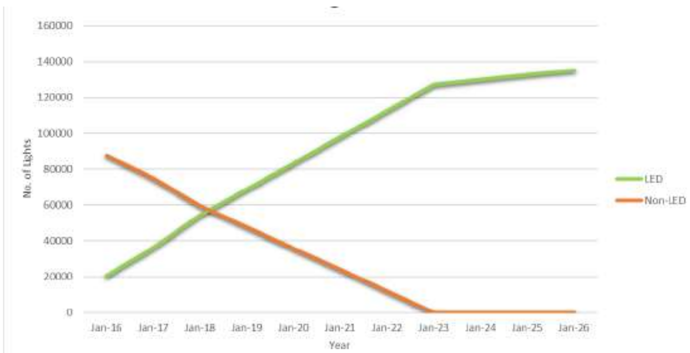
</table>

AT's annual spend on streetlights is around 15 per cent of the streetlight asset replacement cost, which again is within the range of other New Zealand urban councils (Figure 7-42). **Conclusions:** AT's spending on streetlighting is efficient compared to other urban councils.		*Figure 7-42: 2015/2016 Streetlight maintenance and renewals spend as a proportion of streetlight replacement cost*  Source: Traffic services benchmarking, 2015/2016 outturn costs
LTP 1 Life cycle management – Network condition The current condition profile for streetlighting shows that 96 per cent of these assets are in moderate condition and above (Figure 7-42). However, while new lighting columns are fully galvanised and have additional root protection, older steel columns have only aluminium or zinc spray coating, which is then overpainted. These painted columns will continue to deteriorate and will initially become unsightly. Surface rust will then corrode the parent metal, weakening the structure (Figure 7-43). The structural condition of these columns needs to be investigated and tested.	Overall	*Figure 7-43: Streetlight asset condition profile* 

Conclusions: AT's streetlighting network is overall in good condition, but there are potential issues due to the unknown structural condition of older designs of poles.		*Figure 7-44: Streetlight column with serious corrosion* 
LTP 2 Sustainability AT is implementing stage 1 of the LED retrofit programme, which involves replacing 70 watt high-pressure sodium bulbs with light-emitting diode (LED) luminaires on P-category (pedestrian traffic dominant) roads by June 2018. To date, AT has replaced approximately 30,000 high-pressure sodium bulbs with new LED luminaires in the network (Figure 7-45). Benefits of LED technology over the high-pressure sodium technology include: • a 50 per cent reduction in energy use (Figure 7-46) • reduced life cycle costs, due to a longer lamp life (20-year design life, with an expected life up to 25 years)	Overall	*Figure 7-45: Luminaire replacements as a result of the LED retrofit programme*  Source: AT road lighting forward works plan

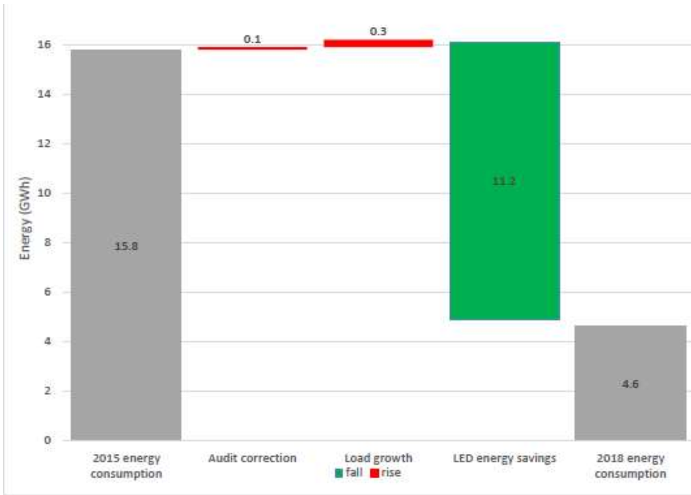
- white light, which is internationally recognised as providing a safer environment
- less light spill and road surface glare.

In addition, a tele-management system has been installed for the LED luminaires (Figure 7-47). The system provides cost, efficiency and performance benefits by enabling lights to be dimmed and switched off where appropriate. Specific benefits of the tele-management system include:

- further energy savings of up to 15 per cent can be achieved through better control of light levels
- actual energy use can be accurately recorded for each light point
- real-time control and monitoring of the network is enabled, negating the need for night patrols of the network. This has the potential to reduce the 750 street-light-related calls that are received each month by AT's call centre.

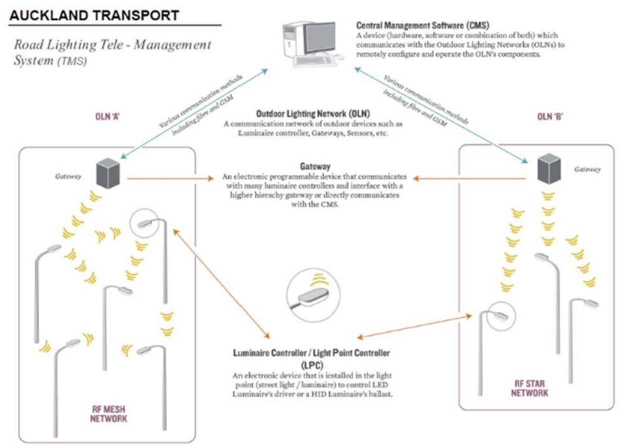
Conclusions: The LED retrofit and use of the tele-management system will reduce the ongoing operational costs of the streetlighting network and help achieve AT's sustainability objectives.

Figure 7-46: Stage 1 changes in energy consumption



Source: AT road lighting forward works plan

Figure 7-47: AT tele-management system



Source: Auckland streetlight network and retrofit presentation, 2016

7.5.5 Impact of the gap analysis on levels of service

This subsection summarises how the issues identified in the gap analysis for streetlighting will impact on levels of services, and sets out potential activities to alleviate these impacts.

Key customer outcomes affected	Level of service impacts and potential mitigating activities
Safety	The rise in night-time crashes and crashes on poles on Auckland's arterial roads is a major concern. Activities that can help alleviate these issues are: • providing adequate illumination for both vehicles and pedestrians • providing adequate designs and materials for lighting components.
Safety and amenity	The current network performance is good. However, better lighting can help achieve higher amenity value for the network. Activities that can help alleviate this issue are: • providing infill lighting in areas where the illumination level is low • investigating lighting requirements in new areas being developed, especially on the urban–rural boundaries.
Life cycle management	The current network condition is good. An appropriate maintenance and renewal programme will mitigate safety issues and the loss of service potential of the network. Activities that can help alleviate this issue are: • investigating the structural condition of poles and developing a programme for their replacement • planning and implementing a maintenance and renewal programme for streetlighting assets.
Value for money	Taking into account the size of the road network and the lighting demands AT experiences, relative to its peers, AT's spend on streetlighting activities is reasonable. Activities that can improve cost efficiency include: • implementing stage 2 of the LED retrofit programme, which is to replace the remaining high-pressure sodium bulbs with LED on V-category (vehicle dominant) roads.

7.5.6 Options to address gaps in the network

AT has developed the following options to address the identified gaps in the network for its streetlighting assets.

Options	Output	Benefits / Consequences
Status quo Make no change to the current approach to streetlight maintenance and renewal.	The current regime is not optimised and business-as-usual continues. Maintenance and renewal activities will not deliver the major outcomes being sought through the strategic case.	Potential asset failures that could compromise the safety of road users. Decline in customer satisfaction with light levels and visibility at night. Value for money not realised.
Optimisation without ONRC Optimise streetlighting management activities, especially renewals, without applying the ONRC framework. Replace all assets when they fall into very poor condition regardless of their ONRC category.	Streetlighting activities, especially the maintenance and renewal programmes and their related investment needs, are optimised. However, these activities are not fully aligned to address the issues and gaps in the network, and will struggle to achieve the outcomes being sought through the strategic case.	Value for money is partially realised. Reduced risk of unexpected asset failures in the network and the associated safety risks to users.
Optimisation with ONRC Optimise streetlight management activities, while applying the ONRC framework. Replace all assets when they reach the appropriate point on the levels of service scale, as aligned with the ONRC framework. Control lights on low classification roads by dimming at night, using the tele-management system.	Streetlighting maintenance and renewal programmes, and their related investment needs, are optimised and aligned with the ONRC fit-for-purpose levels of service concept. These activities will start achieving the outcomes being sought through the strategic case. Efficiencies will be realised through this approach, as it will direct programmes towards high-volume roads.	Reduced risk of unexpected asset failures in the network and the associated safety risks to users. Respond to amenity and life cycle management outcomes Value for money is demonstrated, with a focus on delivering fit-for-purpose levels of service for different ONRC categories.
Run to failure	This is the closest regime to providing a minimum level of investment for maintenance and	Extreme asset failure and road safety risks.

Allow streetlighting assets to run to failure before intervening with renewals.	renewals activities. There are no proactive renewals, but assets are replaced after they have failed. This approach is not sustainable in the long run and will lead to a large backlog, poor levels of service, especially in relation to safety, unhappy customers and the need for substantial investment in the future to bring the network back to an acceptable level.	Major decline in amenity value and customer satisfaction. High maintenance and renewal costs over the life cycle of assets, with a growing backlog of assets in poor and very poor condition.

7.5.7 Recommended option

AT recommends adopting the 'optimisation with ONRC' option for the maintenance, operation and renewal of its streetlighting assets, as it considers this the best option to deliver the strategic outcomes.

This option aims to deliver ONRC fit-for-purpose levels of service, and plans to renew assets before they fail, but with later intervention in relation to less busy roads.

See Section 7.1.8 for a brief explanation of the ROM, which has been used along with the ONRC framework, to develop the renewals programme for AT's streetlighting assets.

7.5.8 Recommended programme and investment plan

The recommended 'optimisation with ONRC' option will deliver safety, resilience, accessibility, travel time reliability, life cycle management and value for money by implementing:

- an optimised maintenance programme that takes into account the impact of growth and demands
- an optimised renewals programme, with a focus on very poor condition streetlighting assets on high-volume roads.

This approach is illustrated in the comparison of three-year investment requirements in Table 7-36.

Table 7-36: Cost of the current and recommended maintenance and renewals programme for streetlighting

Forecast Category ($ millions)	Current			AMP 2018-2021		
	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021
Maintenance and Operations (asset-based)	$19.4	$18.9	$18.0	$17.3	$17.1	$16.0
Renewals	$10.5	$14.6	$12.2	$12.5	$13.1	$15.4
Total	$29.9	$33.5	$30.2	$29.8	$30.2	$31.5

The details of these recommended programmes are given below.

Operation and maintenance

The recommended operation and maintenance investment will save costs, due to less power being used as energy saving LED luminaires are introduced. The investment also allows for increasing demand for streetlighting operation and maintenance needs due to network growth.

The consequential operation and maintenance investment needs have been assessed based on historic asset growth in the network; this includes streetlights on new roads but also additional streetlights on existing roads as required to improve safety and to align with AT capital projects. The current growth rate that has been applied for streetlight luminaires is 2.7 per cent per annum, and for energy consumption is 1 per cent (calculated by Consumer Price Index).

This approach will result in the operation and maintenance investment programme shown in Figure 7-48 and Table 7-37.

Figure 7-48: Streetlighting maintenance and asset-based operations costs

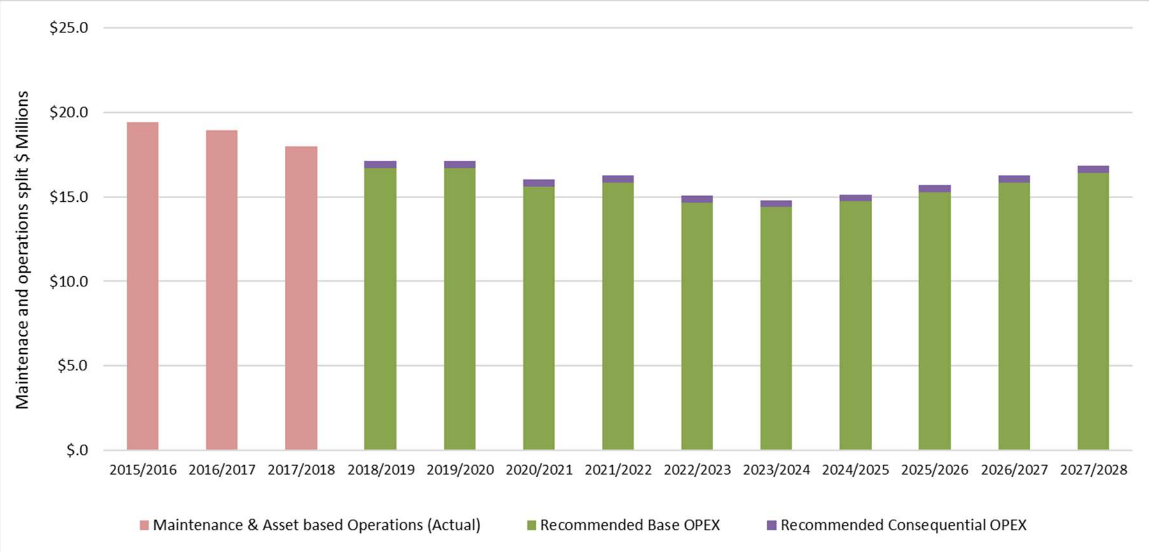


Table 7-37: Streetlighting maintenance and asset-based operations costs

Total Investment

Forecast Category ($ millions)	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	$3.8	$3.7	$3.3	$3.0	$2.6	$3.1	$2.5	$2.2	$2.3	$2.4	$2.5	$2.6
Asset based operations	$15.1	$14.3	$14.0	$14.1	$13.5	$13.2	$12.6	$12.5	$12.8	$13.3	$13.8	$14.3
Total	$18.9	$18.0	$17.3	$17.1	$16.0	$16.3	$15.1	$14.8	$15.1	$15.7	$16.3	$16.9

Baseline Investment

Forecast Category ($ millions)	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	$3.8	$3.7	$3.2	$3.0	$2.5	$3.0	$2.4	$2.2	$2.3	$2.3	$2.4	$2.5
Asset based operations	$15.1	$14.3	$13.6	$13.7	$13.1	$12.8	$12.2	$12.2	$12.5	$12.9	$13.4	$13.9

Consequential OPEX needs

Forecast Category ($ millions)	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	-	-	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1
Asset based operations	-	-	$.4	$.4	$.4	$.4	$.4	$.4	$.4	$.4	$.4	$.4

Source: AT (SAP), August 2018

Renewals

The recommended optimised renewal strategy for streetlighting assets is to prioritise renewals investment for high-volume roads in the network that are likely to experience higher demand, and to align with the ONRC performance requirements for the network. The approach we have taken to align AT's ROM with the ONRC is detailed in Section 7.1.8.

This approach will result in a short-term reduction in renewals investment needs, as some works will be delayed. This approach is shown in Figure 7-49 and Tables 7-38 and 7-39. Over time, it is expected that the overall condition of the network will stabilise, which means the network will have achieved the optimum value of its service life.

Figure 7-49: Streetlighting renewals costs

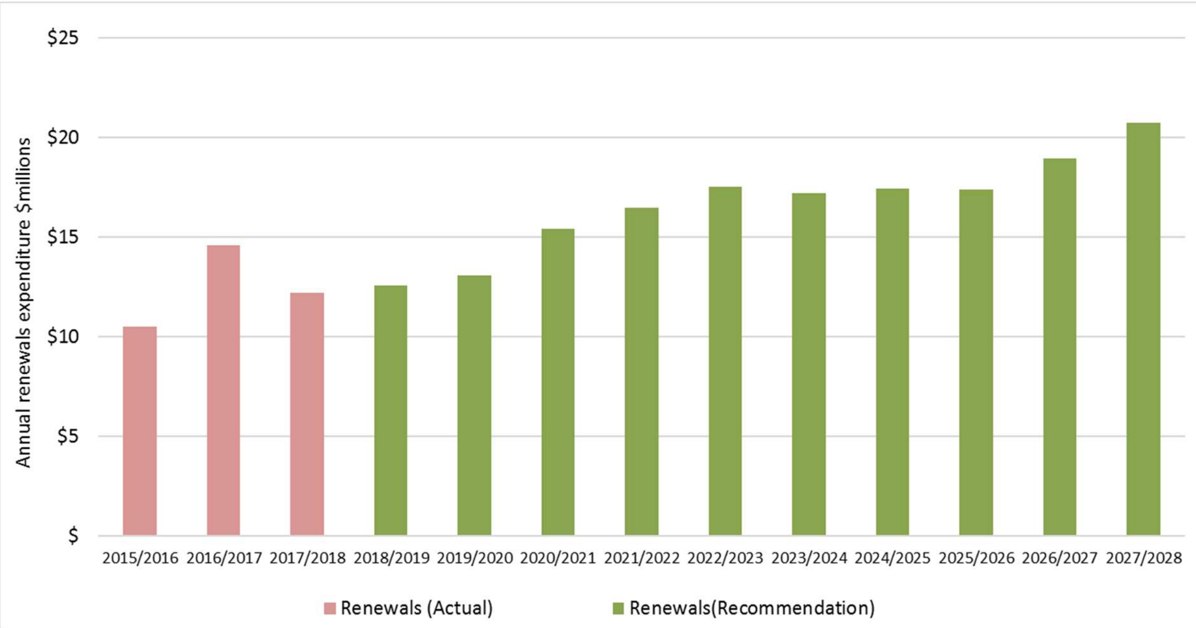


Table 7-38: Streetlighting renewals costs

Forecast Category ($millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Renewals (Actuals)	$10.5	$14.6	$12.2										
Renewals (Recommended)				$12.5	$13.1	$15.4	$16.5	$17.5	$17.2	$17.4	$17.4	$18.9	$20.7
Total	$10.5	$14.6	$12.2	$12.5	$13.1	$15.4	$16.5	$17.5	$17.2	$17.4	$17.4	$18.9	$20.7

Table 7-39: Detail of streetlight renewals costs

Asset type ($ '000)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Management fees	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Poles	5,744	6,333	6,333	6,333	6,333	6,333	6,333	6,333	6,333	6,333
Accelerated pole replacement	0	809	3,346	4,590	5,825	5,764	5,980	5,903	7,445	9,215
Brackets	875	875	875	875	875	875	875	875	875	875
Luminaires	1,800	900	700	500	300	0	0	0	0	0
Overhead to underground power (Vector)	566	571	576	583	589	594	600	606	612	619

Asset type ($ '000)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Overhead to underground power (Counties)	737	745	753	760	767	775	783	790	798	806
Car versus pole	500	500	500	500	500	500	500	500	500	500
CMS	200	200	200	200	200	200	200	200	200	200
Clocks	50	50	50	50	50	50	50	50	50	50
Internal time charges	374	377	381	385	389	393	397	401	405	409
Total	**12,545**	**13,060**	**15,413**	**16,475**	**17,528**	**17,184**	**17,417**	**17,358**	**18,918**	**20,706**

Source: AT (SAP), August 2018

The indicative programme of renewals associated with the above recommended investment plan is given below:

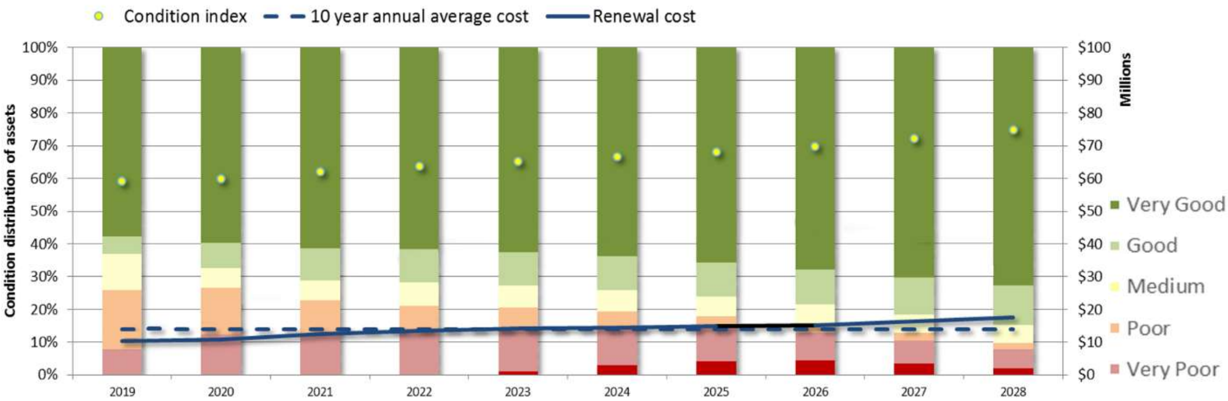
Asset type	Unit	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Brackets	Unit	2,088	2,961	3,845	4,557	3,821	2,915	2,443	2,170	2,128	2,155
Columns	Unit	2,515	3,068	4,052	5,441	5,537	5,156	5,089	5,049	5,344	5,736
Luminaires	Unit	12,238	10,151	8,440	2,672	5,110	8,202	10,096	11,250	12,811	14,129

Source: ROM, July 2017

Detailed investment plan and indicative programme per management is available in section 15.12.

Under this investment plan, the resultant condition profile of the streetlighting network will vary, as indicated in Figure 7-50. There will be a steady improvement in the proportion of streetlighting assets in very good condition.

Figure 7-50: Impact of renewals recommendation on condition of streetlighting



Percentage in very poor condition	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Streetlighting	7.8%	12.4%	12.3%	13.4%	14.6%	14.9%	14.2%	12.9%	10.6%	7.8%

Source: ROM, July 2017

7.5.9 Forward works programme

AT has developed its forward works programme for streetlighting based on the recommended invested strategy outlined above.

The recommended forward works investment for AT's streetlighting assets is shown in Table 7-40.

Table 7-40: Forward works investment plan for streetlighting

Asset class	Asset type	Unit (000)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	Annual average
Street lighting	Streetlights	Unit	16.8	16.2	16.3	12.7	14.5	16.3	17.6	18.5	20.3	22.0	17.1

Source: ROM, July 2017

The key renewals projects that will be delivered in the early years of this AMP are shown in Table 7-41.

Table 7-41: Three-year streetlights renewals programme

Programme Year	Asset type	Count	Estiamted Cost ($ '000)
2018/19	Poles	1,800	$6,333
	Luminaires	2,400	$1,800
	Brackets	3,498	$875
2018/19 Total		**7,698**	**$9,008**
2019/20	Poles	1,800	$6,333
	Luminaires	1,200	$900
	Brackets	3,498	$875
2019/20 Total		**6,498**	**$8,108**
2020/21	Poles	1,800	$6,333
	Luminaires	933	$700
	Brackets	3,498	$875
2020/21 Total		**6,232**	**$7,908**
Grand Total		**20,429**	**$25,023**

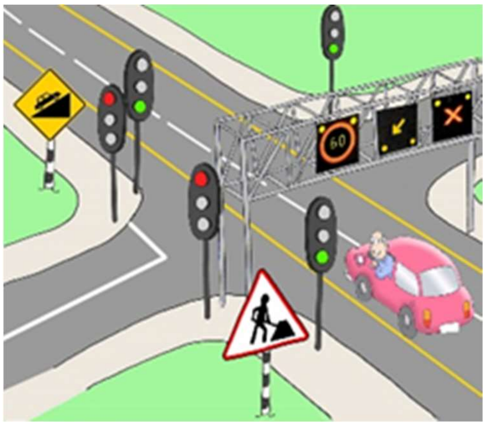
Source: AT road lighting 10-year forward works plan, 2017

7.6 Traffic systems, signs and markings

7.6.1 Asset inventory

AT is responsible for traffic systems, signs and markings assets in the road corridor. Table 7-42 provides an overview of these assets.

Table 7-42: Traffic systems, signs and markings asset overview



Source: Asset management team, October 2017

Road markings are categorised as standard pavement markings and high-performance markings. There are an estimated 570 kilometres of thermoplastic road markings in the AT transport network.

7.6.2 Links to the strategic case

This subsection sets out how our asset management activities for traffic systems, signs and marking link to and deliver the strategic case.

Problem statements

- Travel times on arterial roads are increasing due to traffic congestion.
- Deaths and serious injuries at intersections are increasing.

Addressing these issues will help achieve our strategic outcomes in the following areas.

Safety	Resilience	Amenity	Accessibility	Travel time reliability	Value for money	Lifecycle asset management	Sustainability
✔	-	✔	✔	✔	-	-	✔

Benefits of addressing the problem

Effective traffic systems support road network optimisation, which helps manage congestion through making best use of the existing road network.

Traffic systems also contribute to safety by setting priorities for traffic movements, supporting the enforcement of road rules, enabling rapid responses to crashes and incidents, and informing travellers about network conditions.

Consequences of not addressing the problem

Without investment in the network's traffic systems, Aucklanders would experience longer travel times, reduced customer satisfaction and increased safety risk. Stop–start travel in congested conditions also leads to high fuel use and affects air quality. Limited road space would not be actively managed to optimise network performance, leading to delays for everyone.

7.6.3 Levels of service

The performance and service measures and targets for traffic systems, signs and marking are listed in Section 15.1.

Key level of service measures that are significant to traffic systems, signs and markings are:

- ONRC Travel time reliability CO1 – Customer satisfaction
- ONRC Safety TO6 – Deaths and serious injuries at intersections
- LTP 1 Travel time reliability – Traffic signal optimisation
- LTP 2 Travel times on key freight routes – Maintain travel times on key freight routes in the interpeak
- LTP 2 Value for money – Cost comparison to peers
- LTP 3 Life cycle management – Condition of assets

7.6.4 Gap analysis

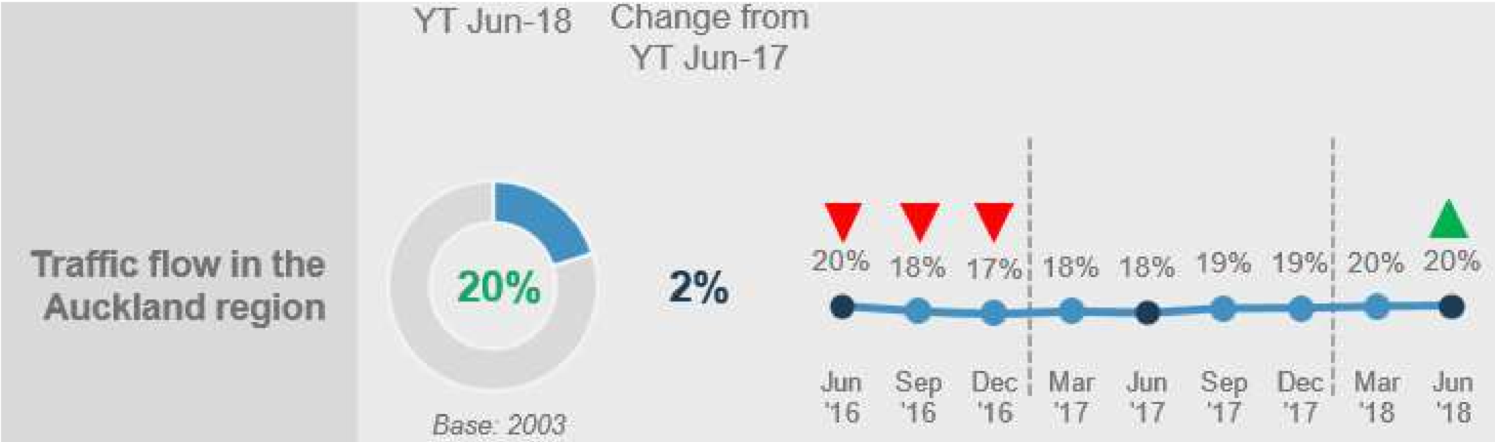
This subsection discusses how AT's traffic systems, signs and markings assets are currently performing against the key measures identified in the previous subsection.

<table>
<tr>
<td>ONRC Travel Time Reliability CO1 – Customer satisfaction

Conclusions:
Auckland residents have low, and declining, satisfaction with traffic flow.</td>
<td colspan="2">Traffic flow is the main concern of AT's customers, as discussed in Section 4.7.

Traffic flow received very low satisfaction scores in AT's roading customer satisfaction survey, declining from 24 per cent satisfaction in the year to June 2016, to 20 per cent currently (Figure 7-51). This result reflects recent growth in traffic and the constraints of the network, but also aligns with trends in travel speed, which have not declined over the past year.

Figure 7-51: AT roading customer satisfaction survey



Source: AT roading customer satisfaction topline report, June 2018</td>
</tr>
<tr>
<td>ONRC Safety TO6 – Deaths and serious injuries at intersections</td>
<td>Regional

Arterial

Primary collector</td>
<td>Crashes at intersections on regional, arterial and primary collector roads are increasing (Figure 7-52), which contributes to the overall trend of increasing deaths and serious injuries across the network.

The risk of intersection crashes can be managed through well-designed traffic signals, signs and road markings, and through enforcement, including speed and red-light cameras. Traffic services and operational</td>
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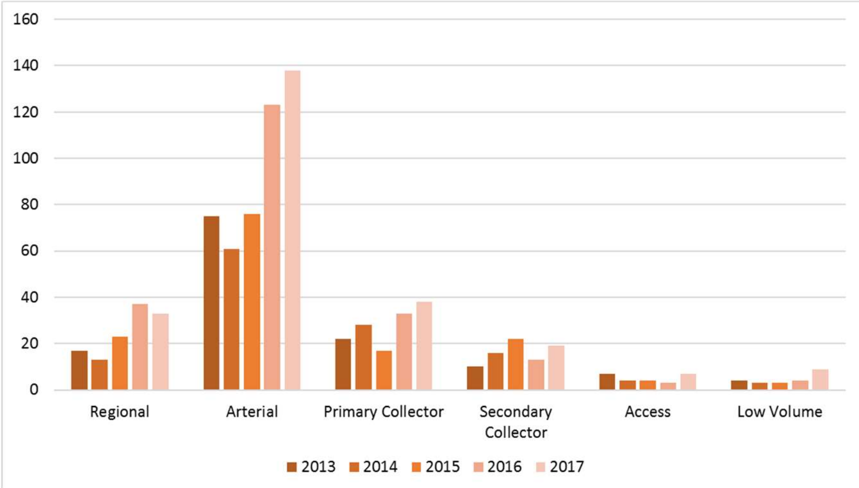
<tr>
<td>Conclusions:
Intersection deaths and serious injuries are rising on high-volume roads.</td>
<td>Secondary collector

Access

Low-volume</td>
<td>traffic management contribute to safety by indicating to road users where to drive, and in areas of potential user conflict, indicate which users have priority.

Maintenance also has a role in ensuring that any defects in signs, markings and traffic signals are identified and responded to quickly.

Figure 7-52: ONRC Safety TO6 - Intersections



Source: ONRC performance measures report, AT Asset management team, May 2018</td>
</tr>
<tr>
<td>LTP 1 Travel time reliability – Traffic signal optimisation

Conclusions: Signal and network optimisation has proven to produce</td>
<td colspan="2">Figure 7-53: Key benefits of traffic signal optimisation


</td>
</tr>
</table>

fuel, emission and travel time savings.	 Source: AT quarterly indicator reports Traffic services and operational traffic management investment supports: • analysing key arterial routes, and recommending how best to move more people and freight (but not necessarily more vehicles) on these routes • optimising traffic signals on these routes, on a 2-year rolling schedule • optimising traffic signals in the CBD continuously, in real time • continuing to expand network user information, including electronic signs and media traffic reports • improving the safety of signalised intersections, and responding more quickly when crashes do occur. This AMP also sets out the strategic case for low-cost, low-risk capital improvements to address identified network deficiencies and contribute to improved travel times for priority road users. Measures for the efficient use of the network can be found in the AT indicators reports and include: • arterial route productivity – an estimate of the numbers of people passing through a particular route • journey times, travel speeds and delays on selected routes and freight routes at peak and off-peak times. The results show that optimisation of signals is highly cost effective in terms of maintaining or improving levels of service (Figure 7-53).

LTP 2 Travel times on key freight routes – Maintain travel times on key freight routes in the interpeak

Conclusions:

Interpeak travel times on selected routes that are important for freight have been maintained at close to 2015 levels (Figure 7-54).

Figure 7-54: Travel times on key freight routes

Travel times on key freight routes during the inter-peak (9am-4pm) for 85th percentile (i.e. 85 per cent of trips on the route are made within the travel time indicated)

MINUTES	TARGET	2017 ACTUAL	2017 TARGET	2016 ACTUAL	2015 ACTUAL
SEART (from Sylvia Park to East Tamaki)	☒	12*	11	11	11
SEART (from East Tamaki to Sylvia Park)	☑☑	11	12	10	10
Wairau Road (from SH1 to SH18)	☒	9*	8	8	8
Wairau Road (from SH18 to SH1)	☒	9*	8	8	8
Harris Road (from East Tamaki to SH1 Highbrook interchange)	☒	11*	10	10	10
Harris Road (from SH1 Highbrook interchange to East Tamaki)	☒	12*	11	11	11
Kaka Street/James Fletcher Drive/Favona Road/Walmsley Road (SH20 to Walmsley)	☑☑	8	13	8	8
Kaka Street/James Fletcher Drive/Favona Road/Walmsley Road (Walmsley to SH20)	☑☑	7	13	8	7
Great South Road (SH1 Ellerslie-Panmure Highway interchange to Portage Road)	☒	12**	11	11	11
Great South Road (Portage Road to SH1 Ellerslie-Panmure Highway interchange)	☒	13**	11	12	11

*Travel times not met were one minute longer than the target but still represent relatively good levels of service for these routes. Wairau Road east bound performance has not lifted despite minor improvements at the SH1 interchanges.

**Minor improvements identified for the key intersection of Church Street/Great South Road are scheduled for the second half of 2017, and are expected to result in some travel time gains.

KEY TO TARGETS:

☑ Result within +/- 2.5% of target = MET. ☑☑ Result above target by more than 2.5% = EXCEEDED.

☒ Result below target by more than 2.5% = NOT MET. See page 34 for Notes 1 to 8 to the performance measure targets.

Source: AT annual report, 2017

<table>
<tr>
<td>LTP 3 Value for money – Cost comparison to peers

Conclusions: Costs for traffic systems, signs and markings are lower, on a per kilometre basis, than AT’s peers</td>
<td>Overall</td>
<td>Benchmarking by comparing Auckland to other transport networks is difficult for three reasons:

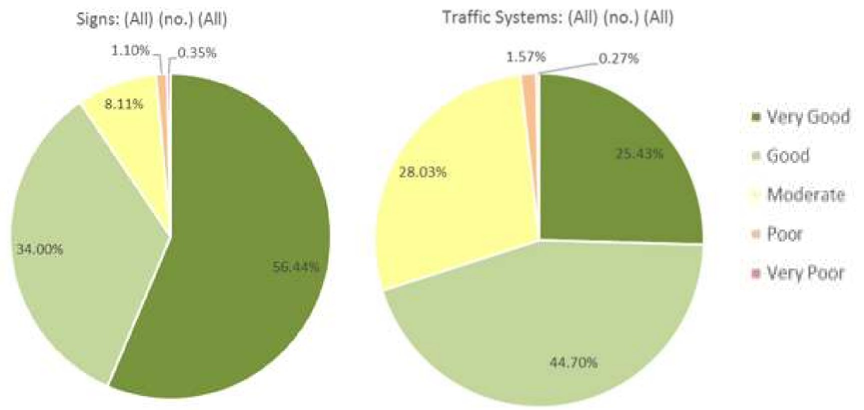
• other councils include signs, marking and lighting all in one asset category of traffic services
• benchmarked costs do not include the traffic operations delivered by the Wellington and Christchurch traffic operations centres
• costs would ideally be benchmarked according to the length of the urban network, or length of arterial roads, rather than of the total network. Urban networks have higher costs for signs and marking, and arterial roads are more likely to need operational traffic management.

Auckland, Hamilton, Tauranga, Hutt, Wellington and Christchurch cities voluntarily shared benchmarking data on traffic services costs and other potential benchmarks. Based on this data, Auckland’s costs are lower on a per-kilometre basis than those of comparable networks, as detailed in Table 7-43.

Table 7-43: Costs for signs, markings and operations

<table>
<tr><th></th><th>Cost/km</th></tr>
<tr><td>Auckland Transport</td><td>3,023</td></tr>
<tr><td>Christchurch City Council</td><td>4,585</td></tr>
<tr><td>Wellington City Council</td><td>10,418</td></tr>
<tr><td>Hamilton City Council</td><td>6,875</td></tr>
<tr><td>Hutt City Council</td><td>7,117</td></tr>
<tr><td>Tauranga City Council</td><td>3,595</td></tr>
</table>

Source: Traffic services benchmarking, 2015/2016 outturn costs</td>
</tr>
</table>

LTP 3 Life cycle management – Condition of assets **Conclusions:** Overall condition is good, however, there is a large portion of traffic system assets that are in the moderate condition rating. These assets are at risk of falling into poor condition unless a proper maintenance and renewal strategy is applied.	Overall	The current condition profiles for this asset class show that 99 per cent of AT's traffic systems assets are in very good to moderate condition, and 99 per cent of traffic signs are in moderate to very good condition (Figure 7-55). High-performance road marking has an expected life of five to seven years and is replaced as a capital renewal at the end of its useful life. No condition information is collected for standard road markings, as these assets are maintained or renewed annually. *Figure 7-55: Asset condition profile*  Source: RAMM, March 17

7.6.5 Impact of the gap analysis on levels of service

This subsection summarises how the issues identified in the gap analysis for traffic systems, signs and markings will impact on levels of services, and sets out potential activities to alleviate these impacts.

Key customer outcomes affected	Level of service impacts and potential mitigating activities
Safety	There is a gap in safety outcomes. The number of deaths and serious injuries is rising, and crashes at urban intersections are a major contributor to this. Activities that can help alleviate these issues are: • ensuring that any defects in signs, markings and traffic signals are identified and responded to quickly, through appropriate maintenance and renewal programmes • optimising traffic signal timings to best serve the mix of road users, achieving improved travel times and reducing risk-taking behavior.
Travel time reliability	Asset failure, and poorly managed and operated systems can result in increased congestion and customer dissatisfaction. Activities that can help alleviate these issues are: • developing and implementing strategies for better asset system monitoring, along with using new technologies • developing and maintaining a risk register of critical assets, which also identifies mitigation measures • actively monitoring system performance and developing quick response strategies.
Life cycle management	The current network condition is good. However, AT needs to implement a renewals programme that will mitigate the risk of loss of service potential of the network. Activities that can help alleviate these issues are: • increasing renewals and maintenance programmes in line with the expansion of traffic systems assets and activities • actively monitoring deterioration and loss of service potential.
Value for money	Value for money is a priority of the Auckland Transport Alignment Project. When AT's network is compared to its peers, it is clear it efficient. However, new strategies can improve efficiency by: • actively managing the network to optimise travel times, and improve response times

- optimising some operational categories (traffic operations and renewals are extremely cost effective, but others require improvement).
- varying the frequency of renewals for road markings, according to traffic volumes.

7.6.6 Options to address gaps in the network

AT has developed the following options to address the identified gaps in the network for its traffic systems, signs and markings assets.

Option	Output	Benefits and consequences
Optimisation Optimise asset management activities, especially renewals. Replace all assets before they fall into very poor condition, to minimise the risk of asset failure.	Traffic system assets are appropriately maintained and are renewed before they fall into poor condition. Signs and marking are appropriately maintained and are renewed before they fall into very poor condition. The frequency of renewals for road markings is varied according to traffic volumes. Future budgets provide for opex costs to grow in line with traffic growth; that is, at 1.8 per cent per year.	Quicker response times. More efficient network. Lower safety risk through active asset monitoring. Value for money realised through better life cycle management.
Run to failure Allow assets to run to failure before intervening with renewals.	This is the closest regime to undertaking a minimum level of investment for maintenance and renewals. There are no proactive renewals, but assets are replaced after they have failed. This approach is not sustainable in the long run and will create a large backlog, poor levels of service, especially in safety, unhappy customers and the need for substantial investment in the future to bring the network back to an acceptable level.	Cost efficiency is not realised. Extreme risk of congestion, and a high risk of safety-related injuries and deaths. High maintenance and renewal costs over the assets' life cycles, with a growing backlog of assets in poor and very poor condition.

Note: There is no ONRC option for traffic systems.

7.6.7 Recommended option

AT recommends adopting the 'optimisation' option for the maintenance, operation and renewal of its traffic system, signs and markings assets, as it considers this the best option to deliver the strategic outcomes.

See Section 7.1.8 for a brief explanation of the ROM, which has been used to develop the renewal programmes for AT's traffic systems, signs and markings assets.

7.6.8 Recommended programme and investment plan

The recommended optimisation option will deliver safety, resilience, accessibility, travel time reliability, life cycle management and value for money by implementing:

- an increased renewals programme that focuses on assets in poor condition and reduces the risk of high life-cycle costs over time
- a proactive maintenance programme that provides better value for money.

This approach is illustrated in the comparison of three-year requirements in Table 7-44.

Table 7-44: Cost of the current and recommended maintenance and renewals programme for traffic systems, signs and markings

Forecast Category ($ millions)	Current			AMP 2018-2021		
	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021
Maintenance and Operations (asset-based)	$25.5	$26.2	$23.4	$23.0	$23.3	$23.6
Renewals	$3.9	$5.2	$5.3	$6.0	$6.5	$7.1
Total	$29.4	$31.4	$28.7	$29.0	$29.8	$30.7

The details of these recommended programmes are given below.

Operations and maintenance

The recommended maintenance option for traffic systems, signs and marking is to adopt a proactive maintenance approach for the region, in line with the current maintenance contract, to mitigate risks of assets failing prematurely.

The recommended investment in maintenance is based on the 2016/2017 actual spend on maintenance for traffic systems, signs and making, with an additional allowance to cater for increased demand for maintenance and consequential opex needed as a result of network growth, as shown in Figure 7-56 and Table 7-45.

The consequential opex needed has been assessed based on the historic growth of these assets in the network, and after consultation with AT's operational team about upcoming projects. The current growth rate that applies for traffic systems, signs and marking assets is 2.4 per cent per annum.

Figure 7-56: Traffic systems, signs and markings maintenance and asset-based operations costs

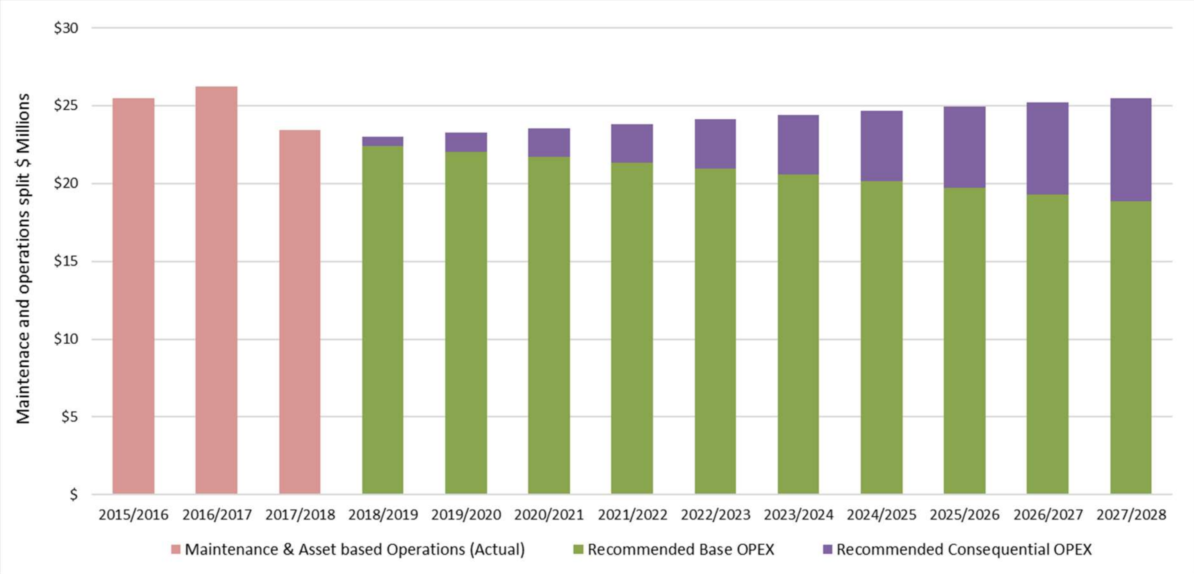


Table 7-45: Traffic systems maintenance and asset-based operations costs

Total Investment

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	$21.8	$19.5	$19.1	$19.3	$19.6	$19.9	$20.2	$20.5	$20.7	$21.0	$21.3	$21.6
Asset based operations	$4.4	$4.0	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9
Total	$26.2	$23.4	$23.0	$23.3	$23.6	$23.8	$24.1	$24.4	$24.7	$24.9	$25.2	$25.5

Baseline Investment

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	$21.8	$19.5	$18.6	$18.4	$18.2	$17.9	$17.7	$17.4	$17.1	$16.8	$16.5	$16.2
Asset based operations	$4.4	$4.0	$3.8	$3.7	$3.5	$3.4	$3.3	$3.2	$3.0	$2.9	$2.8	$2.6

Consequential OPEX needs

Forecast Category ($ millions)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance	-	-	$.5	$1.0	$1.5	$2.0	$2.5	$3.0	$3.6	$4.2	$4.8	$5.4
Asset based operations	-	-	$.1	$.3	$.4	$.5	$.6	$.8	$.9	$1.0	$1.2	$1.3

Source: AT (SAP), August 2018

Renewals

The recommended approach for renewals for traffic systems, signs and marking is to adopt an proactive approach to renewals at a regional level in order to mitigate the risk of increased life cycle costs over time.

The key asset management factors that will be considered in this approach the assets' decay curves, optimum condition profiles and base life, the level of acceptable risk, the condition intervention point, the consequential renewals needed due to growth, the number of years to address any backlog and the unit rate for renewal.

The proposed renewal investment plan that has been developed using this approach is shown in Figure 7-57 and Table 7-46.

Figure 7-57: Traffic systems, signs and markings renewals costs

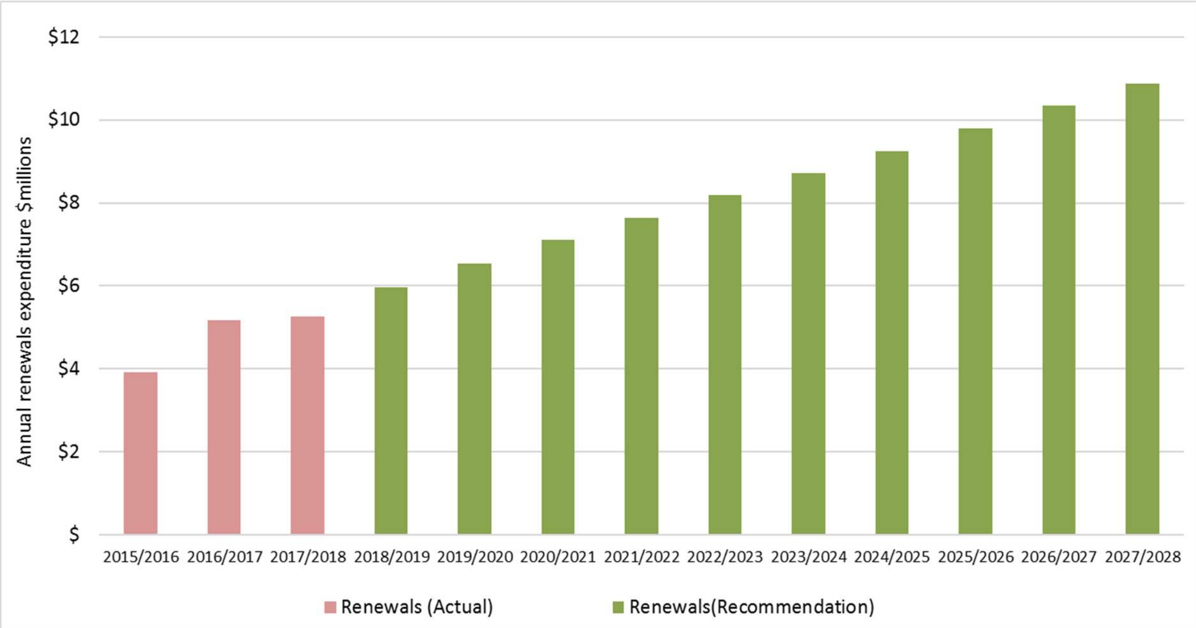


Table 7-46: Traffic systems, signs and markings renewals costs

Forecast Category ($millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Renewals (Actuals)	$3.9	$5.2	$5.3										
Renewals (Recommended)				$6.0	$6.5	$7.1	$7.6	$8.2	$8.7	$9.3	$9.8	$10.3	$10.9
Total	$3.9	$5.2	$5.3	$6.0	$6.5	$7.1	$7.6	$8.2	$8.7	$9.3	$9.8	$10.3	$10.9

Forecast Category ($ millions)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Road markings	$1.1	$1.1	$1.2	$1.2	$1.2	$1.3	$1.3	$1.3	$1.4	$1.4
Road signs	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.3
CCTV	$.1	$.1	$.2	$.2	$.2	$.2	$.2	$.2	$.3	$.3
Electronic signs	$.3	$.4	$.5	$.5	$.6	$.6	$.7	$.8	$.8	$.9
IS hardware	$1.5	$1.5	$1.6	$1.6	$1.6	$1.6	$1.6	$1.6	$1.6	$1.6
Red light camera	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1	$.1
Traffic signals	$2.5	$2.9	$3.4	$3.8	$4.2	$4.6	$5.0	$5.5	$5.9	$6.3
Total	**$6.0**	**$6.5**	**$7.1**	**$7.6**	**$8.2**	**$8.7**	**$9.3**	**$9.8**	**$10.3**	**$10.9**

Source: AT (SAP), August 2018

The indicative programme of renewals associated with the above recommended investment plan is given below:

Asset type	Unit	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Traffic systems	Unit	2,657	2,906	3,380	3,557	3,749	3,722	3,819	3,858	4,129	4,426
Signs	Unit	1,769	1,993	2,024	2,046	2,116	2,266	2,496	2,685	2,982	3,275

Source: ROM, July 2017

Detailed investment plan and indicative programme per management is available in section 15.12.

Under this investment plan, the condition profile of AT's traffic systems, signs and markings assets will vary as shown in Figure 7-58.

Figure 7-58: Impact of renewals recommendation on condition of traffic systems

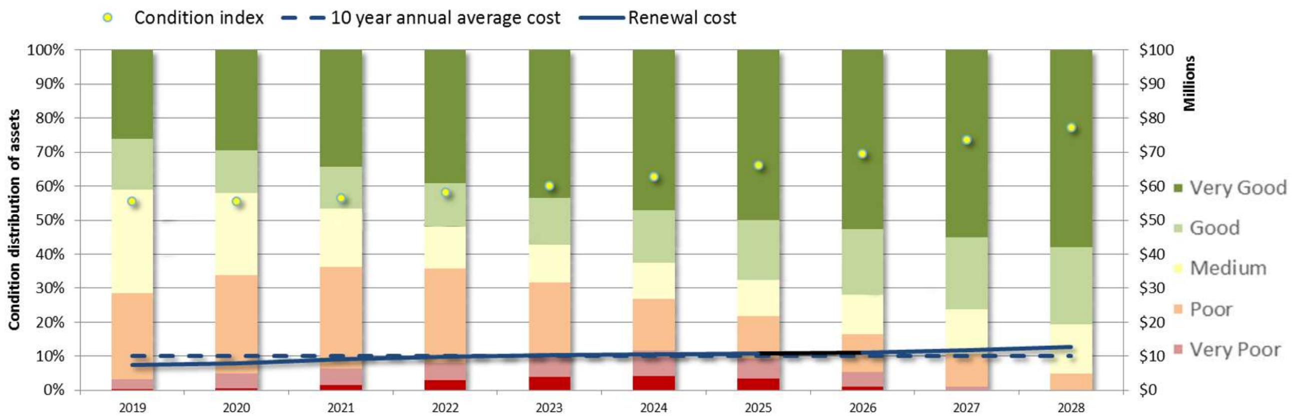
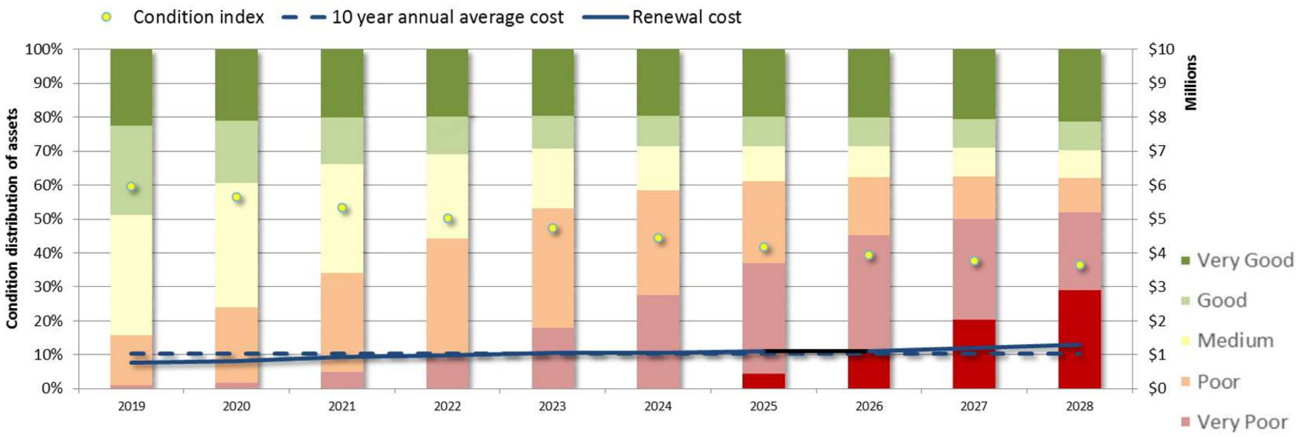


Figure 7 58b: Impact of renewals recommendation on condition of signs



Percentage in very poor condition	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Traffic systems	3.3%	4.8%	6.4%	8.1%	10.8%	11.6%	9.1%	5.5%	0.9%	0.0%

Source: ROM, July 2017

The condition profiles of traffic systems and signs will be closely monitored to identify any worsening trends, and any remedial measures required will be introduced at the next planning cycle in 2021/2024.

7.6.9 Forward works programme

AT creates its forward works programme for its traffic systems and signs assets in order to schedule works based on the recommended investment plan in this AMP. This plan aims to optimise network performance while meeting all key strategic goals. The plan will enable the programme of works detailed in Table 7-47.

Note that markings are generally repainted as part of road maintenance or road re-alignment activities.

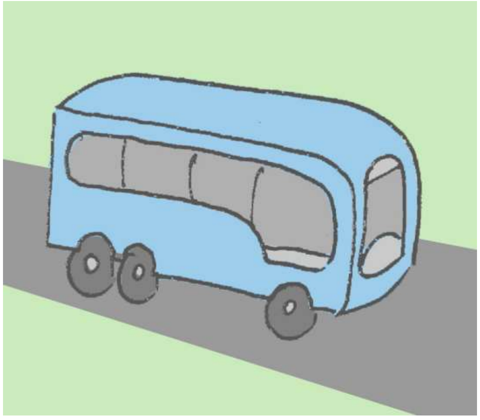
Table 7-47: Forward works plan for traffic systems and signs

Programme Year	Asset Type	Count	Estimated Cost ($'000)
2018/19	Signs	$58	$360
	Traffic systems	$949	$2,515
	CCTV	$29	$111
2018/19 Total		**$1,036**	**$2,986**
2019/20	Signs	$59	$364
	Traffic systems	$1,223	$2,517
	CCTV	$30	$115
2019/20 Total		**$1,312**	**$2,995**
Total		**$2,348**	**$5,981**

Source: AT traffic systems team, 2017

7.7 Public transport

7.7.1 Asset inventory



The increasing investment in public transport means that AT is managing a fast-growing portfolio of infrastructure, much of which is complex and specialised. This includes the assets in Table 7-48.

Table 7-48: Public transport asset overview

57	Electric trains
10	Diesel trains (active)
43	Rail stations (active)
1	Depots
5	Stabling
75 km	Fibre-optic cable
11	Major bus stations and interchanges
9	Intermediate bus interchanges
6,017	Bus stops
2,337	Bus shelters
21	Ferry wharves
	AT HOP ticketing system
	Real-time Information system

Managing AT's public transport assets requires a wide array of skills, from diving (for ferry wharf inspections) to banking software (for the AT HOP system). AT is expanding its specialist public transport asset management staff and also engages outside experts as required.

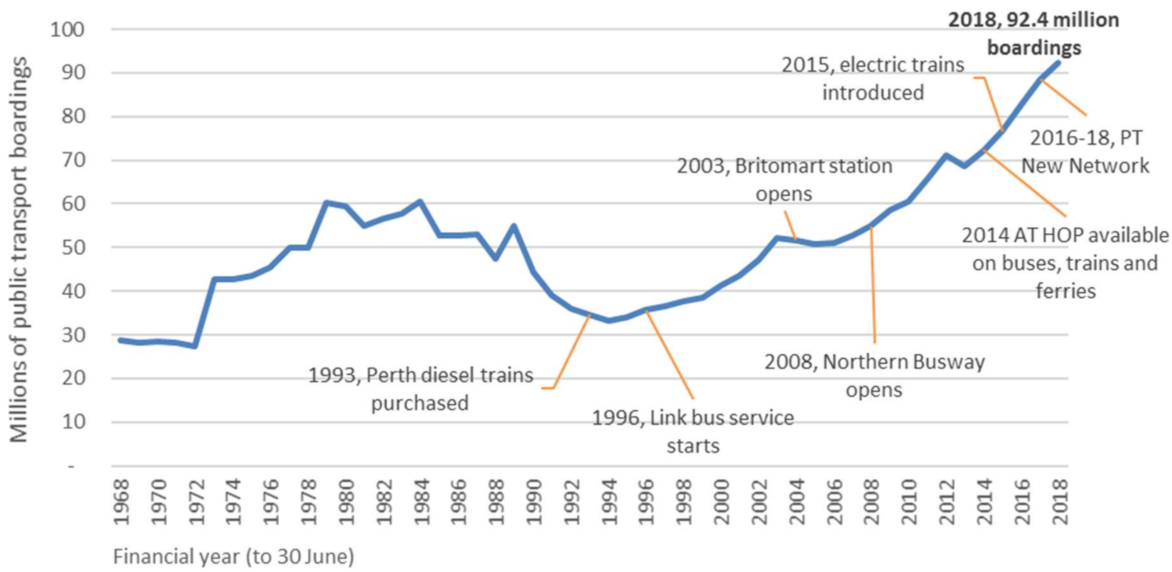
7.7.2 Links to the strategic case

Auckland's strategy to achieve a world-class transport network relies absolutely on increasing public transport patronage. There is simply not enough road space to provide for forecast increases in travel by car.

This is not a new strategy. Current increases in public transport patronage follow a pattern of investment-led growth which dates back to Auckland Regional Authority's decision to purchase second-hand diesel trains from Perth in 1993, as shown in Figure 7-59.

Auckland's network now carries well over half (58 per cent) of all public transport trips in New Zealand (51).

Figure 7-59: Public transport patronage and key investments, 1968 to 2018



Sources: Yearbook of New Zealand; AT patronage data

This subsection sets out how our asset management activities for public transport link to and deliver the strategic case.

Problem statement

Auckland's growing portfolio of public transport assets needs to be maintained to a high level to meet customer expectations, and contribute to growing public transport patronage and managing congestion.

Addressing these issues will help achieve our strategic outcomes in the following areas.

Safety	Resilience	Amenity	Accessibility	Travel time reliability	Value for money	Lifecycle asset management	Sustainability
✔	✔	✔	✔	✔	-	-	✔

Benefits of addressing the problem

Contributes to improving safety, resilience, amenity and accessibility. Improves travel time (relative to projected levels). Optimises life cycle benefits from capital investments and contributes to sustainability.

Consequences of not addressing the problem

Reduced customer satisfaction, leading to lower patronage growth. Reduced benefits from investment in public transport assets.

7.7.3 Levels of service

AT's current strategy is to prioritise rapid, high-frequency public transport. To reflect this, we have adopted the following key level of service measures in AT's Statement of Intent:

- SOI 1 – Total public transport boardings
- SOI 2 – Total rail boardings

- SOI 3 – Patronage on the rapid and frequent transport networks (rail, busway, bus frequent network)
- SOI 4 – Percentage of public transport customers satisfied with their public transport service
- SOI 8 – Public transport punctuality
- AMP 1 – Percentage of public transport customers satisfied with public transport infrastructure
- AMP 2 – Percentage of public transport assets in poor condition
- AMP 3 – Safety of public transport travel.

7.7.4 Gap analysis

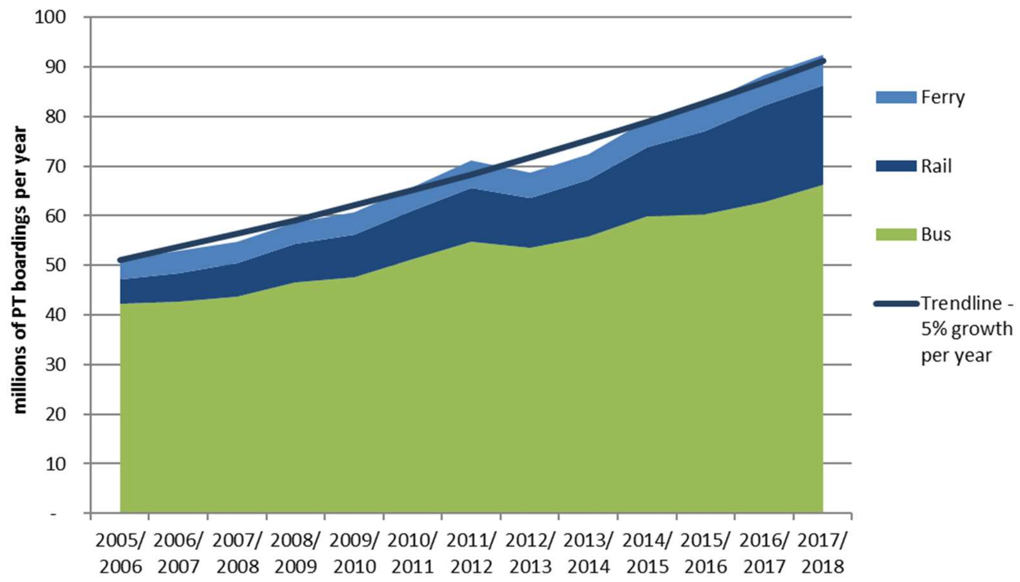
This subsection discusses how AT's public transport assets are currently performing against the key measures identified in the previous subsection.

SOI 1 – Total public transport boardings

There were 92.4 million public transport boardings in 2017/ 2018. Public transport use continues to grow rapidly, with an average growth rate of 5 per cent per year over the past decade as shown in Figure 7-60

Public transport boardings

Figure 7-60: Public transport patronage growth since 2005/2006



Source: AT quarterly report to Auckland Council

SOI 2 – Total rail boardings

Rail has been a significant contributor to overall public transport patronage growth (Table 7-49).

Rail boardings

Table 7-49: Rail boardings, total and as a percentage of all public transport boardings

Rail as % of total	10%	11%	12%	13%	14%	15%	15%	15%	16%	18%	20%	22%	22%

SOI 3 – Patronage on the rapid and frequent transport networks

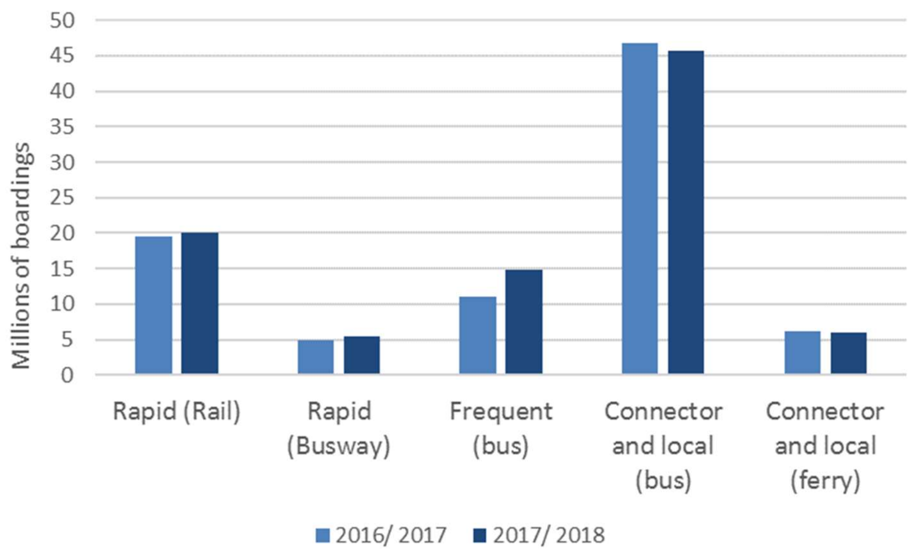
Overall public transport patronage increased by 4.4 per cent (Figure 7-60). Use of the frequent bus network grew by 35.8%, significantly faster than the public transport network as a whole. (Figure 7-61)

Conclusion: Frequent bus services put in place as part of the PT New Network are responsible for the bulk of new patronage growth over the past year.

Public transport hierarchy

- Rapid network – rail
- Rapid network – bus
- Frequent network – bus
- Collector and local network – bus
- Ferry network

Figure 7-61: Public transport patronage growth 2017/2018 by mode and hierarchy



Source: AT quarterly report to Auckland Council

	Rapid (Rail)	Rapid (Busway)	Frequent (bus)	Connector and local (bus)	Connector and local (ferry)	Total PT boardings
2016/ 2017	19,595,151	4,919,092	10,998,863	46,779,578	6,149,274	88,441,958
2017/ 2018	20,150,664	5,458,350	14,932,713	45,772,229	6,042,966	92,356,922
Growth in %	2.8%	11.0%	35.8%	-2.2%	-1.7%	4.4%
Growth as number	555,513	539,258	3,933,850	-1,007,349	-106,308	3,914,964

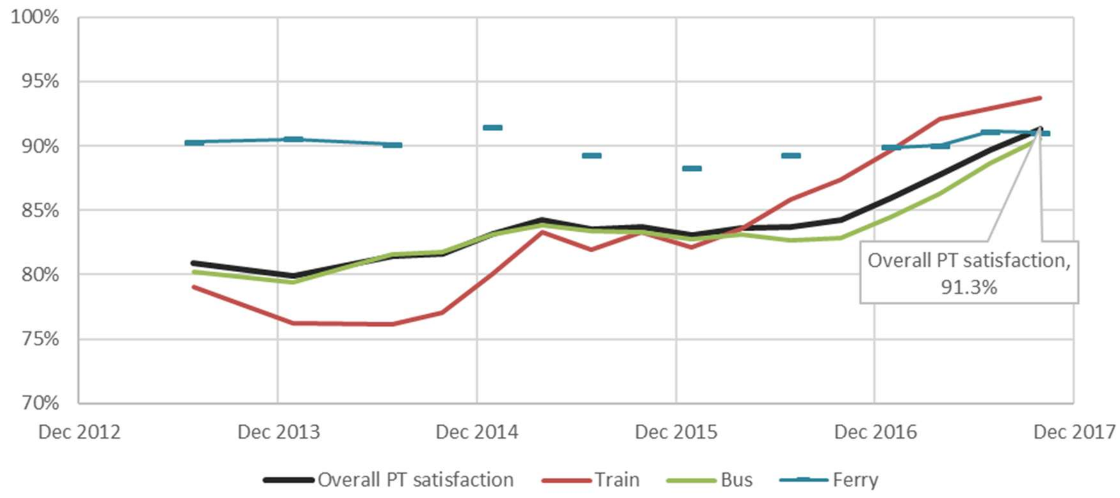
<table>
<tr>
<td>SOI 4 – Percentage of public transport customers satisfied with their public transport service

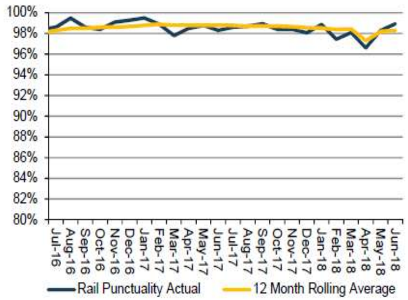
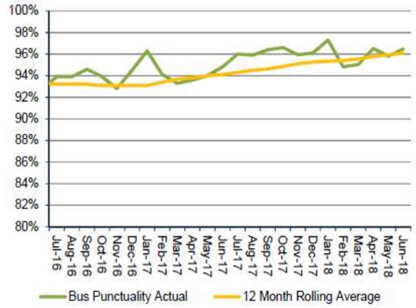
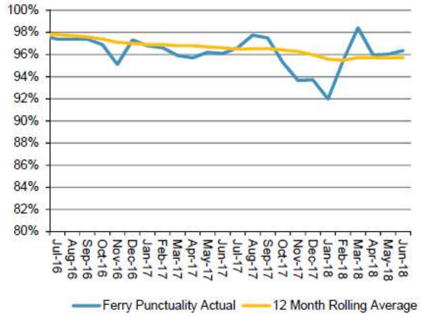
Public transport customer satisfaction in September 2017 was the highest ever recorded, at 91.3 per cent overall, as shown in Figure 7-62.

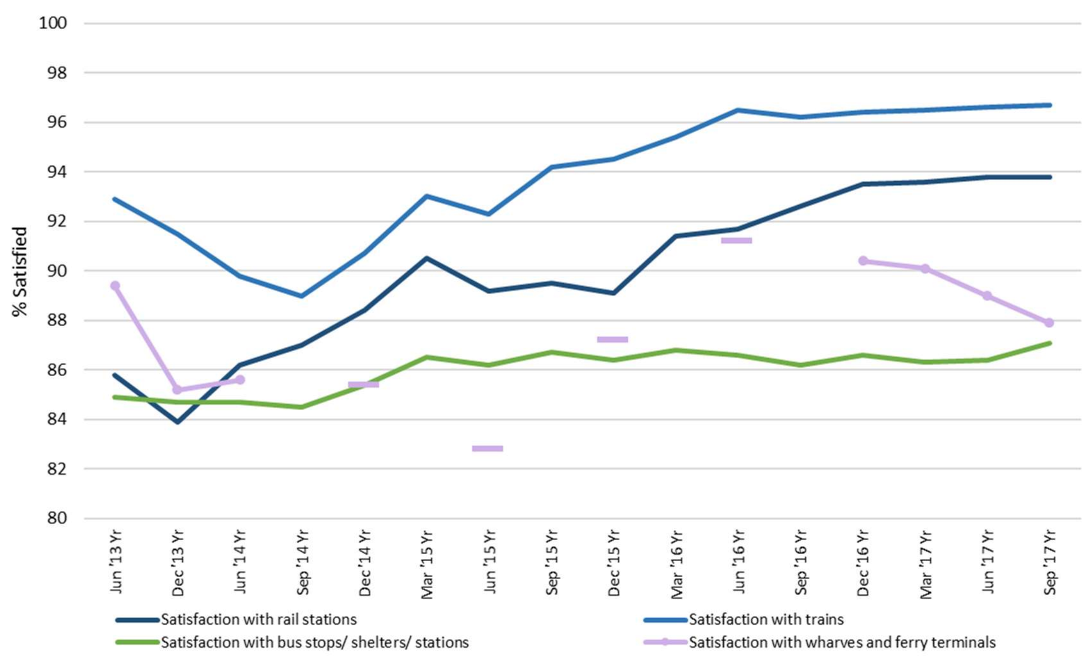
Also significant is that rail overtook ferry in July 2016 (after the rollout of electric trains) as the mode with the highest customer satisfaction.</td>
<td>Public transport customer satisfaction

Rail

Bus

Ferry</td>
<td>Figure 7-62: Public transport customer satisfaction, September 2013 to September 2017

Source: AT quarterly report to Auckland Council</td>
</tr>
</table>

SOI 8 – Public transport punctuality The weighted average punctuality of Auckland buses, trains and ferries in 2016/2017 was 95.2 per cent, against a target of 93 per cent. Rail and bus punctuality is improving, but ferry punctuality has declined slightly. However, all three modes were above the target of 93 per cent punctuality (Figures 7-63 to 7-65).	Public transport punctuality Rail Bus Ferry	*Figure 7-63: Rail services punctuality*  *Figure 7-64: Bus services punctuality*  *Figure 7-65: Ferry services punctuality*  Source: AT quarterly report to Auckland Council

AMP 1 – Percentage of public transport customers satisfied with public transport infrastructure Survey staff boarded public transport services to ask customers about their satisfaction with their trip overall, and with infrastructure, vehicles and service features. Customers consistently rated the infrastructure as high as, or higher than, their rating of the service overall (Figure 7-66).	Public transport customer satisfaction with infra-structure Rail Bus Ferry	*Figure 7-66: Customer satisfaction with public transport infrastructure*  Source: AT quarterly report to Auckland Council

AMP 2 – Percentage of public transport assets in poor condition

The majority of public transport assets are relatively new and still in very good condition (Figure 7-67 and Table 7-50).

The asset group of most significant concern is wharves, with 5 per cent of assets in poor condition, and 2 per cent of assets in very poor condition.

Public transport asset condition

Rail

Bus

Wharves

Public transport systems

Figure 7-67: Public transport asset condition, October 2016

Table 7-50: Public transport asset condition, October 2016

	Rail	Bus	Wharves	Public transport systems
Very good condition	58%	85%	44%	91%
Good condition	31%	8%	30%	8%
Moderate condition	6%	3%	19%	1%
Poor condition	3%	3%	5%	0%
Very poor condition	2%	1%	2%	0%

Source: AMP team

AMP 3 – Safety of public transport travel

Safety risk of public transport travel

Public transport is the least risky mode of travel (52). Safety incidents while travelling on the public transport network are extremely rare.

AT does, however, recognise the need to improve safety at rail level-crossings and to continue working with bus operators to ensure safe driving practices.

7.7.5 Impact of the gap analysis on levels of service

This subsection summarises how the issues identified in the gap analysis for public transport will impact on levels of services, and sets out potential activities to alleviate these impacts.

Key customer outcomes affected	Level of service impacts and potential mitigating activities
Safety	• Maintain the current high level of safety for public transport customers. • Address safety at rail level-crossings through investment in traffic systems.
Resilience	• Continue to grow public transport patronage, in order to enhance the resilience of the system.
Amenity	• Continue to ensure that customer-facing assets do not fall into very poor condition. • Maintain the current high level of customer satisfaction with public transport assets.
Accessibility	• Continue to grow public transport patronage, in order to enhance the accessibility of the system.
Travel time reliability	• Maintain the current high level of punctuality for public transport services.
Life cycle management	• Increase investment in public transport maintenance and renewals, in line with the capital improvement programme. • Expand AT's internal capability of managing an increasingly complex network of public transport assets.
Sustainability	• Continue to grow public transport patronage, in order to enhance the sustainability of the system.

7.7.6 Options to address gaps in the network

AT has developed the following options to address the identified gaps in the network for public transport assets. Given that there are not many significant gaps, the options are relatively simple.

Option	Output	Benefits / Consequences
Status quo Make no change to the current approach to bus, rail and wharf network maintenance.		Levels of service on the public transport network begin to decline, as the maintenance and renewals programmes fall short of the rapid network-building capital programme.
Optimisation Expand public transport systems, in line with the expansion of the network. Increase public transport maintenance and renewals budgets, in line with the capital investment programme.	A high level of service continues to be delivered on an expanding public transport network. Current and new technologies are proactively developed to operate the network more efficiently.	The full benefits of the public transport network construction programme are delivered, as the network is maintained to a high level of service consistent with the level of capital investment.
Run to failure Allow public transport network assets to run to failure before they are renewed.		The benefits of capital investments in public transport are not realised. High maintenance and renewal costs over the life cycle of the assets.

7.7.7 Recommended option

AT recommends adopting the ‘optimisation’ option for the maintenance, operation and renewal of its public transport assets, as it considers this the best option to deliver the strategic outcomes.

This option will see the operations, maintenance and renewals programmes for public transport all increase relative to past investment, as shown in Table 7-51. It reflects the need to keep up with a growing public transport asset base and with expanding services and patronage.

Table 7-51: Cost of the current and recommended maintenance and renewals programme for public transport

Forecast Category ($ millions)	Current			AMP 2018-2021		
	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021
Maintenance and Operations (asset-based)	$65.9	$61.3	$66.3	$73.2	$78.5	$81.6
Renewals	$4.9	$6.8	$12.9	$8.8	$10.9	$15.8
Total	$70.8	$68.1	$79.2	$82.0	$89.4	$97.4

Operations and maintenance

AT’s operations and maintenance costs will increase over time, as shown in Figure 7-68 and Table 7-52, although not as fast as the rates of growth for services and patronage. New and expanded bus interchanges in Silverdale, Manukau and Pukekohe will contribute to this increase, as will expanded hours of service across the network. From 2023/2024, these costs will include costs for the operation of new stations constructed on the City Rail Link.

Due to their technological nature, public transport systems assets are replaced rather than renewed. The budget for this comes out of operational expenditure.

Figure 7-68: Costs to operate and maintain public transport stops, stations and interchanges

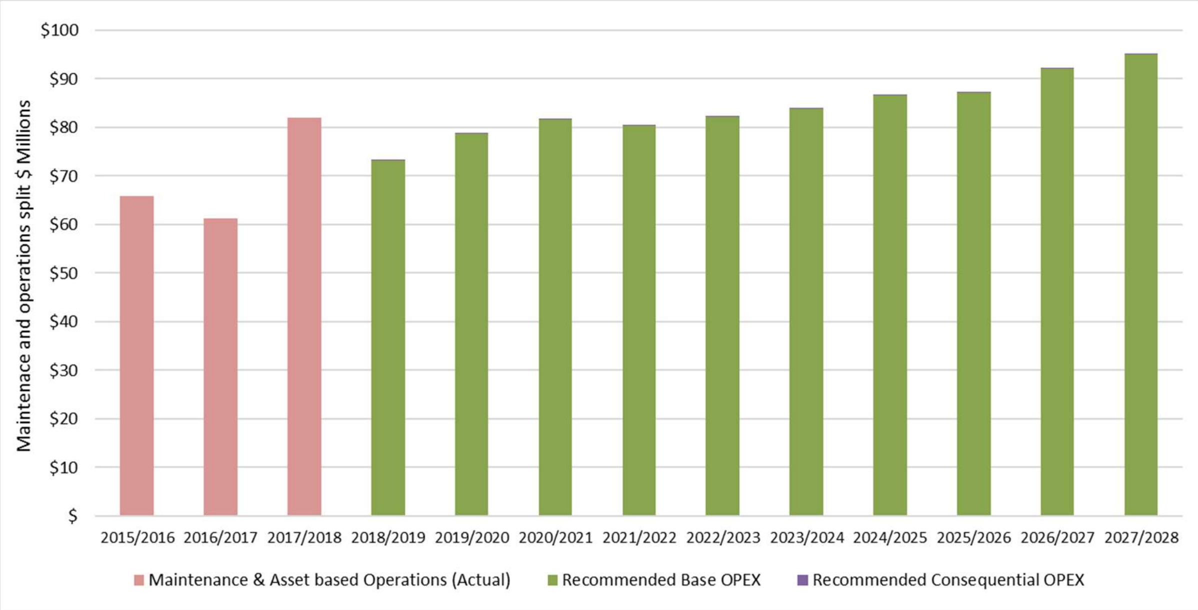


Table 7-52: Costs to operate and maintain public transport stops, stations and interchanges

Forecast Category ($ millions)	2015/ 2016 (Actuals)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Rail network	$33.9	$31.7	$34.4	$38.1	$41.2	$42.6	$38.7	$38.7	$38.9	$39.3	$39.2	$39.0	$39.4
Wharves	$5.2	$5.5	$6.1	$6.9	$7.1	$7.3	$7.5	$7.8	$8.1	$8.5	$9.0	$9.6	$10.4
Bus Network	$5.2	$4.3	$4.8	$6.3	$7.9	$8.7	$9.0	$9.4	$9.6	$10.1	$10.8	$11.1	$11.5
Public transport systems	$21.6	$19.9	$21.0	$22.0	$22.3	$23.0	$25.0	$26.0	$27.0	$28.6	$27.8	$32.0	$33.5
Public transport network total	$65.9	$61.3	$66.3	$73.2	$78.5	$81.6	$80.2	$82.0	$83.6	$86.5	$86.9	$91.7	$94.7

Source: AT (SAP), August 2018

Renewals

Renewals costs for public transport assets vary year on year, as shown in Figure 7-69 and Table 7-53.

The biggest area of renewals expenditure in the current year is on ferry terminals. Wharf and ferry terminal renewals remain high over the first half of the coming decade, as the backlog of wharf assets in very poor condition is renewed. Rail station renewals grow steadily, as rail station asset components, constructed since the opening of Britomart in 2003, reach the end of their useful life.

Renewals for the City Rail Link and for the future mass rapid transit network are not included in the first decade, as these are long-lived assets, which are not expected to require renewals in their early years of operation. There is also no provision in the first decade for renewals of electric trains, as this will still be the responsibility of the supplier.

Figure 7-69: Renewals costs for public transport stops, stations and interchanges

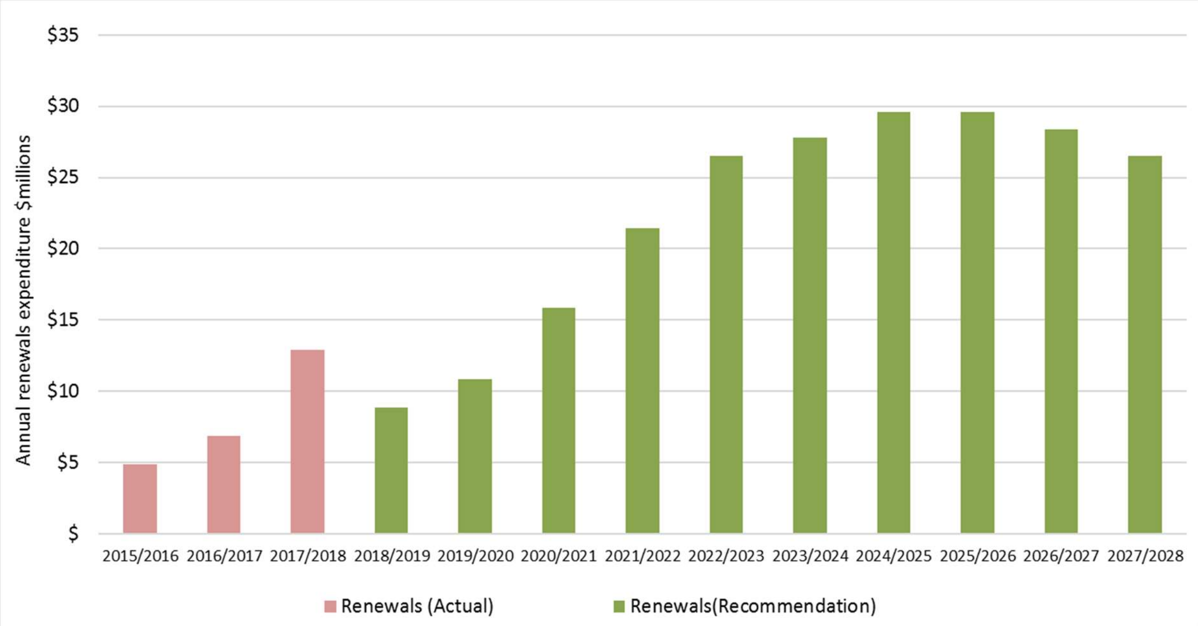


Table 7-53: Renewals costs for public transport stops, stations and interchanges

Main activities	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Bus shelter renewals	$2.5	$3.3	$4.5	$6.1	$7.9	$8.1	$8.1	$7.6	$7.2	$7.0
Station renewals	$1.4	$2.1	$5.6	$10.0	$13.3	$14.8	$17.2	$18.3	$18.1	$16.9
Wiri depot renewals	$0.0	$0.0	$0.0	$0.0	$0.1	$0.2	$0.2	$0.2	$0.2	$0.2
Rolling stock (diesel) renewals	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5
Public transport ferry terminal renewals	$4.5	$4.9	$5.2	$4.8	$4.8	$4.2	$3.5	$2.9	$2.3	$1.8
Total	**$8.8**	**$10.9**	**$15.8**	**$21.4**	**$26.5**	**$27.8**	**$29.6**	**$29.6**	**$28.4**	**$26.5**

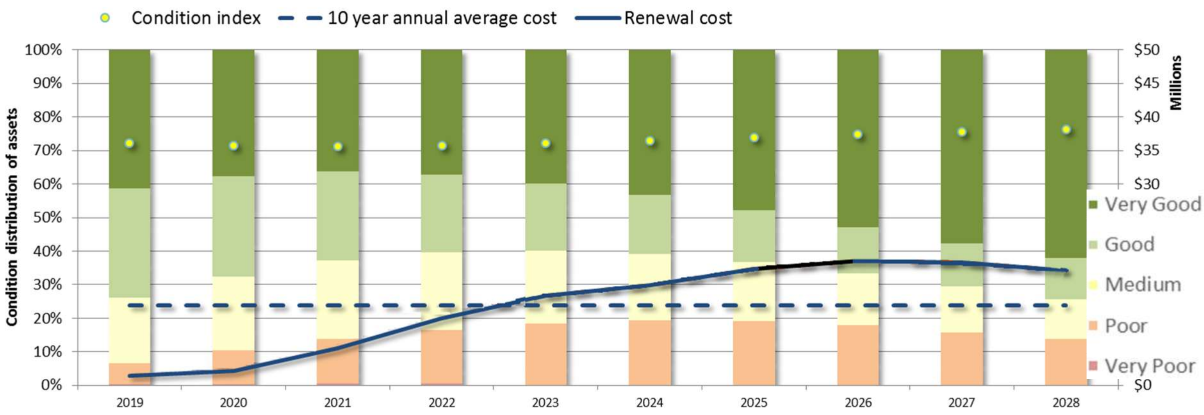
Source: AT (SAP), August 2018

The impact of the recommended renewals programme on the condition of the various public transport asset groups is discussed in the following subsections.

Rail stations

Renewals requirements for rail stations increase steadily through to 2025, as rail station components reach the end of their useful life. AT’s policy is to renew rail station assets in the year in which they fall into very poor condition, so that the worst condition rating on the rail network is poor. The impact of this renewals approach on the condition of rail stations is shown in Figure 7-70.

Figure 7-70: Asset condition and renewals expenditure – rail stations



Source: ROM, July 2017

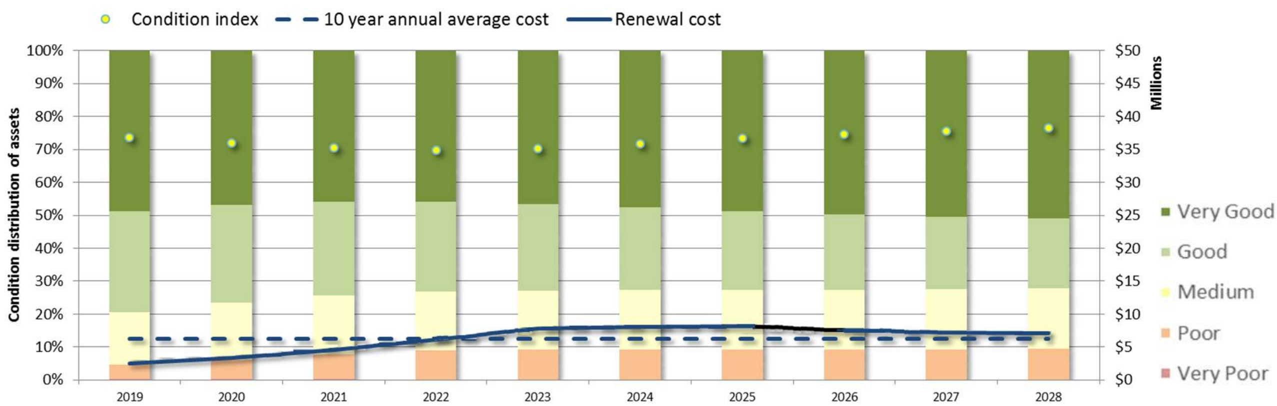
Bus shelters and stations

The most significant bus assets, by value, are the Northern Busway stations. The Albany and Constellation stations opened in 2005 and the full busway in 2008. Over the coming five years, some of these asset components come due for replacement, before they fall into very poor condition.

AT also has an ongoing programme of bus shelter renewals.

The impact of this renewals approach on the condition of bus shelters and stations is shown in Figure 7-71.

Figure 7-71: Asset condition and renewals expenditure – bus shelters and stations

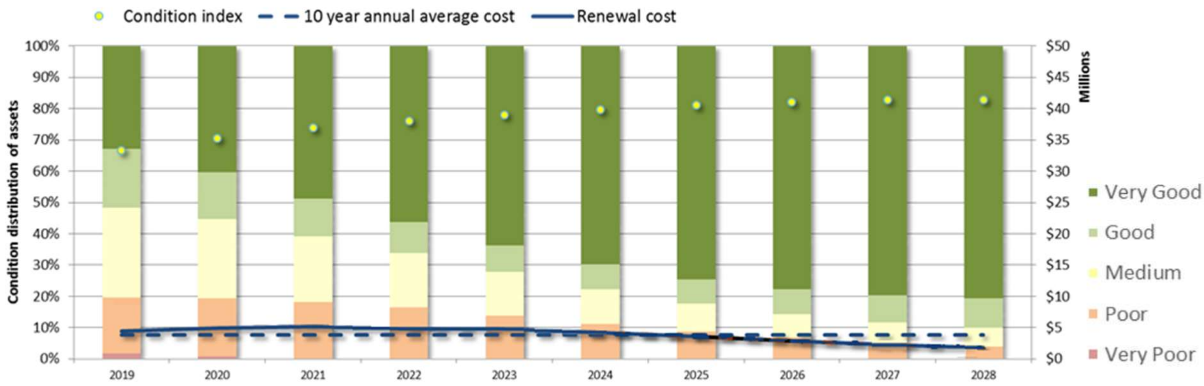


Source: ROM, July 2017

Wharves and ferry terminals

At present, 1.7 per cent of wharf and ferry terminal assets are in very poor condition and are due for renewal. Addressing this backlog will require significant expenditure in the early years of this AMP. By the end of the 10-year period, 90 per cent of wharf and ferry terminal assets are forecast to be in very good or good condition, with no assets in very poor condition, as shown in Figure 7-72.

Figure 7-72: Asset condition and renewals expenditure – wharves and ferry terminals



Percentage in very poor condition	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Bus	0.4%	0.3%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Ferry	1.7%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rail	0.3%	0.3%	0.6%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: ROM, July 2017

7.7.8 Forward works programme

AT's public transport operations and asset management teams have developed a site-specific programme of renewals, based on local operational knowledge and condition surveys.

While every effort has been made to develop a robust programme, it is in the nature of public transport assets to fail in unpredictable ways. When this happens, the renewals programme can be adjusted at short notice.

Rail

The rail forward works programme is still being developed, but will focus specifically on Britomart station.

Bus

The forwards works programme for bus stations is as shown in Table 7-54. Note that this programme relates to bus stations only, as the renewals programme for bus shelters is ongoing.

Table 7-54: Bus forward works programme – bus stations

Facility	2018/ 2019	2019/ 2020	To be determined	Grand Total
Akoranga Busway Station	$19,250	$54,320	$119,383	$195,910
Albany Bus Station - Park & Ride	$1,484	$29,149	$273,553	$323,410
Constellation Busway Station	$7,984	$55,006	$162,339	$225,328
Smales Farm Bus Station (& lockers)	$720	$21,879	$107,390	$129,989
Sunnynook Bus Station - Northern Busway			$40,221	$40,221
Sunnynook Busway Station	$12,094	$937	$6,348	$22,337
Total	**$41,531**	**$161,291**	**$709,234**	**$937,196**

Wharf and ferry

The wharf and ferry renewals forward works programme has been prepared at a time of uncertainty over the future of AT's main wharf and ferry asset, the Downtown Ferry Terminal.

Key decisions about the future of Auckland's waterfront are still being made, and these decisions will affect the balance of maintenance, renewals and new capital investments that AT makes in its wharf and ferry assets in this area.

Key elements of the current forward works programme, include keeping the Downtown Ferry Terminal safe and operational, and renewing Pier 1B. These works will be designed to balance the short- and long-term needs for the site, integrate with any planned redevelopment and keep future options open.

Other wharf and ferry assets scheduled for significant renewals works over the coming three years include:

- Matiatia
- Kennedy Point
- Half Moon Bay

Minor assets on all AT wharves will be renewed as needed.

8. Asset investment requirements

Chapter 7 set out, for each class of assets, AT's recommended actions in order to deliver the strategic priorities set out in Chapters 1 to 5.

This chapter brings together the total investment required for renewals, maintenance and asset-based operations, across all asset groups.

This recommended programme for renewals, maintenance and asset based operations has been prepared in the context of AT's 2018 plans. It is influenced by the capital programme, in that it includes the costs of owning the new assets that will be created within the next 10 years, and takes into account renewals work undertaken through capital projects. The programme also reflects planned changes in services, including the expansion of public transport, as set out in the Public Transport Network Plan.

8.1 Developing the renewals programme

The renewals component of the recommended programme was developed using AT's ROM, as described in Section 7.1.8. ROM is used to test policy options and optimise future renewals across AT's large and diverse portfolio of transport assets.

ROM supports life cycle asset management and value for money because:

- renewals are timed to get the optimum useful life from each asset
- an evidence-based, stable renewals programme supports good procurement and programming.

The ROM analysis provides a detailed 30-year renewals cost forecast table, which is then discussed and moderated. The analysis provides details for each:

- asset class, type, sub-type and component (the asset hierarchy)
- asset material or specification (asphaltic concrete, chipseal, concrete, steel, timber etc.)
- ONRC category (regional, arterial, primary and secondary collector, local and access)
- geographical management area (north, central, Hauraki Gulf islands, west, south)
- urban or rural speed category.

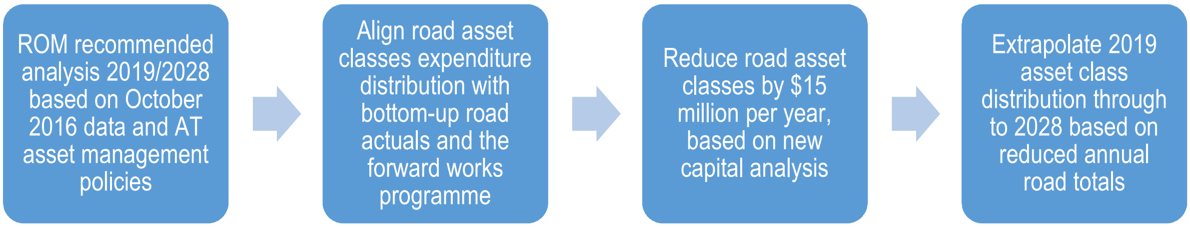
This level of granularity ensures that variables such as unit rates, base lives, growth and deterioration are consistently applied.

Renewals analysis moderation

ROM is a financial top-down renewals investment decision support tool, based on asset condition and intervention policies. Within AT, ROM recommendations are moderated to incorporate bottom-up actual expenditure and the backlog of priority works identified in AT's forward works programme.

Further adjustments also take account of assets that are being replaced as part of AT's capital projects, hence contributing to the overall renewals programme. The agreed final 2018/2019 renewals budgets are then forecast out to future years. This approach is outlined in Figure 8-1.

Figure 8-1: Renewals process from ROM to final recommended renewals



8.1.1 Optimising expenditure using the ONRC

For each of the asset classes in Chapter 7, the following options were considered to develop a recommended renewals programme:

- status quo
- optimisation without ONRC
- optimisation with ONRC
- run to failure.

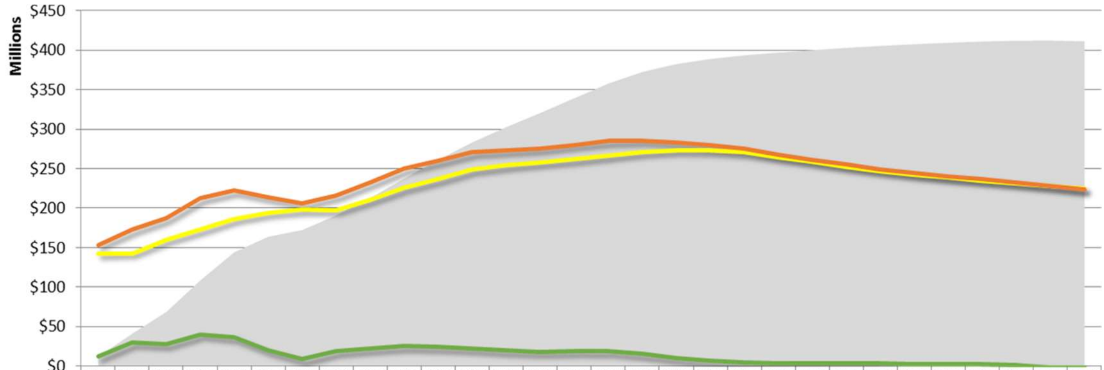
The ONRC is not relevant to footpaths and cycleways or to public transport, so for these assets only three options were considered.

Across all other assets, the ROM model was used to set appropriate intervention thresholds that are aligned to the ONRC framework. This changes the timing of renewals on collector and access roads, while maintaining the current level of service on regional and arterial roads.

Figure 8-2 shows the financial impact of this change across the full portfolio of road network assets. In the first decade, the impact of this change is a reduction of $238 million over the decade, or an annual average reduction of $23.8 million.

The gap between the two options closes over the second decade and by the third decade, there is only $18 million ($1.8 million per year) difference in expenditure between the options.

Figure 8-2: Total under the 'with ONRC' and 'without ONRC' optimised renewals programmes



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Cumulative impact	12	41	69	108	144	164	172	191	213	238	261	283	303	320	339
With ONRC	142	144	160	173	187	194	198	198	211	226	236	249	254	258	262
Without ONRC	154	173	188	213	222	214	206	216	233	250	260	271	273	276	281
ONRC annual impact	12	29	27	40	36	20	8	19	22	25	24	22	19	18	19

	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
Cumulative impact	358	372	382	389	394	397	400	403	405	408	409	411	412	412	411
With ONRC	267	271	274	273	271	264	259	253	247	243	239	235	232	228	224
Without ONRC	285	286	284	280	275	268	262	255	250	245	241	237	233	228	224
ONRC annual impact	18	15	10	6	5	3	3	3	3	2	2	2	1	0	-1

	1st decade total	2nd decade total	3rd decade total
ONRC impacts (savings) by decade ($m)	238	156	18

8.1.2 Accounting for assets renewed through the capital programme

Most of AT's capital improvements projects for roads have an element of renewals, because the original road assets are replaced. For example, the Albany Highway project created a wider road, improved drainage, and provided fit-for-purpose walking and cycling facilities and modern streetlights. A proportion of this cost can be attributed to replacement of the original two-lane road.

AT has analysed the 2015 long-term plan capital improvement programme of $528 million, and concluded that $150 million of this expenditure, or $15 million per year, met the criteria to be considered renewals.

Although the capital programme for the 2018 long-term plan has not yet been finalised, this AMP conservatively assumes that at least $15 million per year from the capital programme will be spent on renewing existing road assets. This provides an opportunity to reduce the recommended roading renewal programme by $15 million per year.

8.1.3 Public transport renewals

The rapid expansion of Auckland's public transport network creates a need for renewals budgets to increase over time. The overall strategy is to attract people to travel on public transport, particularly at peak times when the road network is already at capacity. To achieve this, AT's growing portfolio of public transport assets needs to be in a condition that is not just adequate, but attractive. This will require investment to increase over time. Further increases are forecast for the second and third decade of this plan, as the renewals requirements for the City Rail Link and the future mass rapid transit network fall due.

8.1.4 Total renewals funding requirements

Total renewals for the 2018/2019 year are significantly lower than previous years. This is the impact of using the ONRC to optimise renewals budgets, as well as of reducing renewals to take into account assets replaced by AT capital projects.

The short-term impact of these changes is a reduction in total renewals, as shown in Figure 8-3 and Table 8-1. Over time, these reductions are offset by the impacts of growth and the increased renewals requirements of public transport assets.

Figure 8-3: Total renewals

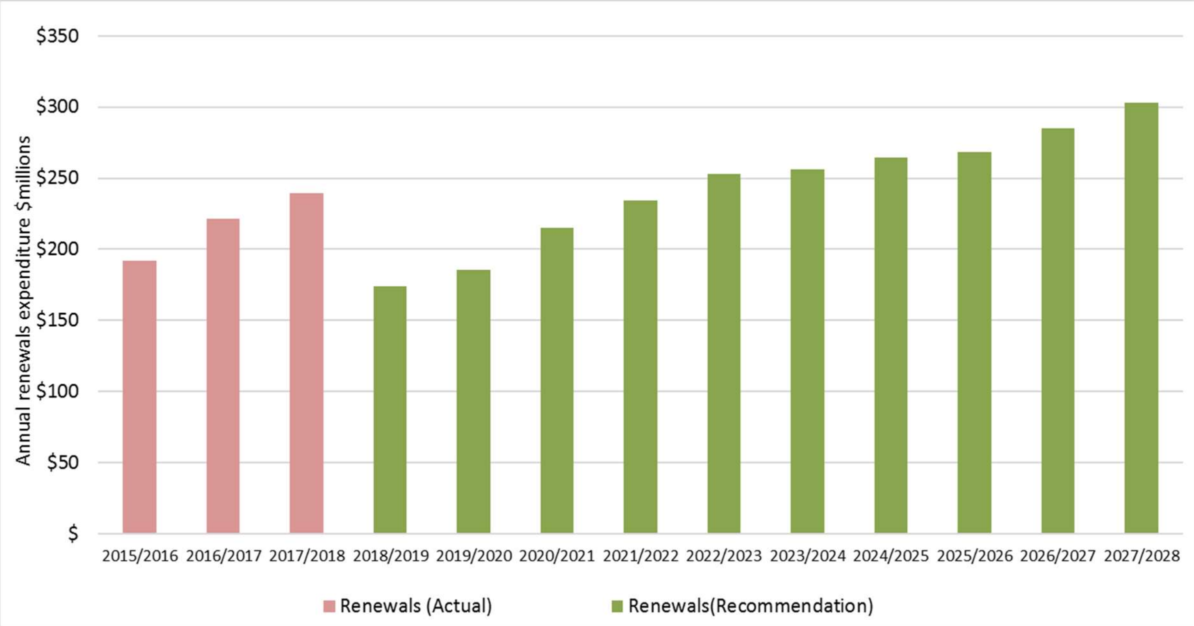


Table 8-1: Total renewals

Forecast Category ($millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Renewals (Actuals)	$199.4	$229.6	$241.8										
Renewals (Recommended)				$174.3	$185.6	$215.2	$234.4	$253.0	$256.0	$264.4	$268.7	$285.3	$303.1

Source: AT (SAP), August 2018

These total renewals figures are made of renewals for each of the eight asset classes, as shown in Table 8-2.

Table 8-2: Detail of total renewals

Forecast Category ($ millions)	2015/ 2016 (Actuals)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Carriageway	$138.7	$158.8	$143.2	$98.4	$104.1	$118.6	$126.6	$134.6	$135.7	$139.6	$142.1	$152.7	$164.3
Stormwater	$14.9	$13.0	$16.1	$14.0	$14.8	$16.8	$17.9	$19.0	$19.2	$19.7	$20.1	$21.5	$23.2
Bridges, walls and structures	$10.0	$13.6	$27.8	$15.1	$16.0	$18.1	$19.3	$20.5	$20.6	$21.2	$21.6	$23.1	$24.9
Footpaths and cycleways	$15.0	$16.6	$20.2	$16.2	$17.1	$19.7	$21.1	$22.5	$22.6	$23.3	$23.7	$25.6	$27.6
Street lighting	$10.5	$14.6	$12.2	$12.5	$13.1	$15.4	$16.5	$17.5	$17.2	$17.4	$17.4	$18.9	$20.7
Traffic systems, signs and markings	$3.9	$5.2	$5.3	$6.0	$6.5	$7.1	$7.6	$8.2	$8.7	$9.3	$9.8	$10.3	$10.9
Parking	$1.6	$1.0	$4.2	$3.2	$3.2	$3.7	$3.9	$4.2	$4.2	$4.3	$4.4	$4.7	$5.0
Total - all road asset renewals	**$194.5**	**$222.8**	**$228.9**	**$165.4**	**$174.7**	**$199.4**	**$212.9**	**$226.4**	**$228.2**	**$234.9**	**$239.1**	**$256.9**	**$276.6**
Public Transport	$4.9	$6.8	$12.9	$8.8	$10.9	$15.8	$21.4	$26.5	$27.8	$29.6	$29.6	$28.4	$26.5
Total - all asset renewals	**$199.4**	**$229.6**	**$241.8**	**$174.3**	**$185.6**	**$215.2**	**$234.4**	**$253.0**	**$256.0**	**$264.4**	**$268.7**	**$285.3**	**$303.1**

Source: AT (SAP), August 2018

8.2 Developing the maintenance and asset-based operations programme

8.2.1 Maintenance and operations of road assets

The maintenance and operations component of the programme is developed by assessing the levels of service currently being provided, as set out in Chapter 7. Where the current level of service is meeting community needs, this indicates that the current maintenance and operations budget is adequate. For some assets, it is also possible to benchmark AT's maintenance and operational expenditure against other New Zealand authorities in order to assess value for money.

New assets, created in response to the growth of the transport network, require consequential operational and maintenance expenditure. The growth factors in Section 4.2 (on the growth of the road network) have been used to calculate the rate at which operational expenditure needs to increase each year for each asset class, in order to continue to provide an equivalent level of service on the growing network.

8.2.2 Maintenance and operations of public transport assets

Maintenance and operations for AT's public transport assets includes operating rail and busway stations, cleaning and maintaining bus shelters, and maintaining and operating wharf and ferry facilities.

It does not include the actual cost of bus, rail and ferry service contracts, which are set in the Regional Public Transport Plan. It also does not include revenue, for example payments by ferry operators for using the wharf facilities, or revenue from advertising and commercial activities at rail stations.

For this AMP, public transport maintenance costs have been extrapolated based on past trends and the recommendations of the AT metro team. There is a significant jump in 2023/2024, with the opening of the City Rail Link, for the operations and maintenance of the Aotea, K'Road and Mt Eden stations.

8.2.3 Total maintenance and operations funding requirements

The total maintenance and asset-based operations funding requirements will increase steadily, due to consequential opex, as shown in Figure 8-4 and Table 8-3.

Figure 8-4: Total maintenance and asset-based operations

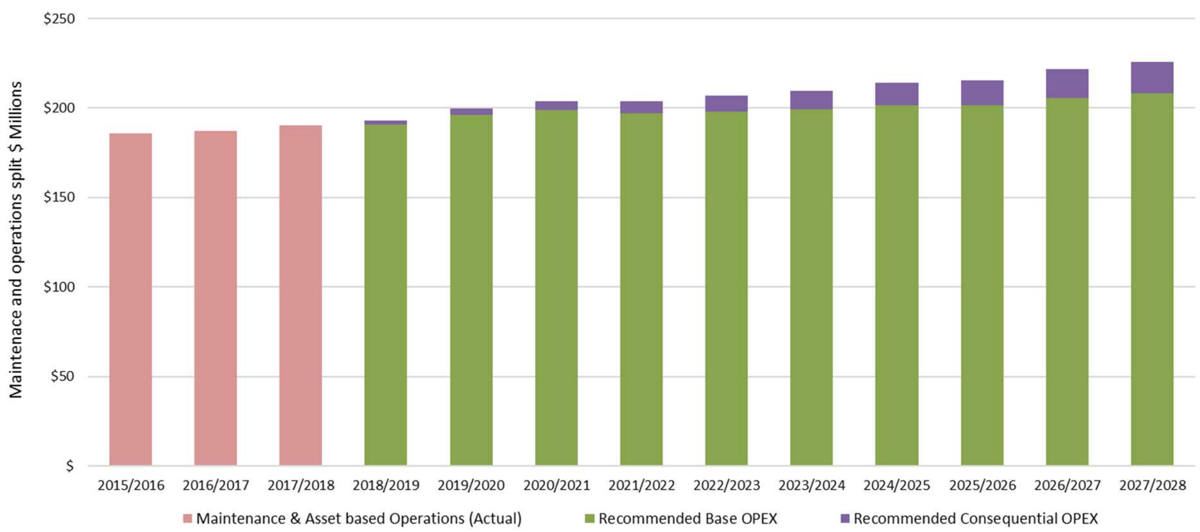


Table 8-3: Total maintenance and asset-based operations

Forecast Category ($ millions)	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Maintenance (Actuals)	$186.0	$187.3	$190.1										
Maintenance (Recommendation)				$193.0	$199.7	$203.9	$203.8	$206.8	$209.8	$213.9	$215.5	$221.7	$226.0

These total figures are made up of maintenance and asset-based operations funding requirements for each of the eight asset classes, plus vegetation, as shown in Table 8-4.

Table 8-4: Detail of maintenance and asset-based operations

Forecast Category ($ millions)	2015/ 2016 (Actuals)	2016/ 2017 (Actuals)	2017/ 2018 (Actuals)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Carriageway	$37.7	$42.1	$43.2	$40.8	$41.5	$43.1	$43.4	$45.1	$45.9	$46.1	$46.1	$46.0	$46.0
Stormwater	$9.0	$9.1	$10.8	$9.4	$9.6	$9.8	$9.9	$10.1	$10.3	$10.5	$10.7	$10.9	$11.1
Bridges, walls and structures	$1.3	$1.7	$1.8	$1.7	$1.7	$1.7	$1.7	$1.8	$1.8	$1.8	$1.8	$1.8	$1.8
Footpath and Cycleways	$2.3	$2.1	$1.7	$3.2	$3.3	$3.3	$3.3	$3.4	$3.4	$3.5	$3.5	$3.6	$3.6
Street lighting	$19.4	$18.9	$18.0	$17.3	$17.1	$16.0	$16.3	$15.1	$14.8	$15.1	$15.7	$16.3	$16.9
Traffic systems	$25.5	$26.2	$23.4	$23.0	$23.3	$23.6	$23.8	$24.1	$24.4	$24.7	$24.9	$25.2	$25.5
Parking	$10.0	$10.2	$9.8	$9.1	$9.3	$9.3	$9.4	$9.6	$9.7	$9.8	$9.9	$10.0	$10.2
Vegetation	$15.0	$15.5	$15.1	$15.3	$15.4	$15.5	$15.6	$15.7	$15.8	$16.0	$16.1	$16.2	$16.3
Road network maintenance	**$120.1**	**$126.0**	**$123.8**	**$119.8**	**$121.1**	**$122.3**	**$123.6**	**$124.9**	**$126.1**	**$127.4**	**$128.7**	**$130.0**	**$131.2**
Public transport maintenance	$65.9	$61.3	$66.3	$73.2	$78.5	$81.6	$80.2	$82.0	$83.6	$86.5	$86.9	$91.7	$94.7
Total - all assets maintenance	**$186.0**	**$187.3**	**$190.1**	**$193.0**	**$199.7**	**$203.9**	**$203.8**	**$206.8**	**$209.8**	**$213.9**	**$215.5**	**$221.7**	**$226.0**

Source: AT (SAP), August 2018

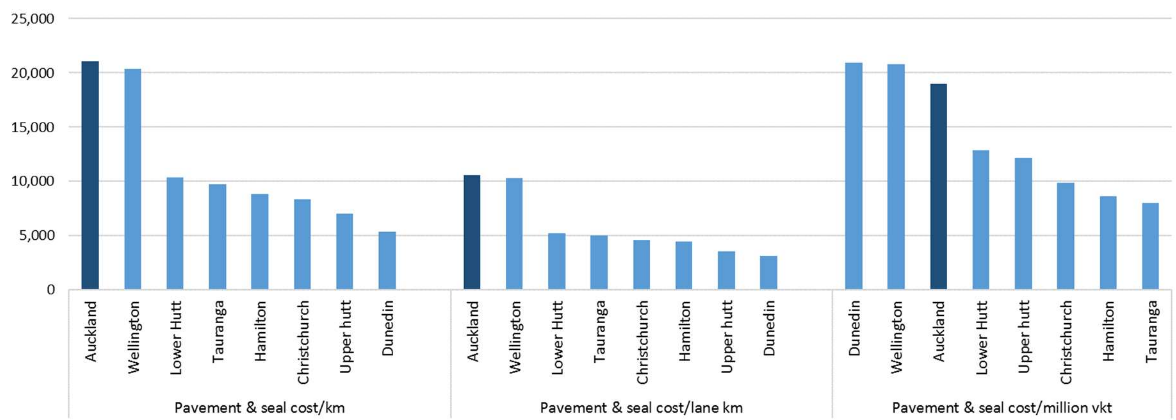
8.3 Peer group comparison – overall value for money

The NZ Transport Agency publishes national accounts for the portion of the road maintenance and renewals programme that is approved for co-funding. In 2017/2018, AT expenditure for road maintenance and renewals was $157.4 million. This equates to:

- $21,056 per kilometre of road network
- $10,566 per lane kilometre of road network
- $20,967 per million kilometres of vehicle travel (or 1.9 cents per kilometre).

The comparison between these costs and other New Zealand cities is shown in Figure 8-5.

Figure 8-5: Benchmarked costs for maintenance, operations and renewals: per kilometre, per lane kilometre, and per million vehicle kilometres



Source: Annual achievement returns to NZ Transport Agency, 2017/18

In principle, an even more useful metric would be cost per kilometre of heavy vehicle travel, as it is trucks, more than cars, that cause damage to road pavements. However, not all road controlling authorities collect good data on truck travel, making it a poor measure to use for benchmarking. What data is available indicates that looking at truck travel will give a similar pattern to that for overall vehicle travel.

8.4 Auckland cost pressures

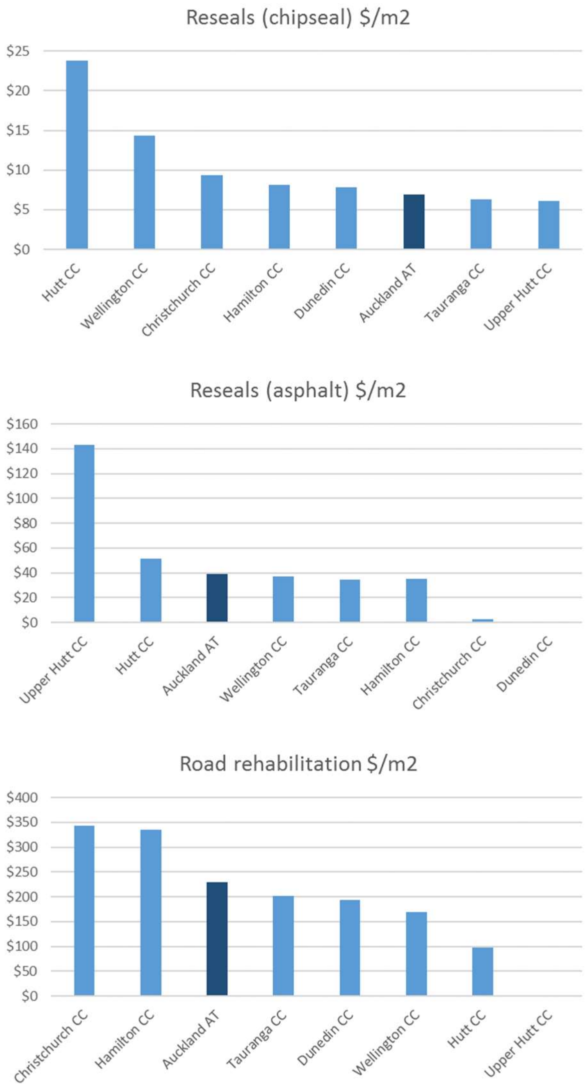
Auckland has specific cost pressures that are affecting all construction activities within the region, including AT's road maintenance and renewals contracts.

These cost pressures include:

- Auckland's high cost of living and shortage of housing, which necessitate higher wages.
- The current construction boom, which means AT has to compete for all resources, including labour, plant, materials. AT's contractors report difficulties securing subcontractors as there is an abundance of work available.
- High haulage costs within Auckland. Resources including aggregate need to be hauled long distances. Heavy traffic affects the cost of haulage for all materials and all wastes.
- Auckland's busy road network, which causes higher costs for temporary traffic management. Often, works are scheduled in weekends and at night in order to minimise traffic disruption.

In spite of all of these cost pressures, AT's contractors are still delivering good value for money per unit of work done. This can be demonstrated by calculating the average cost per square metre of work reported by other metropolitan authorities in their annual achievement reports to NZ Transport Agency, as shown in Figure 8-6.

Figure 8-6: Benchmarked costs for carriageway renewal activities



Source: Annual achievement reports to the NZ Transport Agency, 2017/2018

9. Final approved budgets

The previous chapters of this AMP have set out the evidence-based requirements for renewals, maintenance and asset operations investment, based on detailed assessment of asset needs. All financial figures and tables in previous chapters show recommended investment needs, and are uninflated.

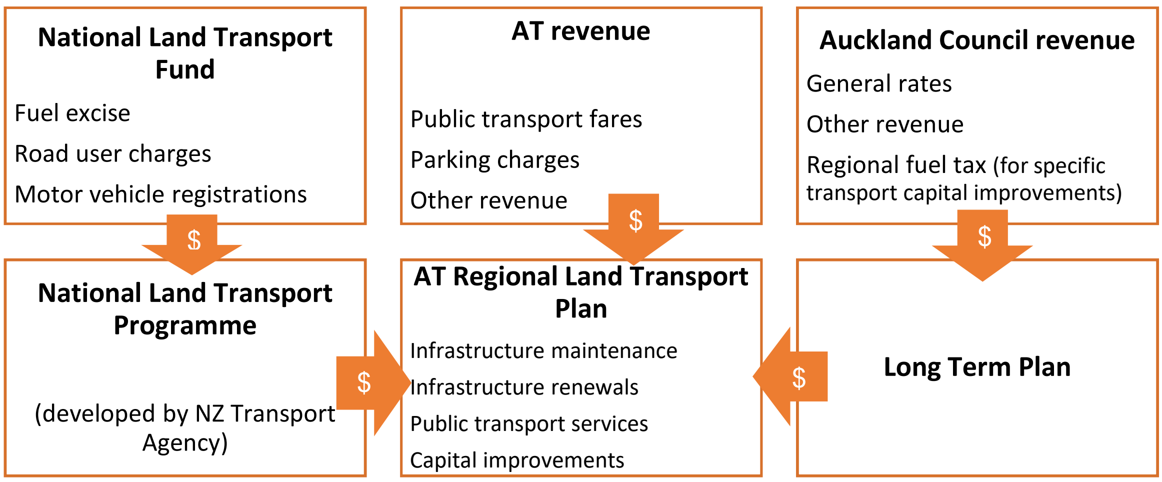
There are a number of important distinctions between recommended investment needs and approved budgets. An approved budget needs to:

- Balance to available funding
- Include provision for inflation and cost escalations in future years
- Take into account the cashflow requirements of funders
- In local government, a budget must be approved using the process set out in the Local Government Act, which includes public consultation

9.1 Collaboration and partnership

The revenue to fund AT's programmes comes from three sources: Auckland Council, the National Land Transport Fund and AT revenue, as shown in Figure 9-1.

Figure 9-1 Funding flows for the delivery of AT programmes



A jointly funded programme depends on collaborative decision making, and AT has worked with Auckland Council and Central Government through the Auckland Transport Alignment Project to reach agreement on the key decisions that underpin this AMP. This included the decision to direct a higher proportion of expenditure to regional and arterial roads, defined using the One Network Road Classification. AT also aligned its public consultation on the Regional Land Transport Plan with Auckland Council's consultation on its Regional Fuel Tax proposal.

AT's assessment of recommended investment requirements for its road and PT assets was submitted to the NZ Transport Agency in December 2017 and formed the basis of the Agency's indicative funding decisions for continuous programmes, released in April 2018.

In summary, AT is confident that the final budgets set out in this chapter are fully funded, are aligned with the plans of AT's co-investors and have the support of stakeholders and the public.

9.2 Approved budgets

9.2.1 Operations and maintenance

For maintenance and asset-based operations, approved budgets are identical to the recommended investment needs set out in earlier chapters of this AMP.

9.2.2 Renewals

AMP recommended renewals budgets reflect the modelled renewal investment requirements for all elements of the network, as set out in earlier chapters. Investment requirements are uninflated, but do include a provision for growth in the network. In total, an investment of $2.44 billion over 10 years (in today's dollars) is recommended to meet the agreed levels of service.

Renewals requirements as set out in this AMP are then included in the Regional Land Transport Plan (RLTP) (47). The RLTP sets out a plan for all transport investment needs over the 10 years from 2018/2019 to 2027/2028, including renewals but also operational expenditure and capital improvements.

All budget information in the RLTP is inflated.

The RLTP also includes provision for renewal of some of AT's corporate information systems, which are assets for accounting purposes, though they fall outside the scope of this AMP. In the RLTP, the total AT renewals budget over the ten year period, including corporate renewals and inflation, is $3.05 billion.

As part of Auckland Council's decision making on the RLTP, the ten year programme had to be revised due to constrained funding in the early years. Funding is constrained due to the challenges Council faces in order to balance investment needs against the acceptability of costs to the community and the key strategic settings around limits on rates increases and debt.

The final, approved renewals budget also totals $3.05 billion over 10 years, but it is weighted towards the later years as shown in Figure 9-2.

AT will be required to find efficiencies and to mitigate the risks caused by the differences between approved budgets and recommended investment needs in the early years of the 10 year period. Looking at individual years, these risks are:

- In 2018/2019, the recommended AMP renewals budget is fully funded, along with provision for inflation and for the renewal of AT's corporate information systems.
- In the 2019/2020 and 2020/2021, the approved (inflated) budget is equal to the recommended (uninflated) investment needs.

  During these years, the recommended investment could potentially be challenged by inflationary cost pressures and those associated with corporate information system renewals. In practice, this means that either planned renewals will need to be adjusted or additional funding will need to be made available by reprioritising the capital works programme during these two years.
- In the following two years, 2021/2022 and 2022/2023, renewals budgets are also constrained. These are indicative forecasts as distinct from approved budgets, because a new Asset Management Plan will be prepared in 2021 with revised assets needs.

- From 2023, the cash flow adjustment is positive and total budgets are increased, though this will need to be confirmed in the 2021 Asset Management Plan.

Figure 9-2:Approved (inflated) final renewals budget vs recommended (uninflated) asset renewal needs

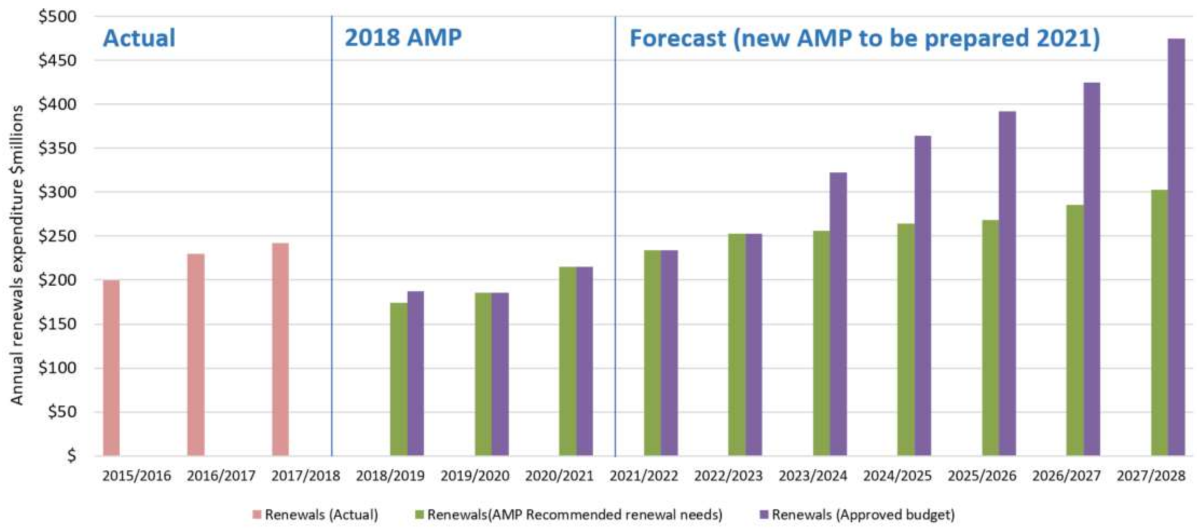


Table 9-1: Approved (inflated) final renewals budget vs recommended (uninflated) asset renewal needs

	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	10 year total
AMP Recommendation	$174.3	$185.6	$215.2	$234.4	$253.0	$256.0	$264.4	$268.7	$285.3	$303.1	$2,439.9
ADD forecast inflation	$7.0	$15.1	$26.9	$37.2	$48.9	$58.7	$70.4	$81.7	$97.9	$116.2	$559.9
ADD Corporate renewals	$6.2	$6.5	$6.7	$7.0	$7.2	$7.4	$7.6	$7.8	$8.1	$8.3	$72.7
Adjustment to balance cashflow		-$21.6	-$33.6	-$44.1	-$56.1	$0.0	$21.6	$33.6	$33.7	$47.1	-$19.4
Final approved renewals budget	**$187.5**	**$185.6**	**$215.2**	**$234.4**	**$253.0**	**$322.1**	**$364.0**	**$391.8**	**$424.9**	**$474.7**	**$3,053.1**

Table 9-2: Detail of uninflated, recommended budgets

($ millions)	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Carriageway	$98.416	$104.060	$118.594	$126.620	$134.612	$135.684	$139.626	$142.126	$152.656	$164.322
Stormwater	$14.046	$14.808	$16.822	$17.932	$19.037	$19.192	$19.741	$20.092	$21.547	$23.158
Bridges, walls and structures	$15.149	$15.961	$18.103	$19.285	$20.462	$20.630	$21.217	$21.593	$23.141	$24.856
Footpaths and cycleways	$16.173	$17.123	$19.680	$21.076	$22.466	$22.636	$23.312	$23.733	$25.569	$27.606
Street lighting	$12.545	$13.060	$15.413	$16.475	$17.528	$17.184	$17.417	$17.358	$18.918	$20.706
Traffic systems, signs and markings	$5.960	$6.531	$7.104	$7.640	$8.178	$8.716	$9.256	$9.796	$10.338	$10.880
Parking	$3.158	$3.168	$3.680	$3.920	$4.160	$4.189	$4.306	$4.379	$4.695	$5.046
Total - all road asset renewals	**$165.447**	**$174.711**	**$199.396**	**$212.948**	**$226.444**	**$228.231**	**$234.875**	**$239.078**	**$256.864**	**$276.575**
Rail network	$1.903	$2.627	$6.107	$10.558	$13.875	$15.518	$17.907	$19.094	$18.885	$17.650
Wharves	$4.468	$4.876	$5.210	$4.798	$4.784	$4.185	$3.545	$2.884	$2.294	$1.812
Bus Network	$2.462	$3.348	$4.519	$6.089	$7.872	$8.095	$8.122	$7.607	$7.218	$7.042
Total - all PT asset renewals	**$8.832**	**$10.851**	**$15.836**	**$21.446**	**$26.531**	**$27.798**	**$29.574**	**$29.585**	**$28.397**	**$26.504**
Total - all asset renewals	**$174.279**	**$185.562**	**$215.232**	**$234.394**	**$252.975**	**$256.029**	**$264.449**	**$268.663**	**$285.261**	**$303.078**

Table 9-3: Detail of approved (inflated) renewals budgets

$millions	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Carriageway	102.048	100.536	115.211	123.001	131.034	166.220	187.748	202.538	222.194	250.886
Stormwater	14.608	14.339	16.360	17.477	18.588	23.591	26.576	28.665	31.440	35.574
Bridges, walls and structures	15.755	15.456	17.606	18.796	19.980	25.358	28.563	30.806	33.767	38.182
Footpaths and cycleways	16.820	16.581	19.140	20.541	21.937	27.824	31.383	33.859	37.310	42.407
Street lighting	13.047	12.647	14.990	16.057	17.114	21.122	23.448	24.765	27.605	31.808
Traffic systems, signs and markings	6.198	6.325	6.909	7.447	7.985	10.714	12.461	13.976	15.084	16.713
Parking	3.284	3.068	3.579	3.821	4.062	5.150	5.797	6.247	6.851	7.752
Total road asset renewals	**171.760**	**168.952**	**193.794**	**207.139**	**220.700**	**279.979**	**315.976**	**340.854**	**374.251**	**423.321**
Rail network	1.979	2.603	6.019	10.387	13.662	19.074	24.064	27.175	27.476	27.015
Bus network	2.560	3.242	4.395	5.935	7.686	9.950	10.935	10.852	10.532	10.818
Wharves	4.952	4.955	5.188	5.084	5.068	5.699	4.980	4.350	3.886	4.299
Total public transport asset renewa	**9.491**	**10.800**	**15.602**	**21.407**	**26.417**	**34.724**	**39.979**	**42.377**	**41.893**	**42.132**
Corporate renewals	6.240	5.810	5.835	5.848	5.858	7.375	8.077	8.560	8.755	9.216
Grand Total	**187.490**	**185.562**	**215.232**	**234.394**	**252.975**	**322.078**	**364.032**	**391.792**	**424.899**	**474.669**

Figure 9-3: Detail of approved maintenance and operations budgets

$millions	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028
Carriageway	40.836	41.486	43.105	43.385	45.138	45.943	46.125	46.096	46.045	45.974
Stormwater	9.378	9.565	9.751	9.937	10.124	10.310	10.496	10.682	10.869	11.055
Bridges, walls and structures	1.701	1.713	1.726	1.738	1.751	1.763	1.775	1.788	1.800	1.813
Footpaths and cycleways	3.210	3.253	3.296	3.339	3.382	3.425	3.468	3.511	3.554	3.597
Street lighting	17.263	17.138	16.045	16.291	15.063	14.784	15.128	15.684	16.259	16.857
Traffic systems, signs and markings	22.998	23.275	23.552	23.830	24.107	24.385	24.662	24.939	25.217	25.494
Parking	9.104	9.284	9.341	9.448	9.559	9.673	9.792	9.914	10.041	10.172
Total road asset renewals	**104.489**	**105.714**	**106.816**	**107.968**	**109.123**	**110.283**	**111.446**	**112.614**	**113.785**	**114.961**
Rail network	38.056	41.215	42.595	38.658	38.744	38.931	39.275	39.225	38.974	39.392
Bus network	6.289	7.942	8.695	9.045	9.408	9.645	10.126	10.822	11.086	11.458
Wharves	6.889	7.052	7.253	7.491	7.774	8.114	8.522	9.017	9.618	10.351
Total public transport asset renewals	**51.234**	**56.208**	**58.542**	**55.194**	**55.926**	**56.690**	**57.923**	**59.064**	**59.678**	**61.201**
Grand Total	**155.723**	**161.923**	**165.358**	**163.162**	**165.050**	**166.973**	**169.369**	**171.677**	**173.464**	**176.162**

10. NZ Transport Agency funding application

Meeting Auckland's current and future needs for a safe, efficient and effective local road network is the shared responsibility of AT and the NZ Transport Agency. One way that the Transport Agency delivers these outcomes is by co-investing in AT's local road maintenance and renewals programme.

The preparation of this AMP has involved working closely with the Transport Agency to develop a programme which is aligned with national as well as regional priorities. Some significant changes in approach were developed by applying the ONRC and the business case approach, and these have influenced final budgets proposed by AT as well as the funding decisions of the Transport Agency.

Table 9-1 summarises AT's programme as submitted in December 2017, and the Transport Agency's co-funding as approved in April 2018. In comparison with the 2015 Asset Management Plan, the proportion of the programme approved for co-funding has increased significantly, from 71% of the total programme to 91%. The Transport Agency funds 51% of the cost of all expenditure that is approved for co-funding; for the 2018/2019 to 2020/2021 programme this total is $402 million. This co-funding is subject to some conditions, which are included in Section 15.7.

Table 10-1: AT funding application and Transport Agency approvals for 2018/2019 to 2020/2021, in comparison with 2015/16 to 2017/18

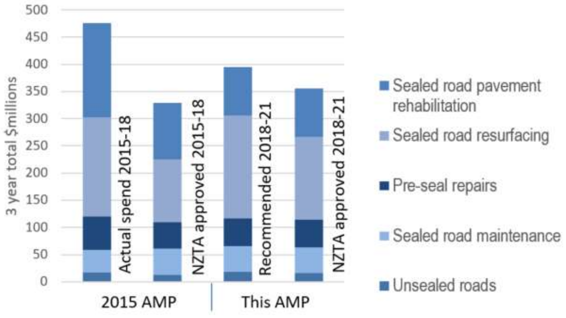
NZ Transport Agency Work Category (in millions)	2015/2016 - 2017/2018		2018/2019 - 2020/2021		
	Actual Spend	Approved for co-funding	Funding Application	Approved for co-funding	% of application approved
111 Sealed pavement maintenance	$41.2	$48.5	$47.5	$47.5	100%
111 Pre-seal repairs	$61.2	$48.3	$50.7	$50.7	100%
112 Unsealed road metalling	$10.9	$8.7	$11.4	$9.9	87%
113 Routine drainage maintenance	$28.9	$27.5	$30.3	$30.3	100%
114 Structures maintenance	$4.2	$4.3	$5.0	$5.0	100%
121 Environmental maintenance	$29.2	$25.2	$47.9	$34.9	73%
122 Traffic services maintenance	$89.9	$85.6	$90.2	$88.7	98%
123 Operational traffic management	$23.9	$26.9	$35.9	$34.4	96%
124 Cycle path maintenance	$.5	$.5	$3.2	$3.2	100%
125 Footpath maintenance	$57.5	$.0	$63.1	$63.1	100%
131 Level crossing warning devices	$.0	$.0	$.0	$.0	100%
151 Network and asset management	$35.7	$32.9	$43.7	$42.2	97%
Subtotal for fundable Road operations and maintenance:	$383.2	$308.3	$428.9	$409.9	96%
211 Unsealed road metalling	$6.7	$4.1	$6.3	$6.3	100%
212 Sealed road resurfacing	$182.7	$115.3	$190.5	$152.3	80%
213 Drainage renewals	$42.6	$26.8	$48.3	$44.8	93%
214 Sealed road pavement rehabilitation	$172.9	$104.1	$89.0	$89.0	100%
215 Structures component replacements	$16.8	$9.4	$34.7	$25.7	74%
222 Traffic services renewals	$53.1	$44.2	$64.3	$60.3	94%
Subtotal for fundable Road renewals:	$474.8	$303.9	$433.1	$378.4	87%
Total fundable budget:	$858.0	$612.2	$862.0	$788.3	91%

Source: AT (SAP), August 2018. Activities such as parking that are not eligible for subsidy are not included, so totals differ between recommended investment requirements and the funding application to the Transport Agency.

10.1 Carriageway

The main change in carriageway budgets is the reduction in sealed road pavement rehabilitation, from $173 million in the three years from 2015/2016 to 2017/2018, to $89 million proposed for the coming three years, as shown in Figure 10-1. This programme will maintain current levels of service on regional and arterial roads, but will take a higher risk on less busy roads, consistent with providing a fit-for-purpose level of service.

Figure 10-1: Carriageway maintenance and renewals



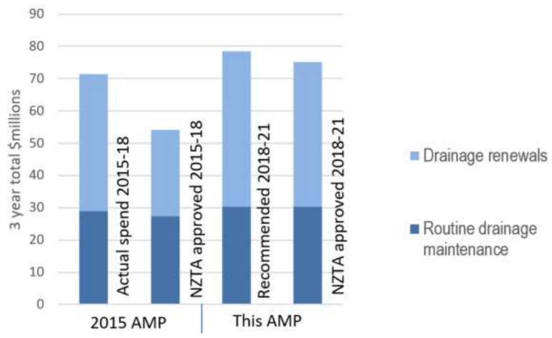
Expenditure on sealed road resurfacing, road maintenance, and unsealed roads combined has increased by 1.2%, in line with growth of the sealed road network.

10.2 Stormwater

The Auckland Transport Alignment Project identified a significant investment gap in the renewal of underground stormwater assets in the road corridor, and this gap has been confirmed by ROM modelling.

This gap has been reduced by reducing expenditure on kerb and channel renewals, but there is still an increase in drainage renewals expenditure from $42.5 million in the three years of the 2015 AMP to $48.3 million in the three years of this AMP, as shown in Figure 10-2. There has also been an increase in the proportion of stormwater expenditure approved for co-funding by the Transport Agency.

Figure 10-2: Stormwater maintenance and renewals



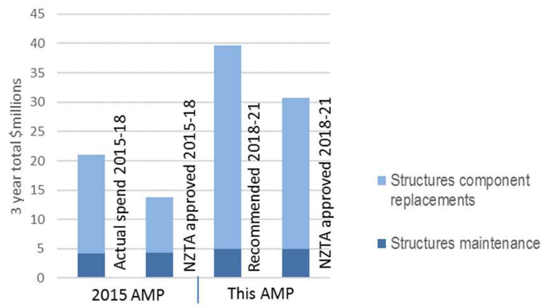
Maintenance costs for stormwater increase slightly due to consequential opex from new stormwater assets.

10.3 Bridges, walls and structures

AT's bridge inspection programme has concluded that 5.3 per cent of bridges (by area) are currently in poor or very poor condition, which poses a high level of risk.

The consequences of failure of bridges and retaining walls are significant. Prudent asset management practices are needed to avoid such events. For this reason, AT has increased its provision for structures component replacements from $16.8 million in the three years of the 2015 AMP to $34.7 million in the three years of this AMP. The Transport Agency has also significantly increased its support for this programme, subject to specific conditions as set out in Section 15.7.

Figure 10-3: Bridges, walls and structures maintenance and renewals



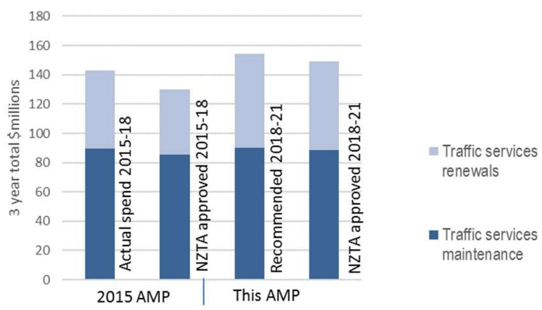
10.4 Streetlights and traffic systems

Traffic services as defined by the Transport Agency includes streetlights, traffic signals, and other traffic systems including CCTV and electronic signs.

AT is increasingly investing in traffic systems, both for renewals and operations, to deliver on the ATAP priority to make best use of existing assets.

This is offset by a reduction in streetlight electricity costs, due to energy efficient LED lights.

Figure 10-4: Streetlights and traffic systems

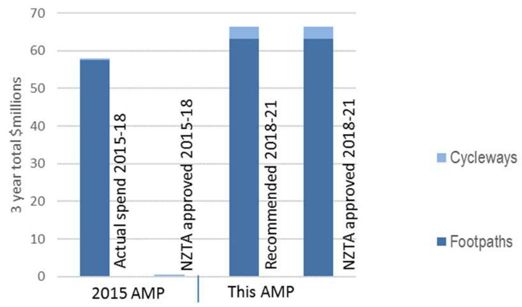


Increased investment in traffic systems is central to delivering the Auckland Transport Alignment Project directive to 'make better use of existing networks'.

10.5 Footpaths and cycleways

Footpaths and cycleways are important components of the transport network, and AT has invested heavily in new cycleway infrastructure in recent years. This has created a need to maintain an increasing portfolio of cycle assets, resulting in an increase in cycle path maintenance needs from $0.5 million in the three years of the 2015 AMP to $3.2 million in the three years of this AMP.

Figure 10-5: Footpaths and cycleways



AT expenditure on footpaths renewals also increases, but the key change is the Government's decision to co-fund footpath maintenance and renewals, which was not the case in the 2015 AMP.

10.6 Expenditure not eligible for co-funding

AT's total expenditure on operations, maintenance and renewals includes activities that are not eligible for NZ Transport Agency co-funding. Activities such as town centre cleaning and maintenance, maintenance and renewal of parking areas, and amenity plantings, are not funded by the Transport Agency.

AT's total budget also includes a 5.7 per cent administration cost, which is on average $14.39 million per year.

10.7 Summary

The following figures and tables summarise AT's funding application to the Transport Agency for road maintenance, operations and renewals:

- Figure 10-6: Summary of key points of AT's funding application to the Transport Agency
- *Table 10-2: AT funding application to the Transport Agency for maintenance, operations and renewals, inclusive of administration costs*

Figure 10-7: Summary of key points of AT's funding application to NZTA

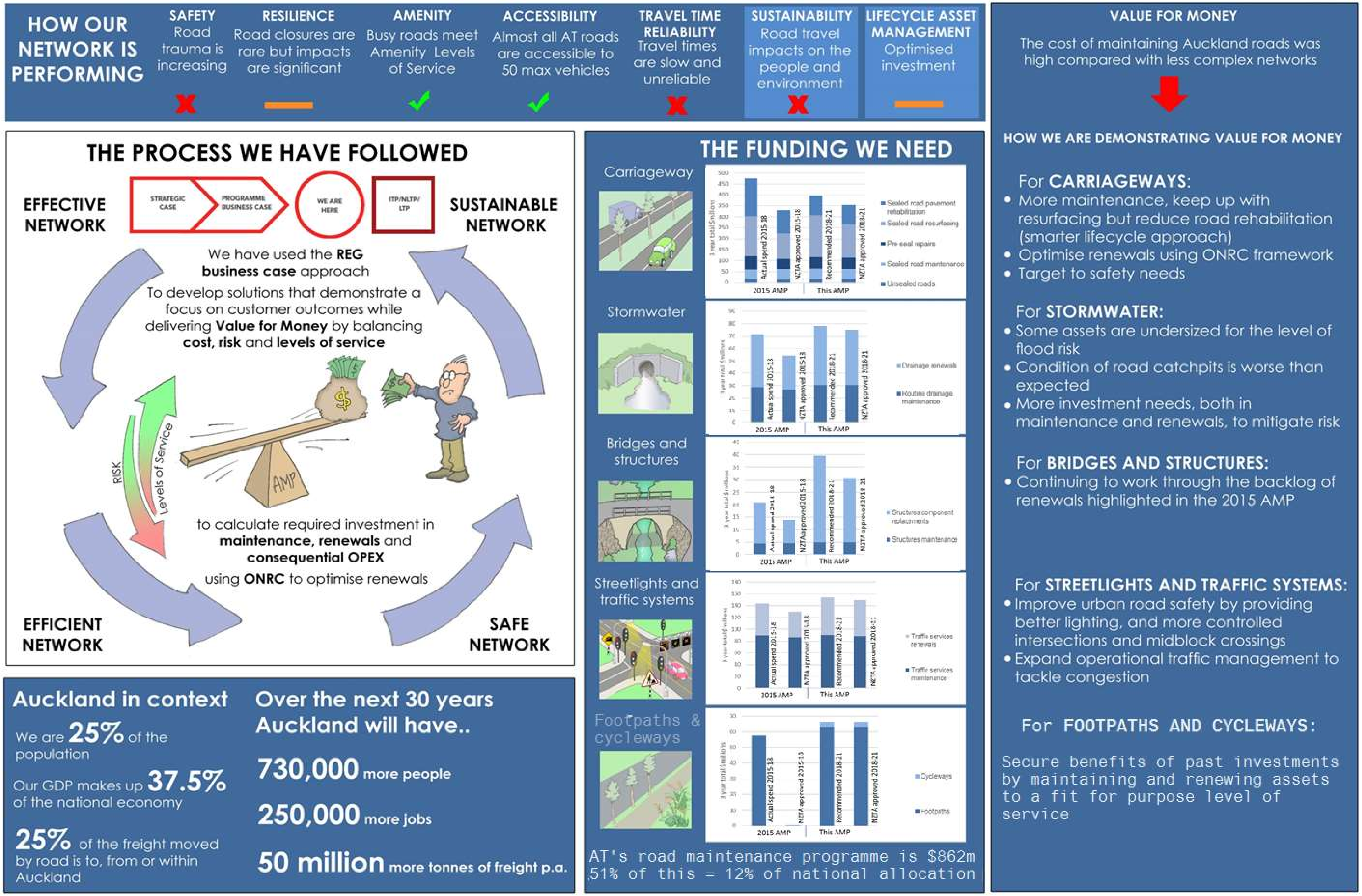


Table 10-3: AT funding application to NZTA for maintenance, operations and renewals, $millions, uninflated.

NZTA Work Category	Main activities	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	AMP Recommendation 2018/19 - 2020/21	Total Approved Funding 2018/19 - 2020/21
111 Sealed pavement maintenance	Pre-seal repairs	$16.9	$16.9	$16.9	$16.9	$16.9	$16.9	$16.9	$16.9	$16.9	$16.9	$50,735,998	$50,735,999
	Sealed road routine maintenance	$15.0	$15.5	$17.0	$17.1	$18.8	$19.5	$19.5	$19.2	$19.0	$18.7	$47,539,110	$47,539,107
111 Sealed pavement maintenance	Total	$31.9	$32.4	$33.9	$34.0	$35.7	$36.4	$36.4	$36.2	$35.9	$35.6	$98,275,108	$98,275,106
112 Unsealed road metalling	Unsealed road routine maintenance	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$11,382,311	$9,882,312
112 Unsealed road metalling	Total	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$11,382,311	$9,882,312
113 Routine drainage maintenance	Channel sweeping and grate cleaning	$2.9	$3.0	$3.0	$3.1	$3.2	$3.2	$3.3	$3.4	$3.5	$3.5	$8,900,140	
	Drainage maintenance	$7.0	$7.1	$7.3	$7.4	$7.5	$7.6	$7.8	$7.9	$8.0	$8.2	$21,429,261	
113 Routine drainage maintenance	Total	$9.9	$10.1	$10.3	$10.5	$10.7	$10.9	$11.1	$11.3	$11.5	$11.7	$30,329,407	$30,329,401
114 Structures maintenance	Bridges routine maintenance	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$1.1	$3,242,433	
	Retaining walls maintenance	$.2	$.2	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$748,254	
	Guardrails maintenance	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$.3	$997,672	
114 Structures maintenance	Total	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$1.7	$4,988,358	$4,988,358
121 Environmental maintenance	Vegetation Control	$13.5	$13.6	$13.7	$13.8	$13.9	$14.0	$14.0	$14.1	$14.2	$14.3	$40,836,820	
	Other environmental maintenance	$2.3	$2.3	$2.4	$2.4	$2.4	$2.5	$2.5	$2.5	$2.6	$2.6	$7,019,183	
121 Environmental maintenance	Total	$15.8	$16.0	$16.1	$16.2	$16.3	$16.4	$16.5	$16.7	$16.8	$16.9	$47,856,002	$34,856,000
122 Traffic services maintenance	Traffic service power supply	$14.7	$14.8	$14.1	$13.8	$13.2	$13.1	$13.4	$13.9	$14.4	$15.0	$43,577,501	
	Traffic services maintenance	$15.6	$15.6	$15.4	$16.3	$16.0	$16.0	$16.3	$16.7	$17.1	$17.5	$46,658,522	
122 Traffic services maintenance	Total	$30.3	$30.4	$29.6	$30.1	$29.1	$29.1	$29.8	$30.6	$31.5	$32.5	$90,236,023	$88,736,023
123 Operational traffic management	Maintenance of operational infrastructure	$1.9	$1.9	$1.9	$1.9	$1.9	$1.9	$1.9	$1.9	$1.9	$1.9	$5,707,800	
	Management and operations of traffic systems	$10.1	$10.1	$10.1	$10.1	$10.1	$10.1	$10.1	$10.1	$10.1	$10.1	$30,162,839	
123 Operational traffic management	Total	$12.0	$12.0	$12.0	$12.0	$12.0	$12.0	$12.0	$12.0	$12.0	$12.0	$35,870,641	$34,370,640
124 Cycle path maintenance	Cyclepath maintenance	$1.0	$1.1	$1.1	$1.1	$1.2	$1.2	$1.2	$1.3	$1.3	$1.3	$3,189,129	
124 Cycle path maintenance	Total	$1.0	$1.1	$1.1	$1.1	$1.2	$1.2	$1.2	$1.3	$1.3	$1.3	$3,189,130	$3,189,129
125 Footpath maintenance	Footpath maintenance	$19.5	$20.5	$23.2	$24.7	$26.1	$26.3	$27.1	$27.5	$29.5	$31.6	$63,111,782	
125 Footpath maintenance	Total	$19.5	$20.5	$23.2	$24.7	$26.1	$26.3	$27.1	$27.5	$29.5	$31.6	$63,111,782	$63,111,781
131 Level crossing warning devices	Level crossing maintenance	$.0	$.0	$.0	$.0	$.0	$.0	$.0	$.0	$.0	$.0	$41,172	
131 Level crossing warning devices	Total	$.0	$.0	$.0	$.0	$.0	$.0	$.0	$.0	$.0	$.0	$41,172	$41,172
151 Network and asset management	Management of asset inventory system	$9.4	$9.4	$9.4	$9.4	$9.4	$9.4	$9.4	$9.4	$9.4	$9.4	$28,172,618	
	Network management	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$3,031,156	
	Network user information	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$12,449,650	
151 Network and asset management	Total	$14.6	$14.6	$14.6	$14.6	$14.6	$14.6	$14.6	$14.6	$14.6	$14.6	$43,653,425	$42,153,423
Non-fundable Road operations and maintenance		$24.4	$24.7	$24.9	$25.1	$25.3	$25.5	$25.6	$25.8	$26.0	$26.2	$74,043,158	
Subtotal for Road operations and maintenance:		$140.4	$142.4	$146.1	$148.7	$151.2	$152.4	$154.1	$155.6	$158.6	$161.7	$428,933,351	$409,933,345
211 Unsealed road metalling	Unsealed road renewals (remetalling)	$4.8	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1	$9,069,055	$6,342,000
211 Unsealed road metalling	Total	$4.8	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1	$9,069,055	$6,342,000
212 Sealed road resurfacing	Thin asphaltic surfacing	$71.6	$40.1	$45.7	$48.9	$52.0	$52.4	$54.0	$54.9	$59.1	$63.6	$157,405,696	
	Chip sealing	$38.8	$21.7	$24.7	$26.4	$28.1	$28.3	$29.1	$29.7	$31.9	$34.3	$85,228,611	
212 Sealed road resurfacing	Total	$110.4	$61.7	$70.5	$75.3	$80.1	$80.7	$83.1	$84.6	$90.9	$98.0	$242,634,305	$152,260,311
213 Drainage renewals	Culverts renewals	$10.1	$6.3	$7.0	$7.8	$8.4	$8.9	$9.4	$9.9	$10.7	$11.6	$23,363,084	
	Kerb and channel renewals	$20.9	$9.4	$10.7	$11.2	$11.7	$11.4	$11.4	$11.3	$12.1	$12.9	$41,007,492	
213 Drainage renewals	Total	$30.9	$15.7	$17.8	$19.0	$20.1	$20.3	$20.9	$21.2	$22.8	$24.5	$64,370,576	$44,779,143
214 Sealed road pavement rehabilitation	Structural pavement rehabilitation	$37.8	$21.2	$26.2	$28.9	$31.6	$32.0	$33.3	$34.2	$37.8	$41.7	$85,152,416	
214 Sealed road pavement rehabilitation	Granular pavement rehabilitation	$12.6	$7.1	$8.7	$9.6	$10.5	$10.7	$11.1	$11.4	$12.6	$13.9	$28,384,139	
214 Sealed road pavement rehabilitation	Total	$50.34	$28.29	$34.91	$38.54	$42.17	$42.65	$44.44	$45.57	$50.34	$55.63	$113,536,555	$88,991,165
215 Structures component replacements	Bridge renewals	$16.3	$10.0	$11.3	$12.0	$12.7	$12.8	$13.1	$13.3	$14.3	$15.3	$37,578,692	
	Guardrails renewals	$1.5	$.8	$.9	$.9	$1.0	$1.0	$1.0	$1.0	$1.1	$1.2	$3,148,297	
	Retaining wall renewals	$.4	$.5	$.6	$.8	$.9	$1.0	$1.1	$1.2	$1.3	$1.5	$1,506,722	
215 Structures component replacements	Total	$18.2	$11.3	$12.8	$13.7	$14.6	$14.8	$15.3	$15.6	$16.7	$17.9	$42,233,711	$25,738,604
222 Traffic services renewals	Traffic services renewals	$40.46	$20.78	$23.89	$25.59	$27.28	$27.49	$28.31	$28.82	$31.05	$33.52	$85,140,753	
222 Traffic services renewals	Total	$40.5	$20.8	$23.9	$25.6	$27.3	$27.5	$28.3	$28.8	$31.0	$33.5	$85,140,753	$60,301,513
Non-fundable Road renewals		$4.2	$4.3	$4.8	$5.1	$5.4	$5.4	$5.6	$5.7	$6.0	$6.4	$13,372,687	
Subtotal for Road renewals:		$255.2	$139.8	$162.0	$174.2	$186.4	$188.1	$194.1	$197.9	$213.9	$231.7	$556,984,954	$378,412,736
Total non-fundable budget:		$28.6	$29.0	$29.8	$30.2	$30.7	$30.9	$31.2	$31.5	$32.0	$32.6	$87,415,845	
Total fundable budget:		$395.6	$282.3	$308.1	$322.8	$337.5	$340.4	$348.2	$353.5	$372.5	$393.4	$985,918,305	$788,346,081

11. Procurement

11.1 Current status

AT procures its operational, maintenance and renewal activities through a competitive tendering process, as required by its own and the NZTA's polices and guidelines.

For service delivery and contract management purposes, the Auckland region is divided into 10 geographical contract areas, comprised of both the urban and rural road networks.

The first set of contracts for these areas was tendered and awarded in 2012.

Table 11-1 provides details of the 10 current contracts.

Table 11-1: Local road maintenance contracts for the Auckland region

Contract area	Contract number	Contractor	Award value ($)	Initial contract period	Possible extension period	Initial start date	Status as at March 2017
North rural	411-14-353-RM	Downer	93,786,307	4 years	2 + 2	1/07/2014	
North-east urban	411-14-354-RM	Fulton Hogan	76,797,053	4 years	2 + 2	1/07/2014	
North-west urban	411-14-355-RM	Transfield	67,084,268	4 years	2 + 2	1/07/2014	
Central Hauraki Gulf islands	414-13-090-RM	Downer	39,715,797	4 years	2 + 2	1/07/2013	Extended 2 years
Central	414-13-091-RM	Downer	129,373,563	4 years	2 + 2	1/07/2013	Extended 2 years
Central east	414-13-092-RM	HEB / Higgins	109,982,924	4 years	2 + 2	1/07/2013	Extended 2 years
West	414-13-093-RM	Fulton Hogan	140,533,014	4 years	2 + 2	1/07/2013	Extended 2 years
South-east urban	414-12-112-RM	Fulton Hogan	78,188,618	4 years	2 + 2	1/07/2012	Extended 2 years
South-west urban	414-12-113-RM	Downer	128,316,296	4 years	2 + 2	1/07/2012	Extended 2 years
South rural	414-12-114-RM	Transfield	89,398,358	4 years	2 + 2	1/07/2012	Extended 2 years

Source: AT Asset management team, March 2017

The form of these contracts is essentially 'measure and value', with some routine operations and maintenance activities included as 'lump sum per month items'.

Contractors' performance is evaluated monthly using the PACE system. Performance issues are discussed with the contractors and other stakeholders on a regular basis.

The initial contracts awarded in 2012 and 2013 have already been extended by a further two years, as allowed in the contract. AT has the option of further extending these contracts, subject to agreement with the contractors. As Table 11-1 shows, the first new contact will be due in July 2020, if AT extends the current contracts by a further two years.

11.2 Future direction

AT is currently assessing the best form of contracts to use in the future. This includes assessing the following key factors, among others:

- lessons learnt
- market situation
- best practices
- size and mix of activities
- geographical split
- innovation
- value for money
- management capabilities.

AT expects to complete this process within the next 6 to 12 months.

An initial assessment, using the Road Efficiency Group template, has already been completed and is summarised in Figure 11-1. The assessment summarised AT's overall performance in procuring maintenance and renewals activities for roads.

Figure 11-1: Road Efficiency Group assessment

REG | THE ROAD EFFICIENCY GROUP

Smart Buyer Self Assessment

This assessment is based on the Smart Buyer Principles identified in the Road Maintenance Task Force Report. Score the following by ticking the appropriate box - (1) Disagree to (5) Strongly Agree.

Whenever you score yourself "4 or 5" think of an example you can use to justify your score to an independent auditor or the other attendees at this workshop.

Assessment statement **Our Organisation**	**Score** 1	2	3	4	5
1. Fully understands the different contracting models available.					✓
2. Holds meetings that update the contracting industry on the forward works programme and any changes in approach, and proactively engages with the contracting industry to ensure it gains optimal value from any changes being implemented.				✓	
3. Has sufficient robust data (or is in the process of gathering robust data) on our networks to enable optimal integrated decision-making.			✓		
4. Has access to expertise that fully enables best use of the data available.			✓		
5. Is open to alternative solutions to those proposed in the contract documents.			✓		
6. Understands risk and how to allocate and manage it.			✓		
7. Has a Council that is prepared to pay more now to achieve a lower whole of life cost.			✓		
8. Actively pursues value for money & does not always award contracts to the lowest price.		✓			
9. Is able to manage supplier relationships/contracts to ensure optimal expenditure, which sustains infrastructural assets at appropriate levels of service.		✓			
10. Supports ongoing skill and competency training and development for staff.				✓	
11. Actively shares and gains knowledge within the sector.				✓	
12. Is effective in keeping up with best practice in procurement, including best practice RFP/contract documentation.			✓		
13. Regularly seeks and receives candid feedback from suppliers on its own performance as a client and consistently looks to improve its performance.			✓		
14. Explores opportunities for collaboration by either sharing in-house resources with neighbours, or by procuring together or tendering together. That exploration could be through an LGA s17A evaluation of transport function delivery options.			✓		
Number of ticks in each column		2	8	3	1
Multiplying factor	x1	x2	x3	x4	x5
Total Score in Column		4	24	12	5
Total Score	45				

Score:	Interpretation
65 to 70:	Our organisation is a Smart Buyer - people love working for us and with us!
55 to 64:	Our organisation has embraced Smart Buyer principles but can still improve.
45 to 54:	Our organisation gets by but has opportunities for improvement.
30 to 44:	Our organisation is not rocking the boat when it comes to pursuing value for money.
0 to 29:	Our organisation is a bit of a basket case!

If you were to repeat this assessment in one or two years' time, how do you expect it will have changed? which questions will show the greatest change (up or down)? and what action/inaction will have been the driver of that change?

The need for 'smarter buyers' (pages 36 and 37 of the RMTF report)

A theme that underpins a number of the conclusions of this review is that RCAs must be both efficient and effective managers of their road assets and smart buyers of the services they require. These issues strongly relate to the concept of 'smart procurement' with a balanced focus across 'the three Es':

1. economy – through securing (or supporting) the provision of products, materials and expertise at the quality, in the volumes and at the times and locations required, at the lowest price
2. efficiency – through the processes used, including standard documentation and contracting forms selected for achieving best cost / quality and outcomes; and knowledge of the product / materials and supplier market applied
3. effectiveness – taking opportunities for changing from traditional products and materials by maintaining support for innovation in the nature and characteristics of products and materials, and for a strong supplier market

The impact of raising the capability of RCAs would include reduced supplier selection process costs, better management of risk and more objective assessment of performance for use in future supplier selection processes.

The contracting industry has provided the following useful analysis of the characteristics of a smart buyer. Some RCAs are smart buyers but this is believed to be the exception.

Smart buyers have:

- An improved understanding of costs that better inform their decision making process
- An understanding of the impact delivery models and supplier selection criteria can have on the value of contracts
- Robust forward work programmes that are communicated to the industry and supported by budgets that allows the work to be completed
- Knowledge of the network to determine treatments required based on physical evidence and supported by knowledge of the costs involved
- In house expertise that aids the decision making process and allows acceptance of innovative solutions possibly with or without the involvement of consultants
- A clear understanding of risk and how it is allocated and managed
- An understanding that lowest price will not always deliver desirable outcomes
- An understanding that being prepared to pay more may result in enhanced whole of life value for money.

Not so smart buyers:

- Award contracts predominately based on price – with little appreciation of any risk to best value for money
- Outsource work to the detriment of asset knowledge
- Choose contract forms that are fashionable, not well understood and poorly managed
- Lack technical and contractual management skills
- Lack asset management skills that prevent the development of robust forward work programmes
- Do not support forward work programmes with appropriate budgets.

Task Force members debated the nuances around individual items in these lists but believe that they provide a platform on which to build a list of the characteristics that would be exhibited by an RCA that has the capability and the capacity to be a smart buyer.

One Task Force member described a smart buyer in the following terms:

A 'smart buyer' RCA ensures its staff are up-to-date, regularly shares best practice experiences with colleagues from other agencies, and supports and resources their teams appropriately in the recognition that getting the strategic direction right is a very small cost compared to the consequence of getting it wrong. This requires staff to be involved in regular training, attendance and participation in sector gatherings, and involvement in NZTA investigating teams and the like. Ironically in the interests of 'cost-saving' many agencies are limiting staff involvement in these activities. A smart buyer does not ask the question – what if I train my staff and they leave? – but rather asks the question – what if I don't train my staff and they stay?

12. Strategic case for road safety

AT's maintenance, operations and renewals programme, as set out in Chapters 7 and 8, will help improve road safety by maintaining safe road surfaces, improving skid resistance, and prioritising renewals investment towards creating safer streets with well-maintained walking and cycling facilities.

While each of these investments is necessary, they are not expected to be sufficient to reverse the trend of increasing deaths and serious injuries on the Auckland network. Improving safety outcomes will require increased capital investment.

12.1 Road safety trends

Road safety capital investment has been static despite increasing road trauma.

AT's road safety capital investment has remained static for the past five years at around $20 million per year. Over this period, the number of people killed and injured on Auckland's local roads has increased, with pedestrians, cyclists and motorcyclists now making up half of total road trauma (53). AT customer requests related to safety have increased significantly, and customer satisfaction with the safety of Auckland roads has declined (54).

The annual cost of road trauma in Auckland is now over $1 billion (53).

Urban and rural safety needs differ, but both are affected by growth.

Most road trauma in Auckland does not involve extreme or illegal behaviour. People make mistakes, and the growth and increasing complexity of the network mean small mistakes have serious consequences (55).

Safety risks differ on urban and rural networks, but some issues are common across the region as shown in Table 12-1.

Table 12-1: Trends in urban and rural road trauma

Urban Changing travel patterns with more walking, cycling and motorcycling, creating a more complex network with reduced margin for error. More mistakes, with worse consequences.	**Both urban and rural** Auckland's population and economic growth, high vehicle ownership, low-density and sprawling suburbs, low fuel prices, competing technology demands
Rural Housing growth is creating increased traffic. New rural drivers are making mistakes on a high-speed, unforgiving road network.	

12.2 Opportunities to improve safety

Half of the high-benefit

The NZTA has recently assessed opportunities to reduce road deaths and serious injuries through engineering improvements, and has concluded that opportunities to improve New Zealand road safety are in Auckland.

half of the national high-benefit opportunities (56) for reducing deaths and serious injuries on New Zealand local roads are on the Auckland local road network.

To address these high-benefit opportunities over the six years from 2018/2019 to 2022/2023 would require AT to invest in road safety capital improvements. The estimated total investment required is between $200 million and $300 million, or between $33 million and $50 million each year (56).

The leading priorities are high-risk areas, speeds, motorcyclists and pedestrians.

The RoadSafe Auckland executive, which includes representatives from AT, the NZTA, the New Zealand Police and the Accident Compensation Corporation, has recommended increased capital investment, targeted at:

- high-risk roads and intersections, both urban and rural
- safe speeds
- pedestrian safety improvements
- motorcycling safety improvements.

Community transport initiatives will continue.

AT has a successful programme of safety behaviour change campaigns and is actively working with schools and workplaces to promote safe and sustainable travel choices. Safety campaigns, combined with road policing, can achieve genuine benefits. However, there are limits to the improvements that can be made in this way, without safety capital investment.

RoadSafe Auckland's Safe Roads Strategy continues these behaviour change activities at similar levels to the current programme (with the addition of programmes dealing with distractions, and targeting older and Māori road users), while significantly increasing road safety capital investment. Areas of particular focus in the strategy are outlined in Table 12-2.

Table 12-2: RoadShare Auckland agreed focus areas for 2018/2021

Extra focus	Safe system management	Road safety plans, safety culture and leadership
	High-risk intersections	Increased capex, automated enforcement
	High-risk urban and rural roads	Increased capex, demonstration projects
	Pedestrian safety	Increased capex, safer communities
	Motorcycle safety	Demonstration projects
	Speed management	Speed management plan, automated enforcement

Continue Focus	Alcohol/Drugged Driving	Continued education and enforcement activities
	Young Drivers	
	Cycle Safety	Urban cycle network and training
	Maori Road Users	Continued education and enforcement activities
Emerging & Monitor	Restraints	Increased education and enforcement activities
	Older Road Users	New education and enforcement activities
	Distraction & Fatigue	New education and enforcement activities

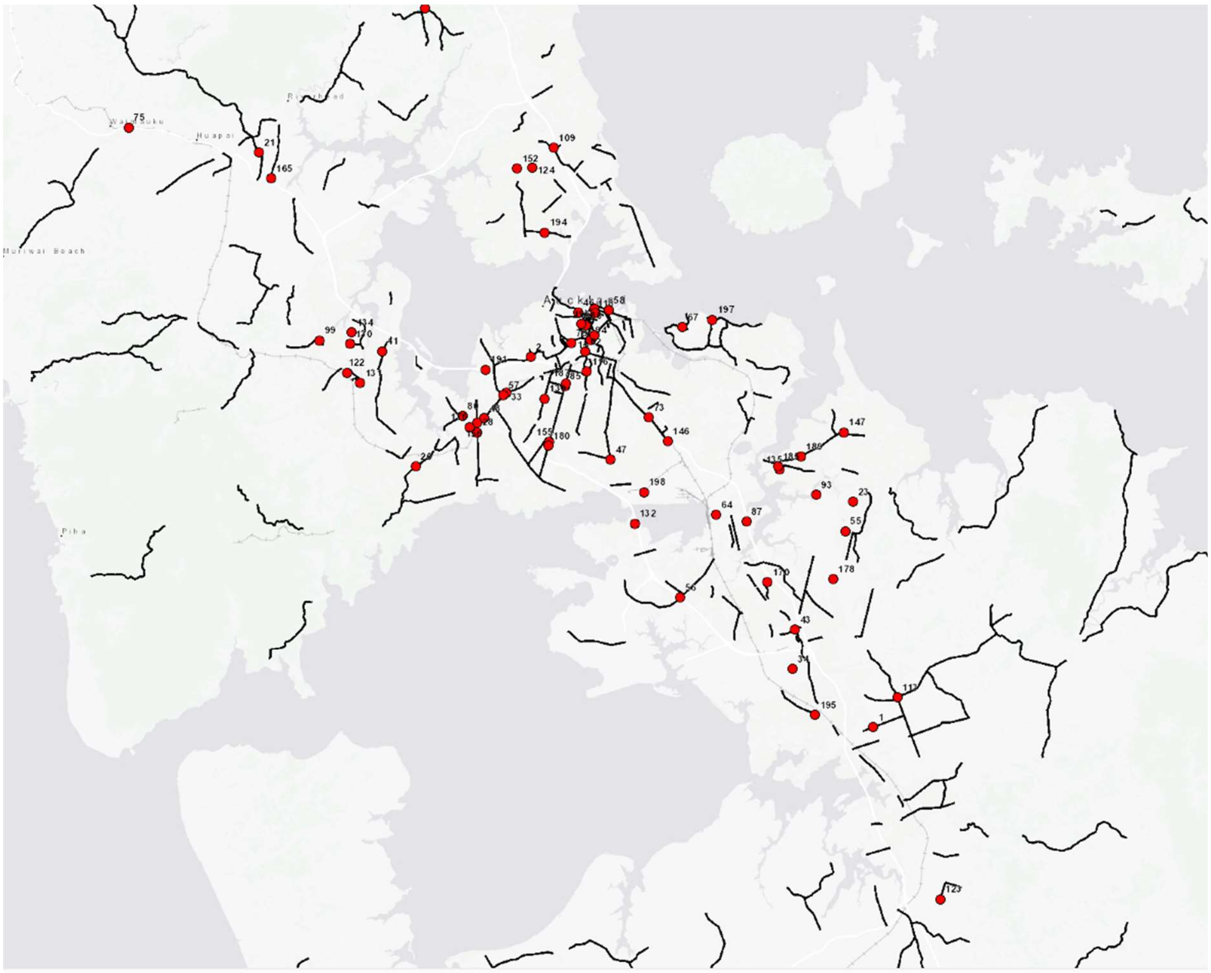
Source: RoadSafe Auckland Safe Roads Strategy

12.3 High-risk corridors and intersections

Auckland roads and intersections that currently meet national criteria of being high-risk are shown in Figure 12-2.

There are 300 intersections on Auckland local roads that are categorised as high-risk. These make up 2 per cent of intersections, but carry 25 per cent of crash-risk. Auckland also has 1,025 kilometres of high-risk local road. These roads make up 13 per cent of the Auckland road network by length, but carry 51 per cent of the crash-risk.

Figure 12-1: High-risk corridors and intersections



Source: NZTA Safer Journeys risk assessment tool

Previous funding levels allowed AT to make major transformations at two or three high-risk intersections and on two or three high-risk roads each year.

12.4 Proposed safety investment programme

The Regional Land Transport Plan includes an average annual investment of $78 million in road safety capital projects over the coming three years. Investment requirements for these programmes is detailed in Table 12-3.

Minor safety improvements	A programme of targeted improvements to address safety and operational deficiencies across AT's road, motorcycle, pedestrian and cycle networks. Also provides funding to implement smaller improvements recommended in Fatal and Serious Crash Investigations
Red-light cameras	Progress the delivery of red light cameras at high-risk urban intersections within the Auckland Region
Rural road safety programme	A programme to address the highest risk rural roads and intersections that require larger scale improvements to address safety deficiencies

Safer Communities and Speed Management	A programme of investment to address safety and operational deficiencies across Auckland's road, motorcycle, pedestrian and cycle networks and speed management interventions such as delivery of safety cameras at high risk urban intersections within the Auckland Region
Urban Road Safety Programme	A programme to address the highest risk urban roads and intersections that require larger scale improvements to address safety deficiencies

Table 12-3: Summary of proposed road safety capital investment

	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25 - 2027/28
Minor Safety Improvements	5.3	10.6	20.6	7.2	8.6	13.2	114.7
Red Light Cameras	0.7	0.8	0.8	0.8	0.8	0.9	3.7
Rural road safety programme	18.5	18.2	21.8	13.4	14.1	16.3	19.6
Safer Communities and Speed Management	11.3	23.3	16.6	16.5	24.1	21.7	81.4
Urban Road Safety Programme	16.9	20.7	47.5	27.5	20.5	25.7	38.5
Total safety-related capital projects	**52.7**	**73.6**	**107.3**	**65.4**	**68.1**	**77.8**	**257.9**

Low-cost, low-risk projects	Many of the proposed capital projects to improve safety are expected to qualify as low-cost, low-risk projects. Funding decisions about these projects can be made based on the merits of this strategic case and of the safety problem statement (Section 6.1). Where investigation demonstrates that a project with a value over $1 million is needed, a separate business case will be required.

13. Strategic case for network optimisation

Network optimisation, like road safety, requires an integrated approach across operations, maintenance, renewals and new capital investment.

As discussed in previous sections of this AMP, travel time and traffic delays are a key concern for Aucklanders, and a significant gap in the performance of the transport network. Section 7.6 set out a plan for increased investment in the operations, maintenance and renewals of traffic management assets, including traffic signals, electronic signs, CCTV and red-light cameras. Most of these services are delivered jointly with the NZTA through the Auckland Traffic Operations Centre, which controls traffic systems on Auckland's motorway network, as well as on AT local roads.

This section sets out the strategic case for increased capital investment in low-cost, low-risk infrastructure improvements on local roads, where opportunities have been identified to optimise network performance.

13.1 Network performance strategic approach

The problem	Currently, between 25 and 30 per cent of Auckland's arterial road network experiences congestion during peak times. In March, this proportion escalates to 33 per cent. The proportion of the network that is congested at peak times (with average travel speeds of half the speed limit or less) is increasing at 2 to 3 per cent per year.
The strategic approach	Infrastructure investments, including the Western Ring Route and the City Rail Link, provide much needed capacity. However, the costs of major transport projects in Auckland is increasing, because land designated for transport purposes is almost all used up, meaning new projects depend on costly land acquisition or tunnelling. Any plan for improving transport in Auckland has to include moving more people and goods on the existing network. The Auckland Transport Alignment Project recommends a mix of initiatives to achieve this, including: • optimising key routes to improve productivity • maximising benefits from new transport technology • maximising new opportunities to influence travel demand (3).
Productivity of key routes	An example of optimising a key route is the bus/T3 lane on Manukau Road and Pah Road. This initiative has resulted in a 14-minute travel time saving for buses and T3 vehicles, and as a result, more people are choosing these travel options. The impact on general vehicle travel times has been negligible. This route now carries approximately 20 per cent more people each morning peak, in the same amount of road space.

Network optimisation principles

AT applies three principles to optimise the road network, as shown in Figure 13-1.

Figure 13-1: AT road network optimisation model

- Network management – optimises traffic signals, across the motorway and local road networks, and is continuously informed by data about traffic flows.
- Behaviour change – reduces reliance on single occupant vehicle travel through targeted campaigns and travel planning. In the longer term, behaviour change will need to include smarter transport pricing, because the way people currently pay for the use of roads does not reflect differences in the true cost of travel.
- Capacity creation – is based on identifying congested elements of the network and delivering improvement projects to address these deficiencies.

13.2 Network capacity creation

Capacity creation could involve major projects, but there are also opportunities to make small improvements to network capacity throughout the city. The network optimisation capital programme focuses on small projects at identified congestion hot spots.

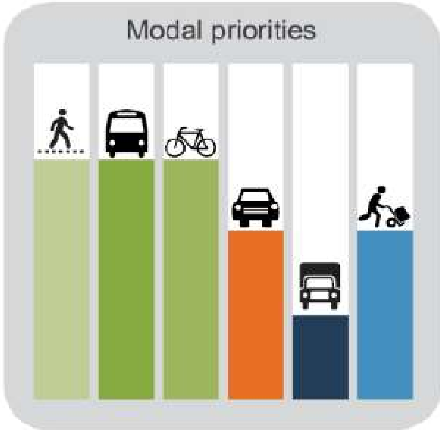
Monitoring the network

The AT operations centre is constantly monitoring traffic on the network, and identifying congestion pinch points and network deficiencies. Some improvements, such as traffic signal optimisation, can be made immediately, but others require physical changes to the road layout.

Identifying network deficiencies

The focus of the network optimisation programme is on traffic congestion, but there are other network deficiencies, including safety risks for cyclists or unreasonable delays for pedestrians.

Figure 13-2: An example modal priority



AT's Roads and Streets Framework (31) sets out how, for different types of roads, priorities can be allocated between the six main road uses:

- walking
- buses
- cycling
- private vehicles
- freight
- deliveries.

Figure 13-2 gives an example of modal priorities suitable for a town centre where walking, public transport and cycling have priority. On a different road, the priorities will be different. For example, AT has identified a freight network where heavy trucks are priority users.

Network deficiencies occur when the customer experience of a road is very different from the modal priorities.

Delivering improvement projects

AT identifies intersections, corridors and local areas with network deficiencies, and investigates these to identify where small capital improvements could make a big difference to network performance.

Examples of network optimisation capital improvements are shown in Figure 13-3.

Figure 13-3: Examples of physical changes to address network deficiencies

13.3 Network optimisation capital programme

The Regional Land Transport Plan includes an average annual investment of $14 million in network optimisation capital projects over the coming three years. Investment requirements for these programmes is detailed in Table 13-1.

Auckland Transport Operations Centres Amalgamation	The amalgamation of ATOC Smales and ATOC Central into a single Transport Operations Centre, to provide a new centre that has the capacity to co-locate external stakeholders involved in incident and emergency management, as well as allow temporary collaboration to deal with large-scale emergency situations
Intelligent Transport Systems	A programme to take advantage of emerging technologies to manage congestion, improve safety and influence travel demand
Network Performance	A package of small scale initiatives such as synchronisation of traffic signals, best use road layout, first-and-final leg trials and implementation, dynamic lanes at highest congestion locations, targeted freight movement improvements, upgrades to traffic light management system to enable smarter intersections, BIG DATA real-time multi modal network performance and congestion monitoring system, ferry interpeak/weekend trials and implementation, and targeted local bus capacity and resilience enhancements

Table 13-1:Summary of proposed network optimisation capital investment

	2018/ 19	2019/ 20	2020/ 21	2021/ 22	2022/ 23	2023/ 24	2024/25- 2027/28
Auckland Transport Operations Centres Amalgamation	0	0.2	5	0.6	0	0	0
Intelligent Transport Systems	2	3.6	5.7	8.6	10	13.7	66.3
Network Performance	7.2	8.2	10.3	15.5	15.1	22.7	101
Total network capacity and performance capital improvements	**9.2**	**12**	**21**	**24.7**	**25.1**	**36.4**	**167.3**

Low-cost, low-risk projects	It is expected that many network optimisation capital projects will often qualify as low-cost, low-risk projects. For straightforward projects with costs under $1 million, funding decisions can be made on the merits of this strategic case. Where an investigation demonstrates that a project with a value over $1 million is needed, a separate business case will be prepared.
Integration with NZTA	Both AT and the NZTA have included a network optimisation capital programme in the 2018 Regional Land Transport Plan. Many of the best opportunities for network optimisation are at the interface of the local road and motorway networks. For

example, an investigation of Esmonde Road has concluded that conversion of the existing bus lane to a T3 lane could result in a 50 per cent improvement in the productivity of this stretch of road.

14. AMP improvement plan and monitoring

14.1 Improvements compared with past AMPs

This 2018 AMP incorporates three fundamental changes in approach from previous AMPs.

- The ONRC – this is a joint initiative of the NZTA and Local Government New Zealand, developed to streamline the operation, maintenance and management of New Zealand road networks. Key outcomes sought be the ONRC framework include consistent fit-for-purpose levels of service for the road network and a mechanism to allocate funding more effectively and efficiently based on the function of the road. The framework also helps guide expectations about the levels of service that might be experienced by road users (57).
- A business case approach – this includes a structured method for defining problem statements, setting levels of service expectations, completing a gap analysis and options assessment, and developing recommended options.
- The Auckland Transport Alignment Project strategic direction – which has been adopted by both central government and Auckland Council. This AMP is one of a set of plans being developed by AT and the NZTA to implement the project's strategic direction, and is focused on the outcome "make better use of existing networks".

As in 2015, this AMP is supported by separate asset class management plans. There are 10 asset class management plans, with each plan recommending options for managing a particular asset class.

14.2 AMP improvement opportunities

In developing this AMP, we have identified a number of opportunities for improving both our asset management practices and how future plans are developed. These improvements are shown in Table 14-1. Further detail is available in a separate Terms of Reference.

Table 14-1: Recommended improvements for developing the 2021 AMP

Network monitoring	Enhance AT's monitoring of the network to assess any potential adverse effects of the investment plan, especially on the road carriageway base and sealed pavements.
In-house capabilities	Enhance the capability of AT's staff to assess network trends and issues, and develop asset management strategies.
Impacts of growth	Continue to refine how consequential opex costs due to growth are calculated. Quantify the costs and impacts on rural roads due to growth on the urban fringe. Improve monitoring of heavy vehicle routes and the impact of construction traffic on road pavements. Quantify the asset management costs arising from more intensive use of urban roads.

Climate change	Systematically review the potential impacts of climate change and sea-level rise on AT assets.
Heavy vehicle usage	Continue to collect heavy vehicle counts, using improved techniques to collect reliable data on busy, congested roads. Improve analysis of heavy vehicle data from multiple sources, to build a picture of heavy vehicle routes, trends and asset management impacts.
General data	Continue to improve the quality of the asset data in asset management systems such as RAMM and SPM. Develop and improve statistical techniques for drawing valid conclusions, even from imperfect or incomplete data. Improve data management techniques, including a data dictionary, data entry systems and training, and enforcement of data requirements in contracts.
Road condition profiles	Develop a process to convert attributes of road defects to a robust road condition profile, suitable for asset management purposes. Develop agreed methods for summarising and simplifying pavement inspection data (both high-speed and visual inspection data), to enable more accurate identification of those areas of the network in poor or very poor condition. Document and agree the differences between the assessments needed at different stages of the renewals planning process, from high-level planning to site-specific choices of treatment.
AMP and renewals forward works programme	Improve the alignment between AMP recommendations and the renewals forward works programme. Develop a 'one source of truth' approach to asset condition data, which can be used for planning purposes and to develop the forward works programme. Also develop a "one source of truth" approach to the forward works programme, including a centralised process for making changes during the year in response to new information.
Bridges and structures forward works programme	Continue to improve AT's process for developing its bridges and structures forward works programme. AT is currently developing a manual to guide this process, which will align with national and international recommended best practice. The process will use a multi-criteria analysis and a value management approach to identify maintenance and renewal needs for AT's bridges and structures assets. AT will work members of the NZTA's highway structures management teams to refine the draft process.
Cross-asset optimisation	Improve and expand AT's ROM, in partnership with the University of Auckland.

Roles and responsibilities	Continue to clarify responsibilities for asset ownership and management with Auckland Council, Watercare and other council-controlled organisations, with respect to: • stormwater assets • green assets in the road corridor, including street trees and gardens • town centres and the wide range of assets in these areas, including seats, bollards and wayfinding signs.
Research and development	Undertake research and development to meet new asset management challenges posed by the changing network.
Asset management policy, strategy and ISO 55000	Develop key asset management policy documents, in line with ISO 55000 requirements.

14.3 Improvements identified through technical audit

AT is also implementing the improvements identified through the NZ Transport Agency's technical audit in 2017. These recommendations are summarised in Table 14-2.

Table 14-2: Recommendations from the 2017 NZTA technical audit

NZ Transport Agency recommendation: that Auckland Transport:		Implementation Date
Q.7	Develop a process to ensure funding requests for WC 212 only reflect the whole of life least cost surfacing option (therefore exclude costs associated with amenity objectives).	Complete during 2018/19 but before 30 June 2019
	Ensure only reasonable and foreseeable do-minimum costs are included in NPV analysis calculations.	Complete during 2018/19 but before 30 June 2019
	Ensure pavement design process includes consideration of alternatives and is based on actual and recent traffic count data.	Complete during 2018/19 but before 30 June 2019
Q.8	Ensure improvements listed in the AMP are assigned to an individual or team, time-bound and have sufficient budget to be completed.	Complete during 2018/19 but before 30 June 2019
Q.9	Amend asset database to ensure traffic and loading data is consistent across all RAMM tables.	Complete during 2018/19 but before 30 June 2019
	Audit surfacing material data to ensure it is accurate.	Complete during 2018/19 but before 30 June 2019

14.4 Alignment of asset management policy and strategy with ISO 55000

A key feature in AT's asset management framework is to continue to improve its asset management practices, processes and tools. This is essential to ensure AT's asset system and services are effectively managed. AT is committed to moving towards appropriate advanced asset management practices. These practices are being developed in accordance with the New Zealand Asset Management Support approach, as presented in that organisation's suite of asset management publications.

To date, AT has undertaken the following activities to support this commitment:

- adopted the asset management and levels of service frameworks
- in the process of developing and adopting an Asset Management Policy and Asset Management Strategy
- in the process of developing and adopting the overall asset management process, and its detailed sub-processes
- developed this asset management improvement plan, which will be reviewed and endorsed by AT's asset management steering group
- completed quality audits of the information it uses for asset planning, to confirm the degree of confidence in, integrity and cost-effectiveness of the data collected
- completed internal and external reviews of the AMP and associated asset class management plans, to incorporate identified improvements and to align them with other strategic documents
- adopted this AMP.

14.5 Current Improvement Tasks

Asset management and systems group has identified a number of priority areas for business improvements during 2018/2019. These take into account the currently known gaps in ATs practices as described above, with a view of lifting the robustness of decision-making processes, and identifying and managing risk better.

14.5.1 Improvement tasks – Road assets

Table 14-3: Improvement tasks - Road assets

Improvement Theme	Description of improvement initiative
ISO 55001 Alignment	Finalise the AM Policy and AM Strategy
	Document the risk management processes as part of the AM System
Responding to heavy vehicle growth	Address the risks of degradation on roads which are subject to (especially sudden) major load increases
Renewals Optimisation Model (ROM) enhancements	Develop means to forecast customer facing performance measures and take account of LoS in ROM
	Further improve ROM to inform both the 10-year AMP view and longer term 30-year view for strategic planning purposes
Lifecycle analytics	Improve the way in which pavement data is used in treatment decision-making

Improvement Theme	Description of improvement initiative
Maintenance / renewals management	Achieve cost efficiencies and optimal outcomes for AT through more rigorous approaches to pavement renewals decision-making
Asset data and information	Maintain an accurate and up-to-date inventory of AT assets and facilities including location, type and material, age, condition, inspection plans and procedures, historic maintenance costs and activities, probability, consequence and risk of asset failure, and levels of performance required by each asset
	Review / develop asset criticality ratings across all asset classes
	Improve Bridge QA and work completed data process
	Review process for capturing inspection records in RAMM, including the completion of work and the scheduling of forward inspections – in particular, bridges and structures
	Improve the quality of maintenance history and maintenance costs data against all assets (also an EAM improvement)
	Asset ownership clarification (AT vs. Council)
Risk management	Enhance risk management processes, including risk profiling and natural hazard risks
	Continue to develop risk-based understanding of Bridges and Structures, including internal risk-based failure management processes, and develop programmes accordingly
	Review the whole criticality framework to see if it can be standardised over the entire asset portfolios, to enable organisation-wide understanding of which are the most important assets – linked to the risk management framework
Reslilience	Formalise what resilience means to the transport system and initiate a Resilience assessment process

14.5.2 Improvement tasks – Facilities

Table 14-4: Improvement tasks: Facilities

Improvement Initiatives -	Description of improvement initiative
ISO 55001 Alignment – Formalising the AM/FM system	Finalise the AM/FM Policy and Strategy. Adopt at senior management / Board level and communicate both across AT
	Describe in the AM/FM Strategy how the asset condition, risk, performance and cost based approach is to be applied across all asset groups
	Document the risk management processes as part of the AM/FM System
PT Levels of Service	Develop some or all of the following PT measures, in addition to those currently utilised;

Improvement Initiatives -	**Description of improvement initiative**
	- SLA performance (work orders completed on time to required performance level) - Percentage of assets in each condition grade. - Expenditure against budget (planned and reactive maintenance). - The level of maintenance and renewals backlog. - LTI incidents / health and safety incidents. - Energy efficiency
Renewals Optimisation Model (ROM) enhancements	Clearly communicate the assumptions and limitations of ROM when determining the AMP long term renewals investment programme
	Review the renewals priorities to ensure that the conditions of critical 'back of house' assets are not being compromised and backlogs are not building up
	Further improve ROM by: - Drilling to a more asset component granular level - Providing information on performance outcomes - Being able to link back to specific assets in SPM - Enabling it to forecast the effects on levels of service
Improving Facilities Maintenance and Management	Develop an overarching strategy for asset maintenance
Resilience	Prioritise a comprehensive assessment of resilience across the PT networks and facilities
	Ensure all asset classes are included in the Auckland University's resilience project
Business process improvements	Complete the current work to clarify asset ownership
Risk management	Specifically include natural hazard risks in the risk assessments – align with Auckland Engineering Lifelines
	Provide more specific information around the risk management process within the Risk Management Plans

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15. Appendices

15.1 Appendix 1 : Level of service – performance and service measures and targets

LOS Framework

Auckland Council transport requirements	**Vision**	**Auckland, the world's most liveable city**				
	Transformational shift	**Prioritise rapid, high frequency public transport**				
	Transport expectations	A well-connected and accessible Auckland	An Auckland of prosperity and opportunity	A fair, safe and healthy Auckland	A green Auckland	
	Strategic directions	Create better connections and accessibility within Auckland, across New Zealand and to the world	Develop an economy that delivers opportunity and prosperity for all Aucklanders and New Zealand	Create a strong, inclusive and equitable society that ensures opportunity for all Aucklanders	Contribute to tackling climate change and increasing energy resilience	
Auckland Transport Policies	Strategic Themes	**Transform and elevate customer experience**				
		Build network optimisation and resilience				
		Ensure a sustainable funding model				
		Develop creative, adaptive, innovative implementation				
	Impacts required	**Increased access to affordable transport choices** **Auckland's transport system enables growth**	**Auckland's transport network moves people and goods efficiently**	**Reduce adverse effects from Auckland's transport system – including safety, environmental, health and cultural considerations**		
Key service outcome areas		**Effective Network**	**Efficient Network**	**Safe Network**	**Sustainable network**	**ONRC customer outcome measures**
Auckland Transport Outcomes	Strategic and Customer Levels of Service	Fit for purpose Accessible Easy to use Travel options Responsive	Efficient Reliable Value for money	Safe for users Safe for the community	Affordable Resilient Environmental impacts	Amenity Accessibility Efficiency Resilience Travel time Safety
Auckland Transport Outputs	Technical LOS to deliver outcomes	Accessibility Demand vs capacity Use trends	Travel time reliability Affordability	Safety trends Security trends	Sustainability measures Environmental Economic	
Auckland Transport activities	Projects to deliver AT outputs	Condition management Renewals & maintenance	Spend optimisation	Risk management projects	Environmental mitigation	**Look after what we have**
		Local minor capital projects	Demand management	Minor safety improvements	Recycling Energy management	**Make better use of what we have**
		Accessibility projects	Traffic reliability projects PT reliability projects	PT security projects Parking security projects	Electric vehicle projects	**Encourage smarter travel choices**
		Road capacity projects PT capacity projects	Traffic efficiency projects PT efficiency projects	Major safety projects	Climate change, emissions and community health projects	**Build new assets**

AT four stage intervention process

Asset Class	ONRC reference	Performance/Service Measure	Current Performance	Target Performance
Carriageway	Safety CO1	Deaths and serious injuries on Auckland local roads	683	
Carriageway	Safety CO2	Collective risk - deaths and serious injuries per km of road	0.16	
Carriageway	Safety CO3	Personal risk - deaths and serious injuries er 100 million vehicle kms travelled	13.9	
Carriageway	Safety TO1	Permanent hazards	TBA	
Carriageway	Safety TO2	Temporary hazards	TBA	
Carriageway	Safety TO3	Sight distances	TBA	
Carriageway	Safety TO4	Loss of control on wet roads	63	
Carriageway	Safety TO7	Hazardous faults	TBA	
Carriageway	Safety TO10	Roadside obstructions	TBA	
Carriageway	LOS PA SA 1	% of customers satisfied with road safety in the Auckland region	59%	60-65%
Carriageway	Resilience CO1	Number of journeys impacted by unplanned events	TBA	
Carriageway	Resilience CO2	Number of instances where road access is lost	TBA	
Carriageway	LOS PA EFE 2	% of customers satisfied with the quality of roads in their local area	61%	TBC
Carriageway	LOS PA EFE 1	% of customers satisfied with the quality of unsealed roads (ie. gravel) in the Auckland region	44%	TBC
Carriageway	Amenity CO1	Road roughness (ride quality) as measured by smooth travel exposure (STE) for rural roads	95%	Rural 92%
Carriageway	Amenity CO1	Road roughness (ride quality) as measured by smooth travel exposure (STE) for urban roads	89%	Urban 82%
Carriageway	LOS PA EFI 3	% of customers satisfied that Auckland roads are kept clean and free of rubbish	49%	TBC
Carriageway	Amenity CO2	Peak roughness (lane km above threshold)	1464	
Carriageway	Amenity TO1	Road and roughness (median and average)	106 - average 97 - median	
Carriageway	Amenity TO2	Aesthetic faults	TBA	
Carriageway	LOS PA EFI 13	Arterial road productivity	60% of the ideal achieved	55% of the ideal achieved
Carriageway	LOS PA EFI 5	% of customers satisfied with traffic flow in the Auckland region	20%	TBC
Carriageway	LOS PA EFI 17	Travel times on key freight routes - from East Tamaki to Sylvia Park (SEART)	10	12
Carriageway	LOS PA EFI 18	Travel times on key freight routes - Gt South Rd (Portage Rd to SH1 Ellerslie Panmure Hwy interchange)	12	13
Carriageway	LOS PA EFI 19	Travel times on key freight routes - Gt South Rd (SH1 Ellerslie Panmure Hwy interchange to Portage Rd)	11	13
Carriageway	LOS PA EFI 20	Travel times on key freight routes - Harris Rd (from East Tamaki to SH1 Highbrook interchange)	10	10
Carriageway	LOS PA EFI 21	Travel times on key freight routes - Harris St (from SH1 Highbrook interchange to East Tamaki)	11	13
Carriageway	LOS PA EFI 22	Travel times on key freight routes - Kaka St/James Fletcher Dr/Favona Rd/Walmsley Rd (SH20 to Walmsley)	8	11

Asset Class	ONRC reference	Performance/Service Measure	Current Performance	Target Performance
Carriageway	LOS PA EFI 23	Travel times on key freight routes - Kaka St/James Fletcher Dr/Favona Rd/Walmsley Rd (Walmsley to SH20)	7	11
Carriageway	LOS PA EFI 24	Travel times on key freight routes - Sylvia Park to East Tamaki (SEART)	11	12
Carriageway	LOS PA EFI 25	Travel times on key freight routes - Wairua Rd (from SH1 to SH18)	8	9
Carriageway	LOS PA EFI 26	Travel times on key freight routes - Wairuau Rd (from SH18 to SH1)	8	10
Public transport systems	LOS PT EFE 7	% PT Punctuality (weighted average across modes)	95%	92%
Bus	LOS RBU EFE 3	% of customers satisfied with the effectiveness of bus and transit (ie. T2, T3) lanes in the Auckland region	53%	TBC
Carriageway	Accessibility TO1	Wayfinding (number of instances that road is not marked in accordance with the standards	TBA	
Carriageway	LOS PA EFI 27	Number of morning peak (7-9am) car trips avoided through travel planning initiatives	24,227	
Carriageway	Cost Efficiency CO2	Chipseal resurfacing length and area	TBA	
Carriageway	Cost Efficiency CO2	Chipseal resurfacing cost & average	TBA	
Carriageway	Cost Efficiency CO3	Asphalt resurfacing length and area	TBA	
Carriageway	Cost Efficiency CO3	Asphalt resurfacing cost & average	TBA	
Carriageway	Cost Efficiency CO4	Unsealed road metalling	TBA	
Carriageway	Cost Efficiency EM10	Routine pavement maintenance	TBA	
Carriageway	LOS PA EFI 15	% of customer service requests relating to roads which receive a response within specified timeframes	87%	85%
Carriageway	LOS PA EFI 1	% of carriageway surface in condition grade 5	3.4%	3%
Carriageway	LOS PA EFI 16	% of the sealed local network that is resurfaced	8%	8%
Carriageway	LOS PA EFI 2	% of customers satisfied that Auckland roads are designed to minimise air pollution from traffic	22%	TBC
Carriageway	LOS PA EFI 4	% of customers satisfied that Auckland roads minimise road noise (noise pollution) from moving traffic	25%	TBC
Stormwater	LOS SW EFI 1	% of stormwater assets (catchpits) in condition grade 5	0.9%	5%
Stormwater	LOS SW EFI 2	% of stormwater assets (kerb and channel) in condition grade 5	0.2%	5%
Bridges, walls and structures	LOS BR EFI 1	% of bridges and major culverts in condition grade 5	0.4%	1%
Bridges, walls and structures	LOS BR EFI 2	% of fixtures and structures in condition grade 5	0.6%	2%
Bridges, walls and structures	LOS BR EFI 3	% of walls in condition grade 5	0.5%	2%
Footpaths and cycleways	LOS FC EFE 1	% of customers satisfied with the availability of cycle lanes and cycle ways in the Auckland region	48%	TBC

Asset Class	ONRC reference	Performance/Service Measure	Current Performance	Target Performance
Footpaths and cycleways	LOS FC SA 1	% of customers satisfied with the amount and location of safe places to cross roads in the area where you live	60%	TBC
Footpaths and cycleways	Safety TO9	Vulnerable users	313	
Footpaths and cycleways	Safety TO8	Cycle path faults	TBA	
Footpaths and cycleways	LOS FC EFE 3	% of customers satisfied with the quality of footpaths in the Auckland region	56%	65%
Footpaths and cycleways	LOS FC EFE 2	% of customers satisfied with the quality of footpaths in their local area	56%	TBC
Footpaths and cycleways	LOS FC EFI 3	% of cycleways in condition grade 5	0.1%	2%
Footpaths and cycleways	LOS FC EFI 4	% of footpaths in condition grade 5	0.4%	1%
Footpaths and cycleways	LOS FC EFI 1	Percentage of footpaths in acceptable condition (C1-C3)	99.0%	99%
Footpaths and cycleways	LOS FC EFI 2	% of customers satisfied with the condition of cycle lanes and cycle ways in the Auckland region	57%	TBC
Footpaths and cycleways	LOS FC EFE 6	New cycleways added to regional cycle network	14.20	7.40
Streetlighting	Safety TO5	Loss of driver control at night	136	
Streetlighting	LOS SL EFI 1	% of street light brackets in condition grade 5	0.2%	19%
Streetlighting	LOS SL EFI 2	% of street light columns in condition grade 5	1.1%	12%
Streetlighting	LOS SL EFI 4	% of street light luminaires in condition grade 5	0.3%	7%
Streetlighting	LOS SL EFI 3	% of streetlighting in condition grade 3 or above	97.4%	99%
Traffic Systems	Safety TO6	Intersections	237	
Traffic Systems	LOS TS EFI 1	% of traffic control systems in condition grade 3 or above	97.5%	95%
Traffic Systems	LOS TS EFI 4	% of traffic signage in condition grade 3 or above	98.6%	95%
Traffic Systems	LOS TS EFI 3	% of traffic signage in condition grade 5	0.4%	1%
Traffic Systems	LOS TS EFI 2	% of traffic systems in condition grade 5	0.3%	0%
Vegetation	LOS VE EFI 1	% of customers satisfied that Auckland roadsides are kept mown and free of weeds	44%	TBC
Bridges, walls and structures	Accessibility CO1	% of network not accessible to 50-max vehicles	1%	TBC
Parking	LOS PK SU 1	Occupancy rates of paid on-street parking (peak 4-hour)	89%	70% - 90%
Parking	LOS PK EFI 3	% of parking assets in condition grade 5	1.21%	1%
Public transport systems	LOS PT EFE 6	% of customers satisfied with their public transport service	90%	85%
Bridges, walls and structures	Accessibility CO1	% of network not accessible to high productivity motor vehicles	1%	TBC
Footpaths and cycleways	LOS FC EFE 5	Annual number of cycling trips in designated areas in Auckland (all day/millions)	1.526	1.80
Footpaths and cycleways	LOS FC EFE 4	Annual cycle movements in the Auckland city centre (millions)	1.554	1.989
Parking	LOS PK EFI 1	% of customers satisfied with the availability of parking in their local area	61%	TBC

Asset Class	ONRC reference	Performance/Service Measure	Current Performance	Target Performance
Parking	LOS PK EFI 2	% of customers satisfied with the availability of parking where they work or study	52%	TBC
Public transport systems	LOS PT EFE 2	Total PT transport boardings (millions)	88.4	93.0
Public transport systems	LOS PT SU 2	Public transport farebox recovery %	47%	47-50%
Bus	LOS RBU EFE 1	% of bus customers satisfied with their service	91%	85%
Public transport systems	LOS PT EFE 5	Boardings on rapid or frequent network (rail, busway, FTN,bus)	12.7% growth compared with 6.7% for total boardings	
Bus	LOS RBU EFI 2	% of bus shelters and stop assets in condition grade 5	0.39%	0-5%
Bus	LOS RBU EFI 1	% of busway station assets in condition grade 5	0.03%	0-5%
Rail	LOS RA EFI 4	% of rail customers satisfied with their service	92%	85%
Rail	LOS RA EFE1	Total Rail boardings (millions)	19.6	21.6
Rail	LOS RA EFI 2	% of rail station assets in condition grade 5	1.63%	0-5%
Rail	LOS RA EFI 3	% of rolling stock assets in condition grade 5	0.00%	0-5%
Rail	LOS RA RE 1	EMU mean distance between service failures		
Rail	LOS RA RE 2	DMU mean distance between service failures		
Wharves	LOS WH EFI 3	% of ferry customers satisfied with their service	89%	85%
Wharves	LOS WH EFI 2	% of wharf assets in condition grade 5	1.93%	2%
Depots and Stabling	LOS DS EFI 3	% of assets in condition grade 5	0.00%	0%
Bridges, walls and structures	LOS BR EFE 1	% of bridges complying with seismic standards		100%
Public transport systems	LOS PTS EFI 10	BDC (Bus Driver Console) / VDC Mean Time between Failures		
Public transport systems	LOS PTS EFI 2	VRD-F (Vending and Reload Device) Mean Time between Failures		
Public transport systems	LOS PTS EFI 3	VRD-L (Vending and Reload Device) Mean Time between Failures Mean Time between Failures		
Public transport systems	LOS PTS EFI 4	FPD (Fare Payment Device) Mean Time between Failures		
Public transport systems	LOS PTS EFI 5	HHDC (Hand-Held Device Checking) Mean Time between Failures		
Public transport systems	LOS PTS EFI 6	SRD (Small Retail Device) Mean Time between Failures		
Public transport systems	LOS PTS EFI 7	TOT (Ticket Office Terminal) Mean Time between Failures		
Public transport systems	LOS PTS EFI 8	EG (Electronic Gate - Standard) Mean Time between Failures		
Public transport systems	LOS PTS EFI 9	EG (Electronic Gate - Wide) Mean Time between Failures		
Public transport systems	LOS PTS EFI 1	% of AT HOP assets in condition grade 5		0%
Public transport systems	LOS PTS EFI 11	% of field devices in condition grade 5		0
Carriageway	LOS PA EFI 11	Average daily speed and delay per km on strategic freight roads		

Asset Class	ONRC reference	Performance/Service Measure	Current Performance	Target Performance
Carriageway	LOS PA EFI 29	Number of vehicle kilometres travelled (VKT)		
Carriageway	LOS PA EFI 28	Modelled lane km		
Carriageway	LOS PA EFI 6	Number of morning vehicle trips		
Carriageway	LOS PA EFI 10	Number of heavy commercial vehicle trips		
Carriageway	LOS PA EFI 7	Average morning vehicle trip time (mins)		
Carriageway	LOS PA EFI 8	Average morning vehicle trip speed (kph)		
Carriageway	LOS PA EFI 9	Road length (km both directions)		
Carriageway	LOS PA EFI 12	Greenhouse gas emissions from land transport		49% reduction by 2040
Footpaths and cycleways	LOS FC EFE 7	Daily active (cycle and walking) trips		
Public transport systems	LOS PT EFE 3	Number of annual public transport boardings (per capita)		
Public transport systems	LOS PT EFE 4	Proportion of morning peak motorised trips (PT and auto) into the CBD by public transport		70% by 2040
Rail	LOS RA EFI 1	Number of morning rail service (km)		
Bus	LOS RBU EFE 2	Number of morning bus trips (km)		
Wharves	LOS WH EFI 1	Number of morning ferry service (km)		
Public transport systems	LOS PT EFE 1	Proportion of people living within walking distance of frequent public transport stops		32% by 2040

15.2 Appendix 2 : Road Efficiency Group performance measurement reports

Safety Customer Outcome 1 – Serious injuries and fatalities – refer to Figures 6-1 and 6-2

Figure 15-1: Safety Customer Outcome 2 – Collective Risk

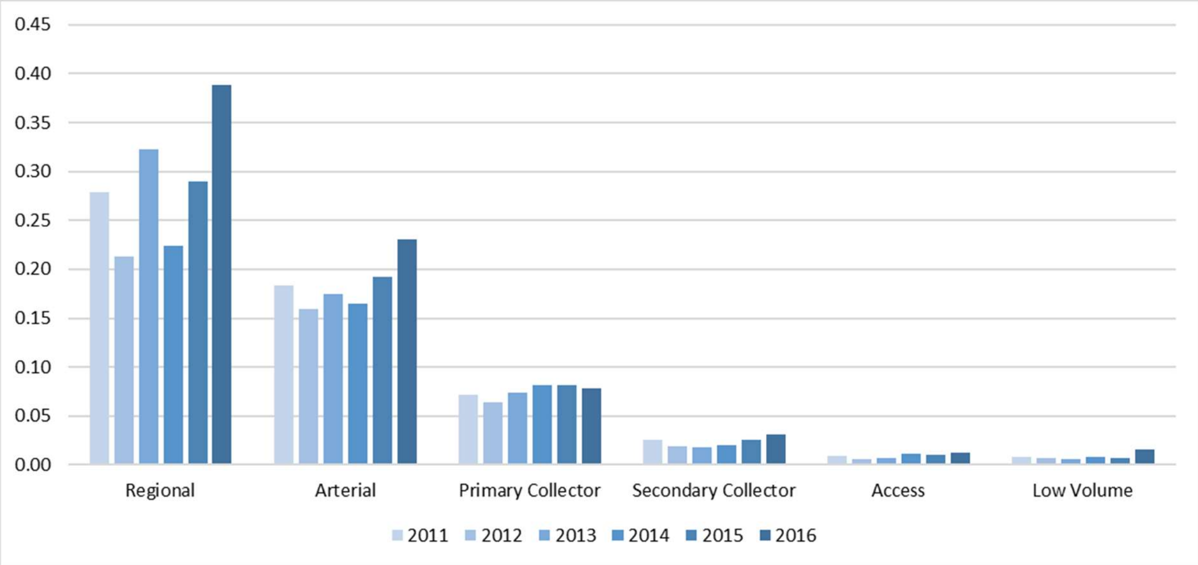
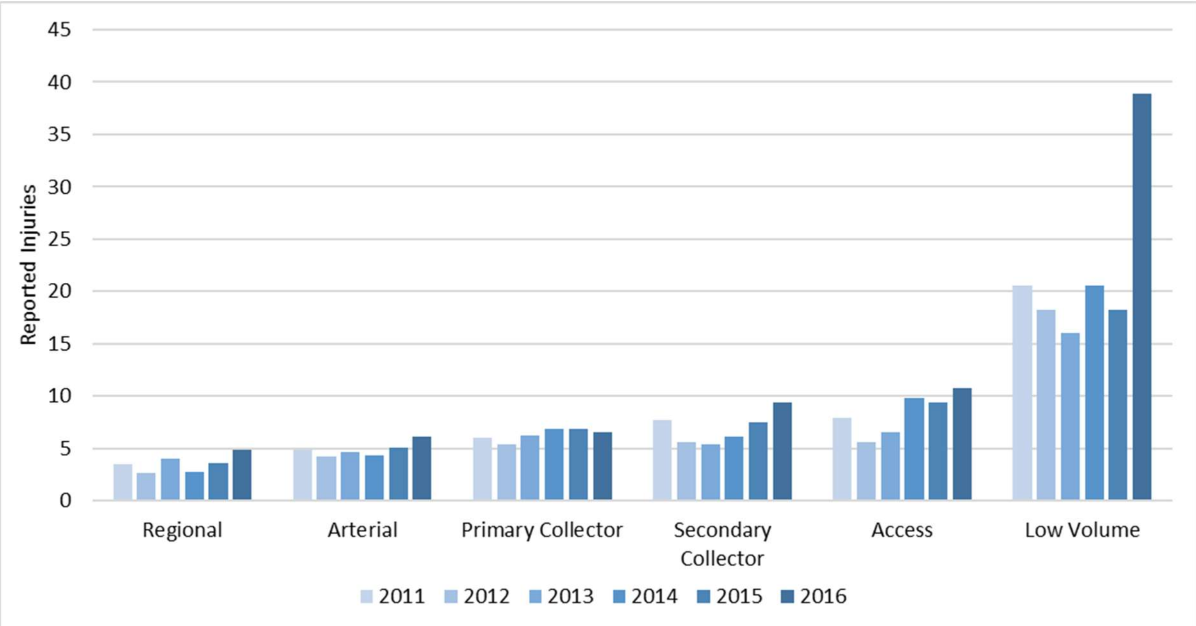


Figure 15-2: Safety Customer Outcome 3 – Personal Risk



Safety Technical Output 1 – Permanent hazards – no data available

Safety Technical Output 2 – Temporary hazards – no data available

Safety Technical Output 3 – Sight distances – no data available

Safety Technical Output 4 – Loss of control on wet roads – refer to Figure 7-10

Safety Technical Output 5 – Loss of driver control at night – refer to Figure 7-38

Safety Technical Output 6 – Intersections – refer to Figure 7-51

Safety Technical Output 7 – Hazardous faults – no data available

Safety Technical Output 8 – Cycle path faults – no data available

Safety Technical Output 9 – Vulnerable users – refer to Figure 7-9

Safety Technical Output 10 – Roadside obstructions – no data available

Figure 15-3: Amenity Customer Outcome 2 – Peak Roughness

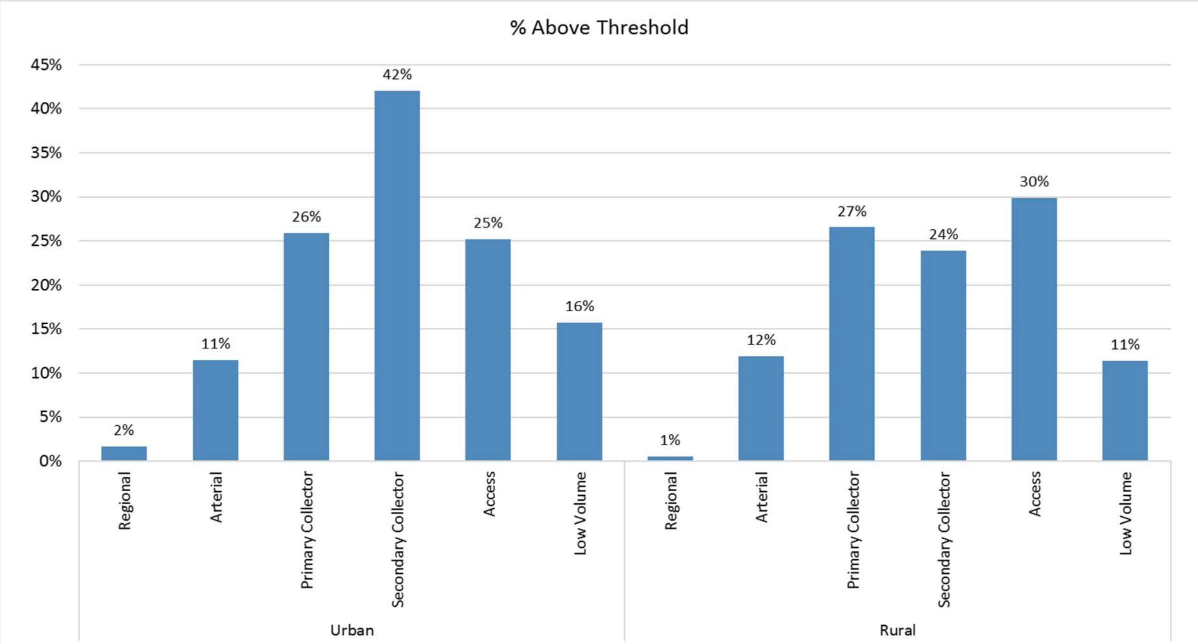
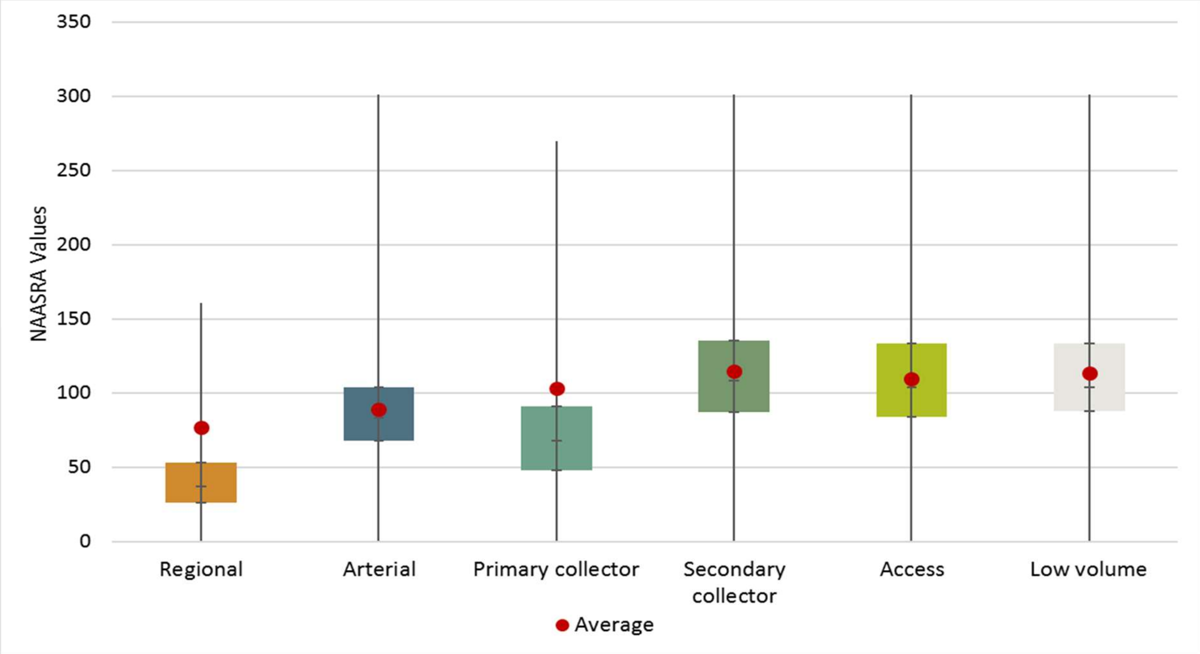


Figure 15-4: Amenity Technical Outcome 1 – Peak Average Roughness



Resilience Customer Outcome 1 – Unplanned closure with detour provided – no data available

Resilience Customer Outcome 2 – Number of instance where road access is lost – no data available

Amenity Customer Outcome 1 - Smooth travel exposure (STE) – refer to Figure 7-3

Amenity Customer Outcome 2 and Technical Outcome 1 - Peak and Average Roughness – refer to Figure 7-4

Amenity Technical Output 2 – Aesthetic faults – no data available

Accessibility Customer Outcome 1 - Proportion of Network not Available to Heavy Vehicles – refer to Figure 7-21

Accessibility Technical Output 2 – Wayfinding – no data available

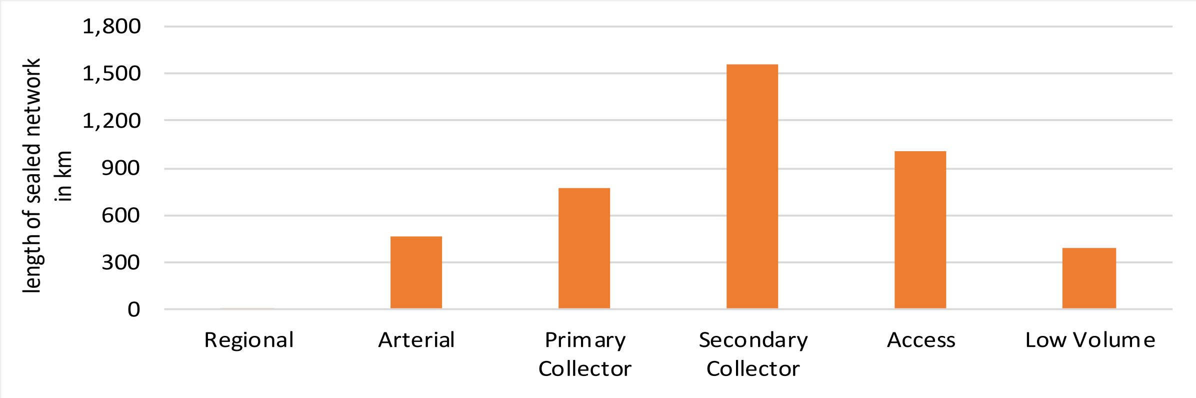
Cost Efficiency 2 - Chipseal Resurfacing (Cost & Avg Life) – refer to Figure 7-6 and Figure 7-5

Cost Efficiency 3 - Asphalt Resurfacing (Cost & Avg Life) – refer to Figure 7-6 and Figure 7-5

Cost Efficiency 4 - Unsealed Road Metalling – refer to Figure 7-6

Cost Efficiency EM10 - Routine Pavement Maintenance – refer to Figure 7-6

Figure 15-5: Cost Efficiency 2 – Chip seal Resurfacing (Length & Area)



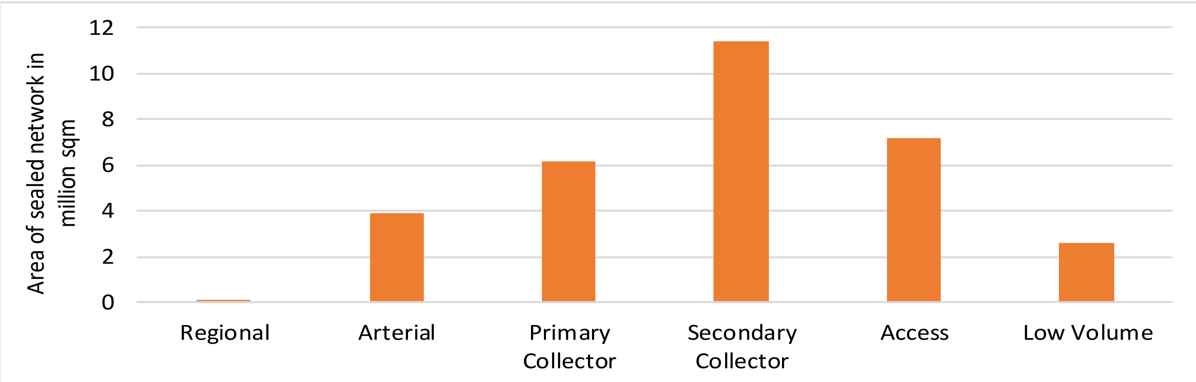
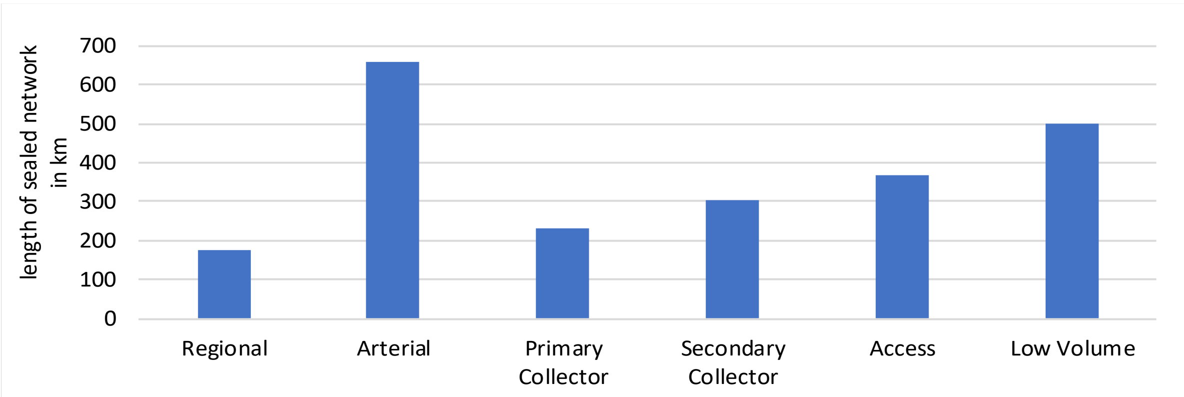
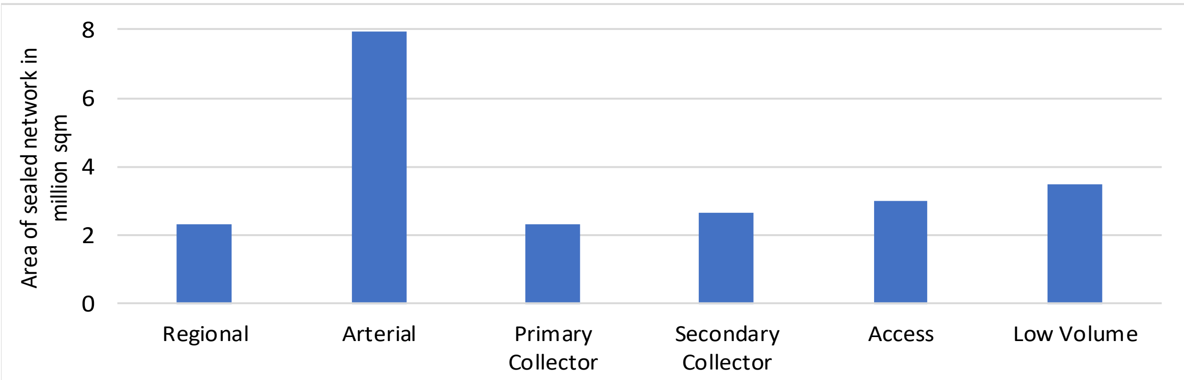


Figure 15-6: Cost Efficiency 3 – Asphalt Resurfacing (Length & Area)





15.3 Appendix 3 : Road Efficiency Group peer group comparison reports

Auckland Transport corrected ONRC summary report

Auckland Transport has classified its network using ONRC and regularly uploads RAMM data to the performance reporting tool. We have actively assisted in the development of the tool at the governance, management and technical levels.

Aligning with the ONRC performance reporting tool is central to our data management efforts, and we are in regular contact with the tool's developers.

That said, the tool does still have shortcomings and these are particularly evident when using the tool to analyse our complex urban network. Specific issues are:

- Safety data does not import into RAMM correctly, with around a third of all death and serious injury crashes not appearing in the RAMM data
- Our network is growing but the ONRC classification table used in the tool is static. Over 200km of new roads added to the network since the classification was done in 2014 do not appear in the tool or the reports.
- Vehicle kilometres travelled are increasing steeply. AT's latest vkt data is significantly better than the data being used in the tool.
- AT uses the RAMM database to manage all of its pavement assets including off-road cycle paths and off-street parking areas, and to keep records relating to private roads and NZTA roads. Some reports in the tool do not yet correctly exclude these from the calculation.

We will continue to work to improve the tool, but in the meantime have produced this corrected report to assist the Agency in comparative reporting.

NETWORK CHARACTERISTICS

Table 15-1: Network statistics for network length and journeys travelled (Million veh km) by ONRC class

ONRC Category	Urban (km)	Rural (km)	Total length (km)	Urban journeys	Rural journeys	Annual total journeys travelled (M Veh Km)
Regional	167	17	183	1,342	181	1,523
Arterial	823	318	1,140	3,831	714	4,545
Primary Collector	596	453	1,049	1,028	274	1,302
Secondary Collector	1,147	905	2,052	545	142	688
Access	1,070	828	1,897	182	31	212
Low Volume	897	201	1,098	42	2	44
Grand Total	**4,699**	**2,721**	**7,420**	**6,970**	**1,344**	**8,314**

Figure 15-7: Network percentage length and journeys travelled

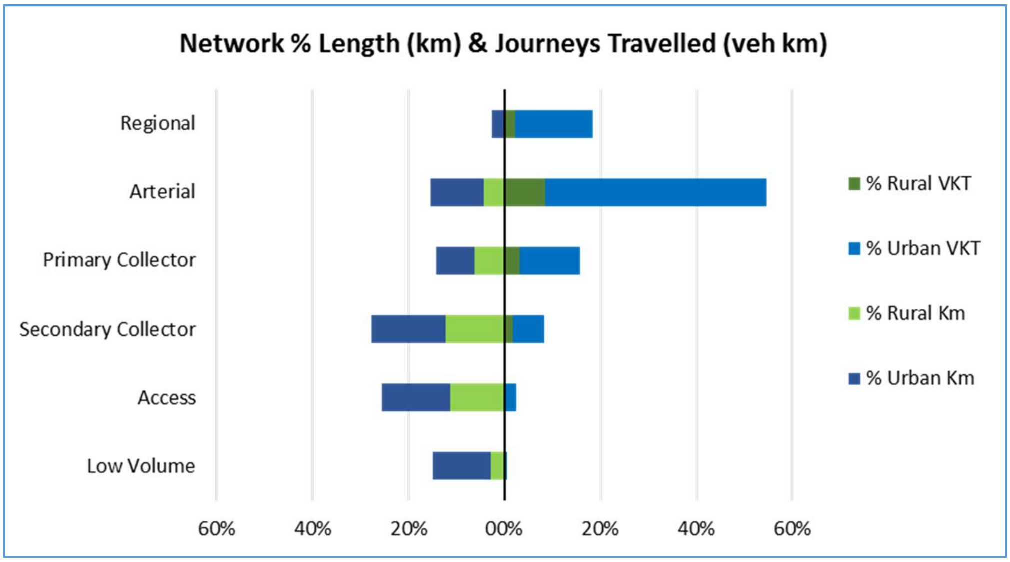


Figure 15-8: Sealed vs unsealed roads

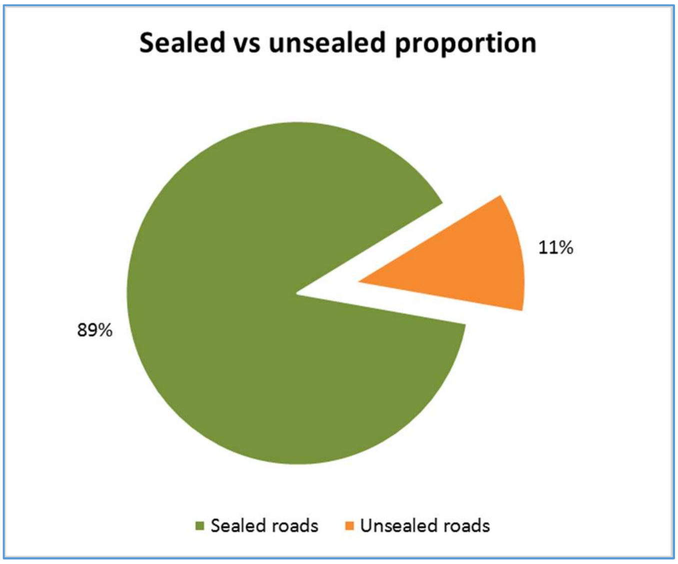


Figure 15-9: Serious injuries and fatalities by ONRC category

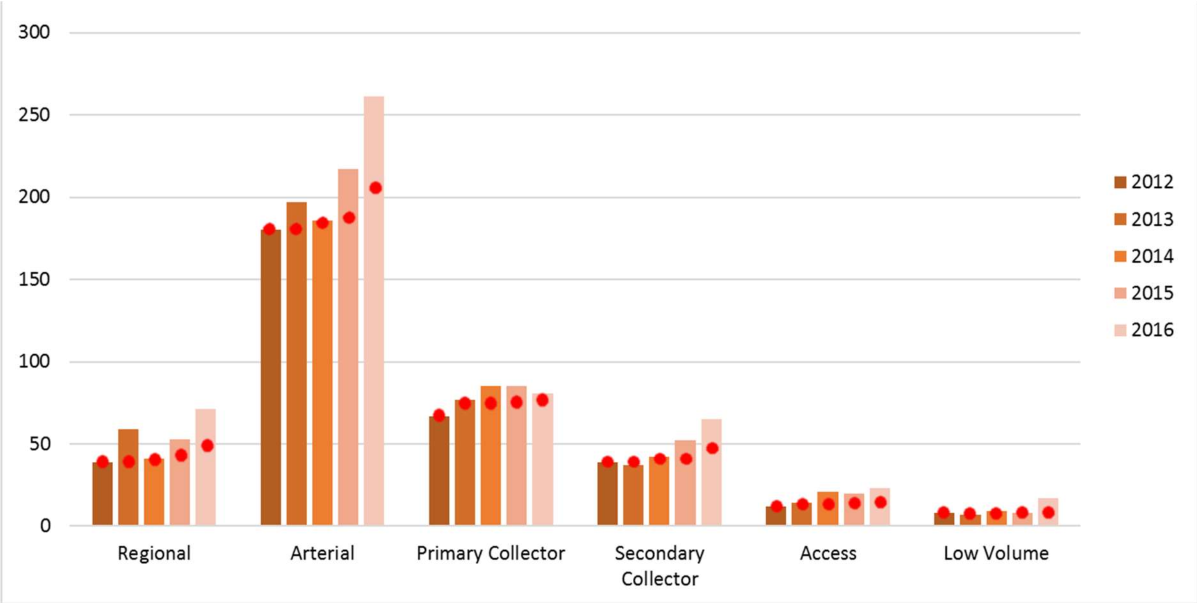


Figure 15-10: Serious injuries and fatalities (DSI) per km of road (low/medium ratings per KiwiRAP)

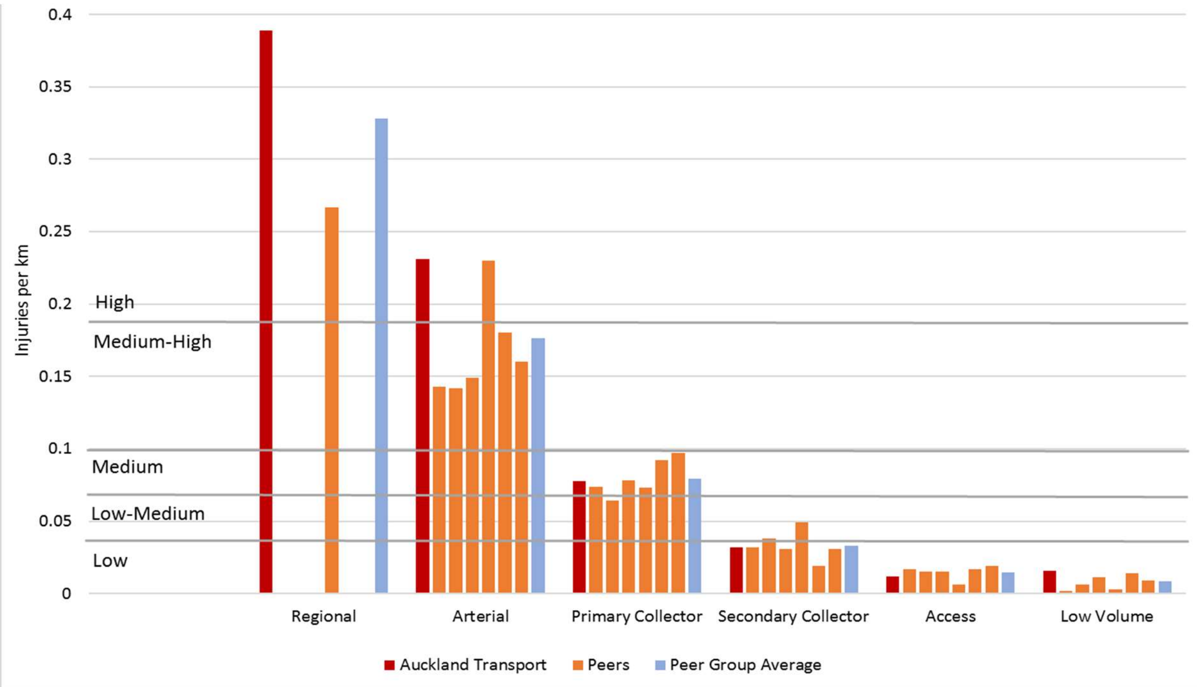


Figure 15-11: Serious injuries and fatalities (DSI) per 100 Million veh km (low/medium ratings per KiwiRAP)

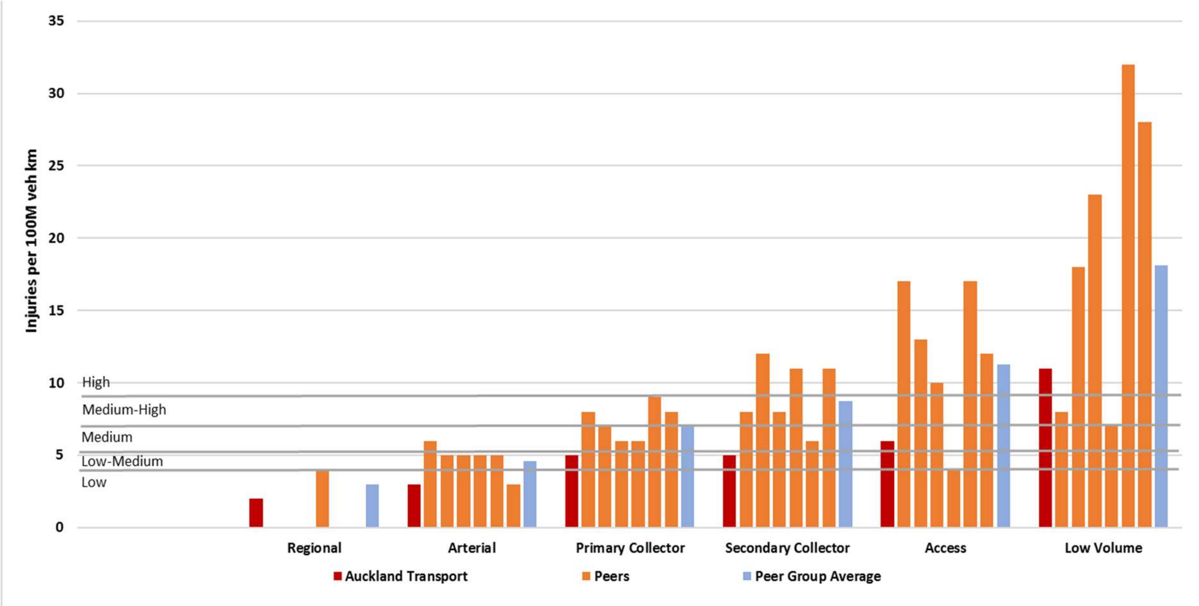


Figure 15-12: Smooth travel exposure by ONRC category (higher percentage indicates smoother roads)

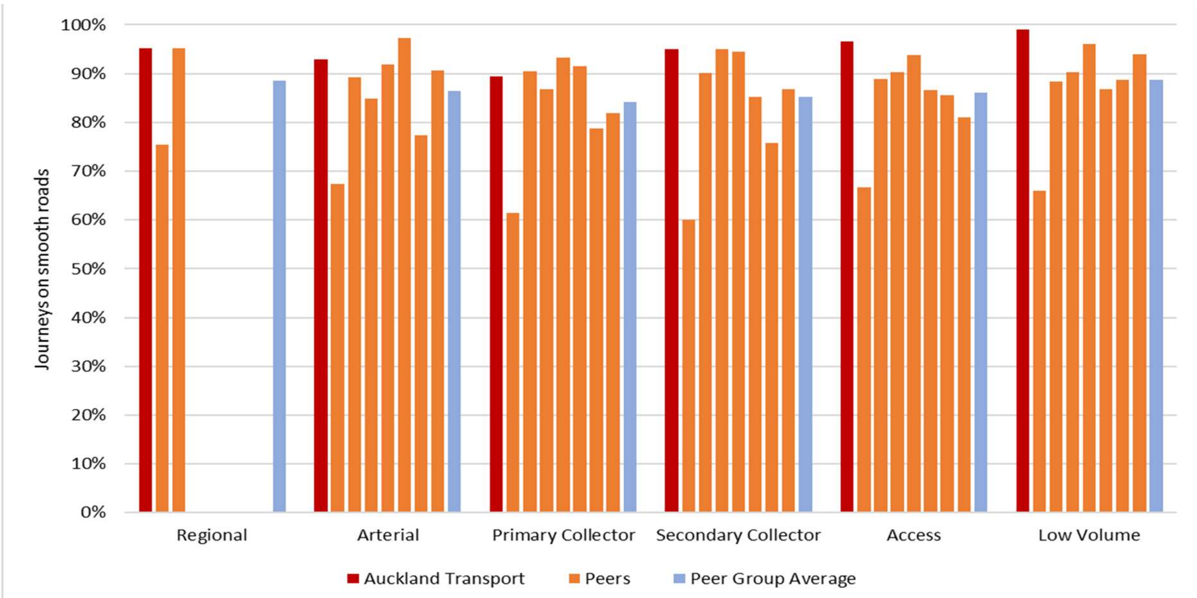


Figure 15-13: Peak Roughness - Urban by ONRC category

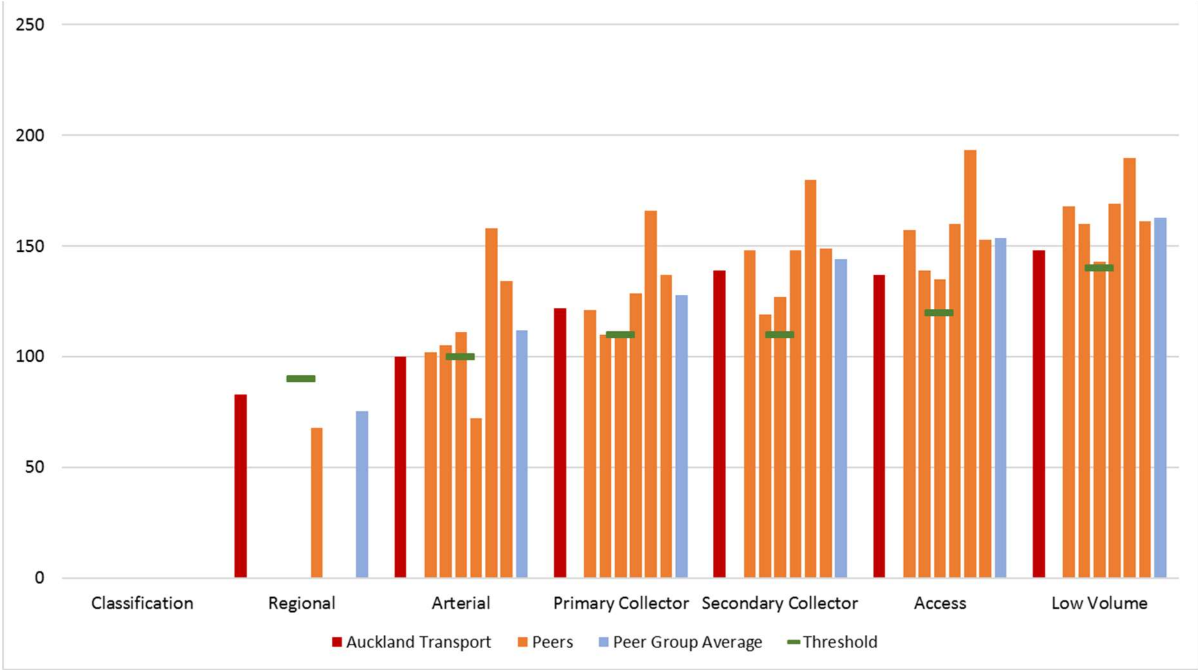


Figure 15-14: Peak Roughness - Rural by ONRC category

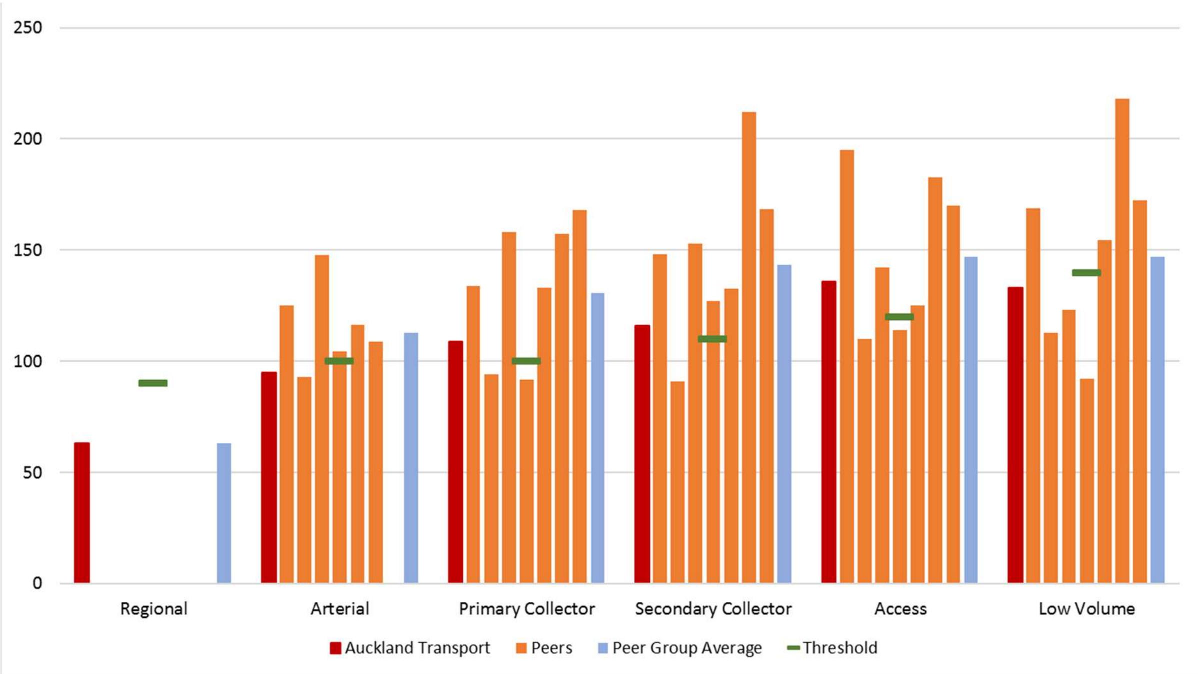


Figure 15-15: Annual surfacing renewal & pavement renewal percentage

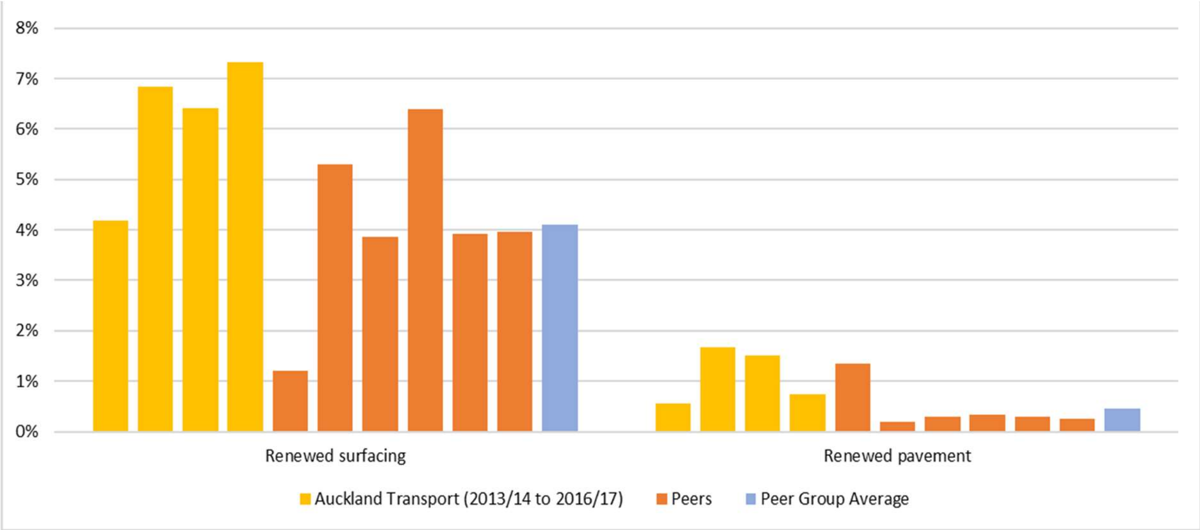


Figure 15-16: Sealed road maintenance cost per km

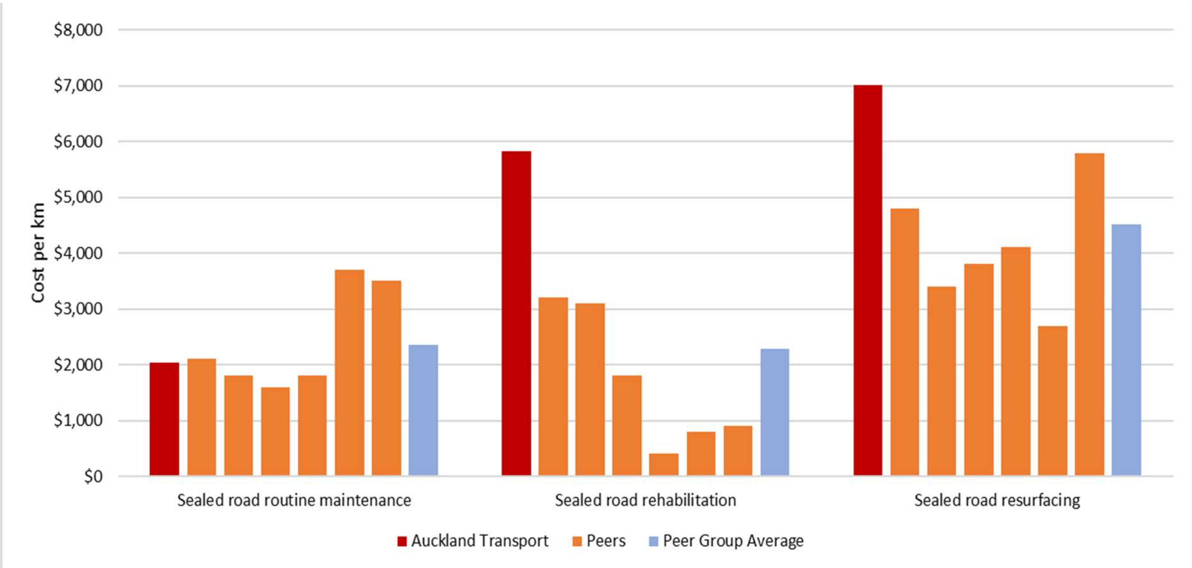


Figure 15-17: Unsealed road maintenance costs per kilometre

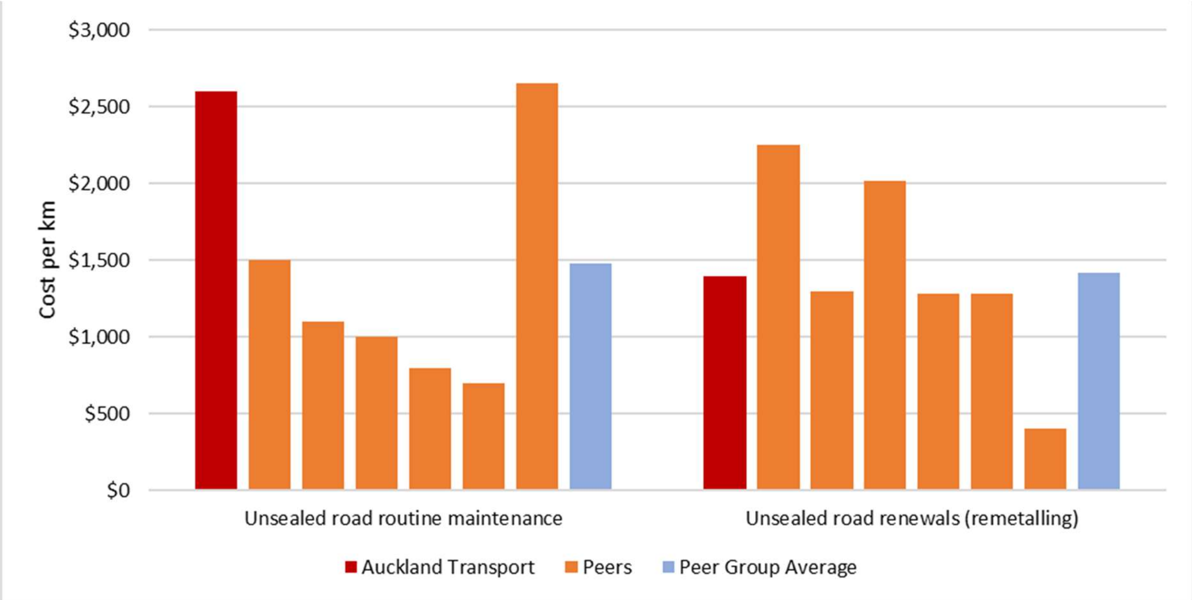
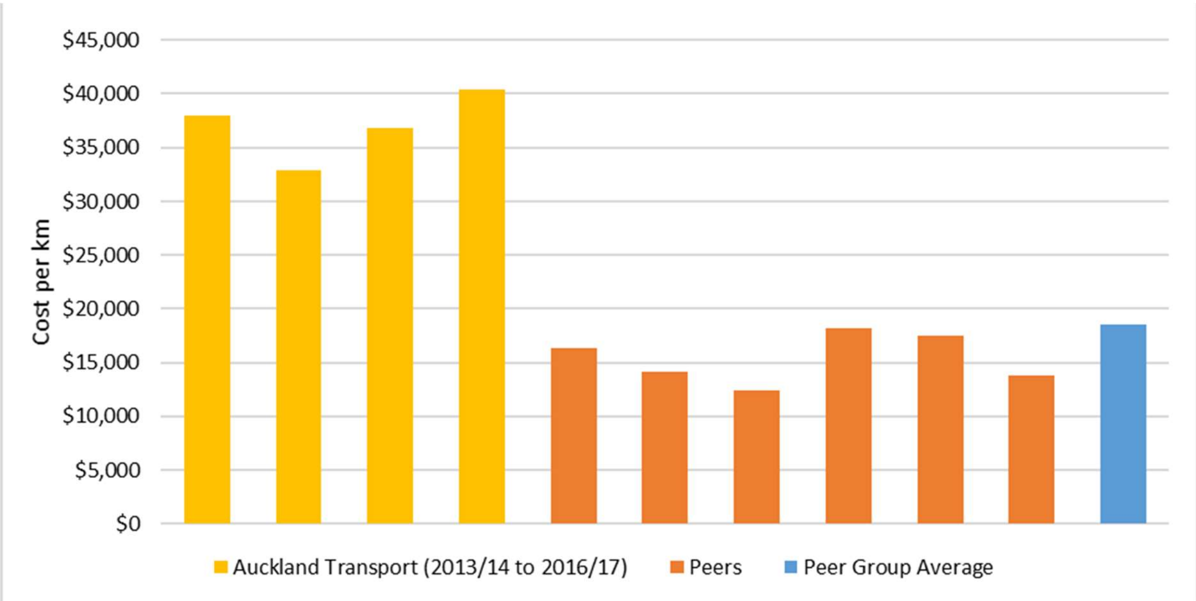


Figure 15-18: Overall network cost (excluding emergency works) per kilometre



15.4 Appendix 4 : Road Efficiency Group data quality assessment report

2016/17 Report

Data Quality Project - 2016/17 Auckland Data Quality Report

Introduction

The quality of the RAMM data being used by the ONRC Performance Measures Reporting Tool has recently been assessed by REG.

This third data quality report is the result of REG's assessment of RCAs 2016/17 data quality. It details your network based on a framework of 30 indicators and 35 data quality metrics. These metrics interrogate your RAMM data for completeness, accuracy and timeliness.

What this report tells me

The intention is for the results to identify opportunities for improvement in the way both an individual RCA and the industry collects, manages and uses data to support our decision-making processes. The report shows, for each metric, how you are positioned against what's considered good (the expected standard) and where the industry sits.

Background behind the metrics

The metrics have been grouped into categories and sub-categories. Each has several metrics interrogating data completeness, accuracy and timeliness. Each metric has a graded result on a scale of 1 to 3. Metrics graded 2 or 3 means a reduced confidence in the data quality.

Grade	Definition
Grade 1	Data quality to expected standard
Grade 2	Minor data quality issues present
Grade 3	Major data quality issues present

What is the source of the data being used?

This third version of the report uses RAMM data from the snapshot loaded to the ONRC PMRT for 2016/17. This is a change from the previous two reports which used the NZTA data warehouse as the data source. This has allowed additional metrics to be included that were previously excluded due to restrictions in the source data. The scripts used to generate the results are available on the REG website.

What indicators and metrics have changed?

Metrics "TL3a" and "TL3b" have been replaced by "Ca4". Metric "TL5" has been replaced by "TL5.1". New metrics "Ro3", "TC4", "TC5", "TE4" have been added. Metric "MA3" has been temporarily removed. Please refer to the Indicator and Metric Change log on the REG website for details of all changes made.

What's next?

REG will be expecting RCAs to improve their data quality to achieve the expected standard by December 2018, shifting the RCA and national result into the "green zone" for each metric.

We suggest each RCA considers their results and incorporates improvements in their 2018/21 AMP improvement plan and work programmes through to December 2018.

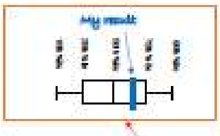
REG has considered the three sets of results and has developed an improvement programme to help RCAs to address the data quality issues. The improvement programme is available on the REG website.

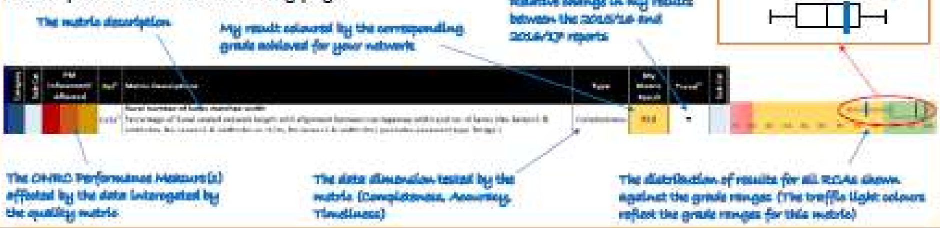
For further information go to https://www.nzta.govt.nz/roads-and-rail/road-efficiency-group/data-2/data-quality-project/

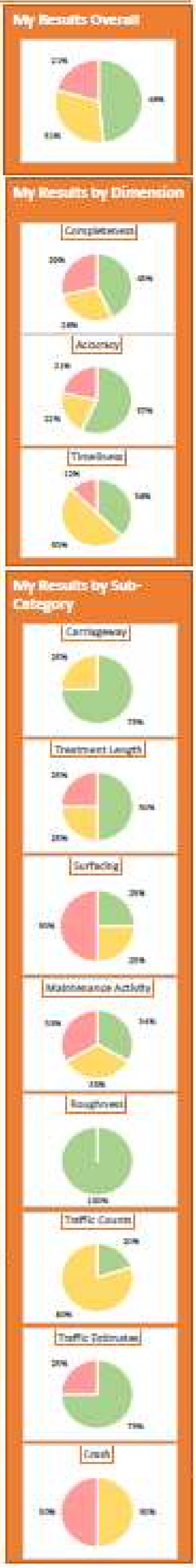
Send any questions or feedback to roadefficiencygroup@nzta.govt.nz

How to interpret the results

The below figure provides an overview on how to interpret the results provided on the following page:

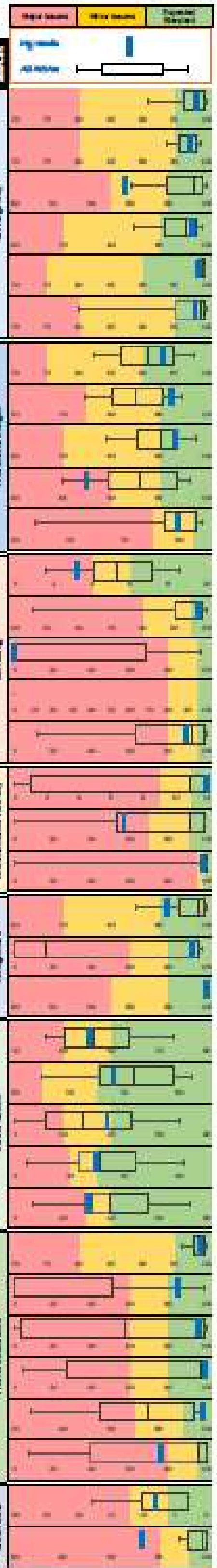






Date of Publication: 2/11/2017 Page 1 of 2 Status: Version 3.0

Road Controlling Authority	Auckland						
Category	**Sub-Cat**	**PM Influenced/ Affected**	**Ref[1]**	**Metric Descriptions**	**Type**	**My Metric Result**	**Trend[4]**
Network	Carriageway	Safety / Amenity / Cost Efficiency	Ca1a[1]	**Rural number of lanes matches width** Percentage of Rural sealed network length with alignment between carriageway width and no. of lanes (No. lanes=1 & width<6m, No. lanes=2 & width>4m or <17m, No lanes>2 & width>9m) (excludes pavement type 'Bridge')	Completeness	99.5	-
			Ca1b[1]	**Urban number of lanes matches width** Percentage of Urban sealed network length with alignment between carriageway width and no. of lanes (No. lanes=1 & width<6m, No. lanes=2 & width>4m or <17m, No lanes>2 & width>9m) (excludes pavement type 'Bridge')	Completeness	97.4	-
			Ca2	**ONRC categories are assigned** Proportion of carriageway section records with an assigned ONRC category (where road type = "L" and owner type "L") (excludes pavement type 'Bridge')	Completeness	95.8	-
			Ca3a[1]	**Rural carriageways are generally not short** Proportion of Rural sealed carriageway records greater than 50m in length (ie. not short) (excludes pavement type 'Bridge')	Accuracy	97.0	-
			Ca3b[1]	**Urban carriageways are generally not short** Proportion of Urban sealed carriageway records greater than 20m in length (ie not short) (excludes pavement type 'Bridge')	Accuracy	98.8	-
			Ca4	**Sealed/unsealed network correctly defined** Percentage of sealed network length with a surface record, or unsealed network with no surface record. (excludes pavement type 'Bridge')	Accuracy	99.3	New
	Treatment Length	Amenity	TL1a	**Treatment Lengths are generally not short** Proportion of sealed Treatment Length records that are not very short (<20m Urban and 100m Rural) (excludes disabled TLs and pavement type 'Bridge')	Accuracy	93.3	-
			TL1b	**Treatment Lengths are not too long** Proportion of sealed Treatment Length records (excludes disabled TLs) that are not exceptionally long (>500m Urban and 5km Rural) (excludes disabled TLs and pavement type 'Bridge')	Accuracy	92.3	-
			TL2	**Treatment Lengths match major surfaces** Proportion of Treatment Length records with >= 80% coverage of the major surfacing (excludes disabled TLs and pavement type 'Bridge')	Accuracy	94.7	-
			TL4	**Network with STE reading** Proportion of sealed Treatment Length records with a Smooth Travel Exposure (STE) value (excludes disabled TLs and pavement type 'Bridge')	Completeness	87.5	-
			TL5.1	**Treatment Lengths match renewals** Proportion of Treatment Length records with >=80% coverage of the major surfacing with a surface date in the reported financial year (excludes disabled TLs and pavement type 'Bridge')	Timeliness	99.4	↑
Inventory	Surfacing	Cost Efficiency	Su1	**Last years' renewals as recorded in RAMM** Percentage of sealed network length surfaced and entered into RAMM for the reported financial year (excludes pavement type 'Bridge')	Timeliness	3.3	↓
			Su2	**Surface records correctly located** Proportion of surface records loaded in reported financial year that are within the limits of the road and have a width no more than 2m wider than the carriageway width (excludes pavement type 'Bridge')	Accuracy	97.4	-
			Su3	**Surface records with original cost** Proportion of surface records with a surface date greater than 30 June 2016 with a cost recorded (excludes pavement type 'Bridge')	Completeness	0.0	
			Su4[3]	**Surface records with works origin** Proportion of surface records with a surface date greater than 30 June 2016 with a works origin/category recorded (excludes pavement type 'Bridge')	Completeness	0.0	
			Su5	**Surface records newer than pavement** Percentage of top surface length newer than underlying pavement layers in the last 3.5 years (excludes pavement type 'Bridge')	Completeness	99.6	↑
Maintenance Activity	Maintenance Activity	Cost Efficiency	MA1	**Complete maintenance activity** Number months with at least one pavement (PA) or surfacing (SU) cost group record on sealed network in reported financial year	Timeliness	12	-
			MA2	**Correctly located maintenance activity** Proportion of pavement (PA) and surfacing (SU) cost group records recorded at appropriate location on sealed network (Proportion of records not at the start of the road)	Accuracy	57.1	↓
			MA4	**Maintenance activity has a valid location** Proportion of pavement (PA) and surfacing (SU) cost group records on sealed network for the reported financial year located within the extents of the road as defined in the carriageway table	Accuracy	97.8	-
Condition	Roughness	Amenity	Ro1	**Roughness survey within 2.5 years** Percentage of sealed network length with a latest roughness reading less than 2.5 years old (from 30 June of reported financial year) (excludes pavement type 'Bridge')	Timeliness	91.9	↑
			Ro2	**HSD Roughness survey within 2.5 years** Percentage of the sealed network length with latest HSD roughness data less than 2.5 years old (from 30 June of reported financial year) (excludes pavement type 'Bridge')	Accuracy	92.3	↑
			Ro3	**Roughness data has valid location** All latest roughness readings located within the extents of the road as defined in the carriageway table (excludes pavement type 'Bridge')	Accuracy	100.0	New
Demand/Use	Traffic Count	Amenity / Cost Efficiency	TC1	**Well targeted traffic count programme** Proportion of sealed network VKT with latest traffic count less than 3 years old (from 30 June of reported financial year) (excludes pavement type 'Bridge')	Timeliness	41.2	↑
			TC2	**Historic count data coverage** Proportion of sealed network VKT with traffic count records (excludes pavement type 'Bridge')	Completeness	66.1	-
			TC3	**Traffic count programme activity** Proportion of sealed network VKT with traffic count record with a count date in reported financial year (excludes pavement type 'Bridge')	Timeliness	19.0	-
			TC4	**Traffic loading understood** Proportion of network VKT with classified traffic count records less than 3 years old (from 30 June of reported financial year) (excludes pavement type 'Bridge')	Accuracy	29.5	New
			TC5	**Historic traffic loading coverage** Proportion of network VKT with classified traffic count records (excludes pavement type 'Bridge')	Accuracy	81.0	New
	Traffic Estimates	Amenity / Cost Efficiency	TE1	**Network has traffic estimates** Proportion of sealed carriageway records having a traffic estimate (excludes pavement type 'Bridge')	Completeness	99.1	-
			TE2a[1]	**Traffic estimates are maintained (High Volume to Arterial)** Proportion of traffic estimate records less than 1 year old on sealed High Volume, National, Regional and Arterial network (from 30 June of reported financial year) (excludes pavement type 'Bridge')	Timeliness	81.2	-
			TE2b[1]	**Traffic estimates are maintained (Primary and Secondary Collectors)** Proportion of traffic estimate records less than 3 years old on sealed Primary and Secondary Collector network (from 30 June of reported financial year) (excludes pavement type 'Bridge')	Timeliness	96.1	-
			TE2c[1]	**Traffic estimates are maintained (Access including Low Volume)** Proportion of traffic estimate records less than 5 years old on sealed Access including Low Volume Access network (from 30 June of reported financial year) (excludes pavement type 'Bridge')	Timeliness	98.1	-
			TE3	**Traffic estimates updated following counts** Proportion of estimate records newer than count records (excludes pavement type 'Bridge')	Accuracy	98.0	↑
			TE4	**Considered traffic loading** Proportion of traffic estimate records with a loading estimate (ie not a default) (excludes pavement type 'Bridge')	Accuracy	76.1	New
Crash	Crash Data	Safety	Cr1	**Crash data is recent** Age (in months) of crash data in terms of time difference between RAMM date_added field and date loaded to the PMRT	Timeliness	8	↓
			Cr2	**Crash records with valid location** Proportion of crash records located within the extents of the road for the five year period up to the end of the reported financial year	Accuracy	93.3	-



Notes:
1 - Metric references denoted with a letter at the end are subsets of the same indicator (ie Ca1a and Ca1b). Their results are aggregated to report as a single indicator on the charts on page 1.
2 - Some metrics may not be applicable to a network, ie those querying the rural network on an urban only network. These will display a result of "N/A" and will not be coloured in line with the grading ranges. These also do not contribute to the results on page 1.
3 - The works origin attribute field is a recent addition to the RAMM tables and was not available to the PMRT at the time of data import. This metric is excluded from the results on page 1.
4 - The trend indicators show the relative change in my results between the 2015/16 and 2016/17 reports. An up arrow represents an improvement in my metric result of at least 5%, a down arrow for a decrease of at least 5%, and a no change indicator if my result change is between a decrease of 5% and an improvement of 5%.

Grade	Definition
Grade 1	Data quality to expected standard
Grade 2	Minor data quality issues present
Grade 3	Major data quality issues present

15.5 Appendix 5 : dTIMS summary report

Background

Auckland Transport (AT) contracts an annual pavement performance modelling report for the sealed road network using dTIMS software. The objective of this work is to:

- Determine whether current funding levels are appropriate, as set out against target levels of service and predicted deterioration
- Determine the optimal funding split between resealing and rehabilitation projects
- Improve the quality of the 10-year Forward Work Programme (FWP)

The base data for this analysis is from AT’s RAMM database (April 2017). Other modelling inputs include:

- The current budget for maintenance and renewal activity limited to pavement rehabilitation and pavement resurfacing (chipseal and asphaltic concrete) treatments
- Unit rates for each of the above mentioned maintenance activities
- The existing FWP; the ‘Specified Programme’.

The dTIMS report identifies predicted condition and treatment forecasts and provides detailed renewals work programme recommendations and forecast budget over the next 10 years.

Seven scenarios were considered to help understand the sensitivity of the different investment levels. Those scenarios are:

- Trigger analysis – treatments determined by policy settings
- Optimal analysis – maximising network condition under a set of constrained budget scenarios:
    - Very High budget
    - High budget
    - Normal budget ($100m)
    - Low budget
    - Very Low budget
    - Least cost (do minimum)

It should be noted that the trigger model takes the condition data and uses trigger levels based on policy to determine when treatments occur regardless of budget constraints. It usually results in a very large forecast cost in year 1 which is not practically affordable.

dTIMS analysis

Optimal model annual average forecast costs (2018-27) and programme kilometres of work across the scenarios are shown in Table 12-2 and Table 12-3:

Table 15-2: Optimal average annual costs ($m)

Optimal 10 year annual average renewal costs ($m)	Least Cost	Very Low	Low	Normal	High	Very High
RHAB	0	13.8	20.8	28.8	38	48
2nd Coat	0.7	0.6	0.7	0.8	0.8	0.9
RSEAL	10.9	16.7	16.9	16.9	17	17
TAC	11.4	48.9	51.7	53.5	54.2	54.1
Total	**22.9**	**80**	**90**	**100**	**110**	**120**

Table 15-3 Optimal annual average length (km)

Optimal 10 year annual average renewal length (km)	Least Cost	Very Low	Low	Normal	High	Very High
RHAB	0	6.7	10.7	15.5	21	27.1
2nd Coat	15.4	12.2	13.6	15.4	16.8	18.4
RSEAL	207.1	315.6	317.8	319.9	320	320
TAC	31	148.4	159.5	165.8	168	168.1
Total	**253.6**	**483**	**501.6**	**516.6**	**525.9**	**533.7**

Model outputs – predicted condition

The dTIMS analysis forecasts future condition through to 2026 against the following criteria across the above six scenarios:

- Average roughness

  All scenarios allow the network average roughness to increase by up to 10 NAASRA. The Trigger model provides a better outcome in improving network average roughness over the analysis period

- Rutting

  All scenarios allow the network average rutting to increase, by 0.3 mm at current funding and 0.6 mm with very low funding.

- Surface Age and Remaining Life

  The weighted average surface age is improving for all budget scenarios except least cost. Most of the improvement is achieved within the first few years of the analysis period. There is improvement as the model can afford to apply enough resurfacing as a cost-effective option to maintain the overall network condition. Resurfacing quantities are not compromised by the current funding constraint. Rehabilitation quantities diminish with increasing constraint though this does not affect the surface age profile.

- Pavement Age

  All scenarios allow the network average age to increase

- Surface Integrity Index

  The predicted SII over the analysis period shows improvement for all optimal scenarios. At low funding, the amount of rehabilitation is limited but this has a modest effect on network average SII.

- Pavement Condition Index

  All Optimal scenarios (except least cost) will slightly improve then maintain the network average PCI.

There is a direct correlation between the five optimal analysis scenarios and the condition criteria outcomes, although the differences are not significant at the end of the analysis period.

There is significant negative condition impact for the least cost scenario over the period of the analysis but the model mitigates the impact of this by focussing on maintaining a useable surface through the reseal programme.

The trigger model provides a better outcome in improving network average roughness over the analysis period but is effectively unaffordable in the short term.

dTIMS report conclusions

The optimised 10-year average programme costs have a range of $80 - 120 million/year. This range is an exact reflection of the available budget constraints put into the model. The Optimal-Normal scenario has an average programme cost of $100 million/year plus routine repair costs of $5 million/year.

The optimal model Least Cost scenario has the lowest total strategy cost of all scenarios. This has programme costs of $23 million/year plus routine repair costs of $28 million/year, resulting in a total of $51 million/year.

The Least Cost model has orientated to achieving a required amount of sealing to ensure lowest overall strategy cost, while the optimised programme attempts to maximise network condition based on a traffic weighted objective function, therefore sacrificing seal length and allowing more rehabilitation treatments. It is clear the appropriate course when funding is extremely limited, is to focus on resealing and not do rehabilitation. This is a strategy that has been adopted by a number of road controlling authorities previously.

dTIMS comparison with AM recommendation

The AM recommended 10 year annual average cost and programme is shown in Table 15-4 and Table 15-5. Note that dTIMS rehabs exclude routine and preseal repairs and that AM rehabs exclude preseal repairs.

Table 15-4: AM and dTIMS recommended 10 year annual average renewal cost

Renewals 10 year annual average renewals cost ($m)	AM recommendation	dTIMS Optimised recommendation							
		Least Cost	Very Low	Low	Normal ($100m)	High ($110m)	Very High ($120m)	Specified	Trigger
Rehab	35.3	0	13.8	20.8	28.8	38	48	61.8	119.5
Asphaltic Concrete	46.2	11.4	48.9	51.7	53.5	54.2	54.1	42.4	35.9
Chipseal	24.8	10.9	16.7	16.9	16.9	17	17	19.1	6.9
Total	**106.3**	**22.3**	**79.4**	**89.4**	**99.2**	**109.2**	**119.1**	**123.3**	**162.3**

Table 15-5: AM and dTIMS recommended 10 year annual average renewal km

Renewals 10 year annual average renewals length (km)	AM recommendation	dTIMS recommendation						
		Least Cost	Very Low ($80m)	Low ($90m)	Normal ($100m)	High ($110m)	Very High ($120m)	Trigger
Rehab	38	0	6.7	10.7	15.5	21	27.1	99.5
Asphaltic Concrete	164	31	148.4	159.5	165.8	168	168.1	107.5
Chipseal	342	207.1	315.6	317.8	319.9	320	320	130.3

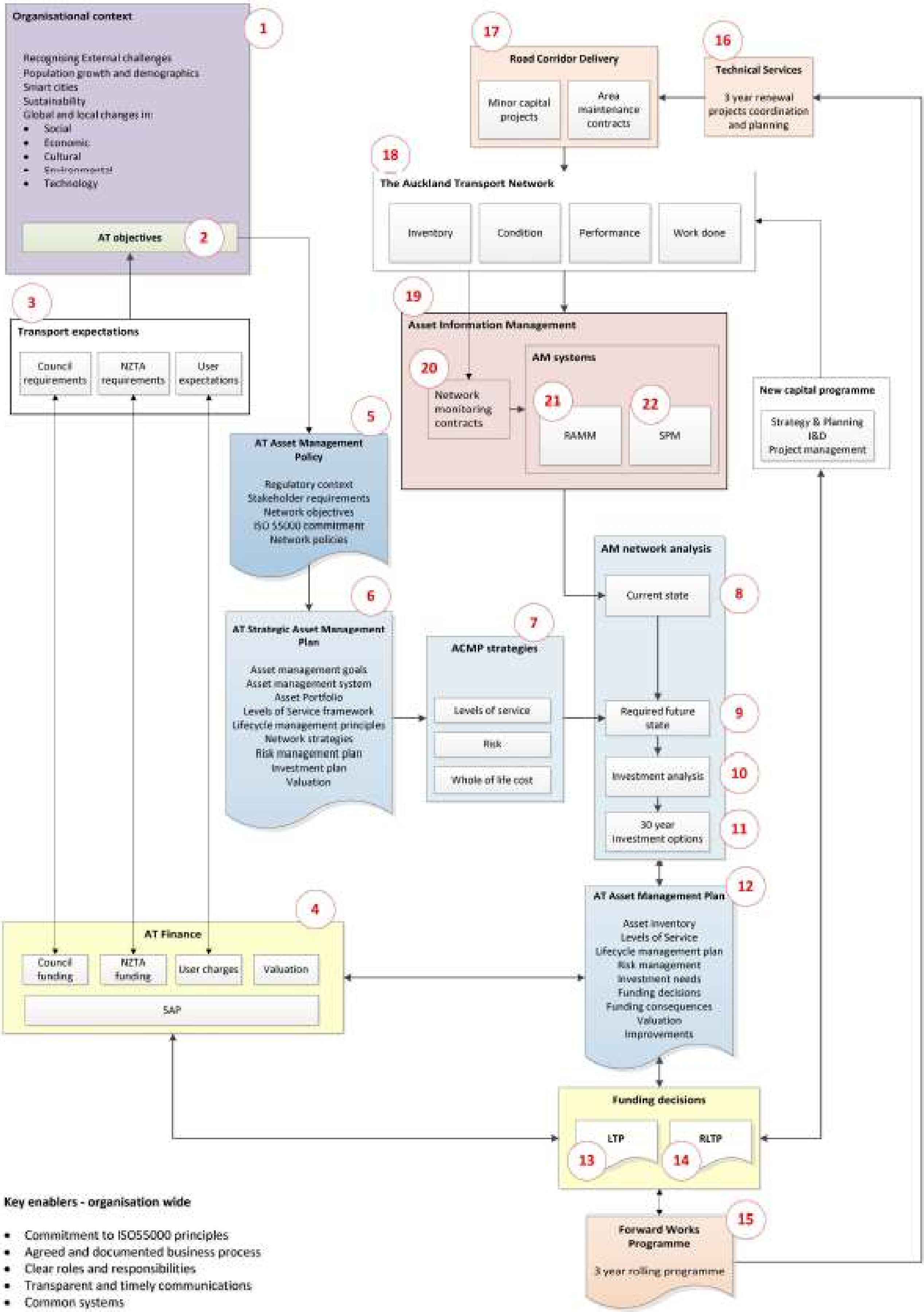
Comparisons to note are:

- dTIMS rehabs exclude routine and preseal repairs; AM recommendation excludes preseal repairs
- AM recommended rehab cost and km are comparable with dTIMS Normal - High recommendation range
- AM recommended AC cost is comparable with the dTIMS Very Low recommendation but the km are more aligned to the dTIMS High recommendation
- AM recommended chipseal cost and km are higher than the dTIMS recommendation by approximately 7%.

Overall conclusion from the dTIMS analysis

Outputs from the dTIMS model confirm that, based on annual average costs, the AM recommended renewals budget is comparable with the normal to high optimised budget and will provide an acceptable and manageable road condition for the period of the analysis.

15.6 Appendix 6 : Asset management processes within AT infrastructure management



Key enablers - organisation wide

- Commitment to ISO55000 principles
- Agreed and documented business process
- Clear roles and responsibilities
- Transparent and timely communications
- Common systems

Auckland Transport Asset Management - roles and responsibilities

	Published documents	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Interactions and dependencies
Transport expectations and budgets	Government – GPS NZTA – NLTP Council – LTP AT – RLTP ATAP 1													
ELT	2	Set AT objectives* 3												Service, risk and value for money outcomes required of AT Confidence that business processes and activities will deliver outcomes
Chief Engineer		Set AM policies*	5											**Strategy and Planning group** New capital identified, recognising:
Asset Planning & Policy Manager			Prepare SAMP *	6										• Future growth & demand • Required levels of service
Asset Planning & Policy Manager			Asset class risk and LOS polices & strategies	7										• Funding constraints • Future disruptors (technology, environmental etc.)
ACMP authors				Identify asset class current state Establish asset class future state			Identify asset class current state	Review asset class future state		8 9	Identify asset class current state	Review asset class future state		RAMM & SPM update from Information Management SAP/valuation update from Finance New capital consequential renewals, operations and maintenance by ACMP authors
AM team				Gap analysis and options development	Develop AMP recommendations			Gap analysis and options development	Develop AMP recommendations		10 11	Gap analysis and options development	Develop AMP recommendations	ROM, dTIMS and other lifecycle analyses
Asset Planning & Policy Manager	Current AMP				Publish AMP update				Publish AMP update			12	Publish AMP	
Finance, AM, Delivery					Funding decisions				Funding decisions		13	14	Funding decisions	Finance liaise with council and NZTA for LTP and RLTP funding 4
Asset Roading Manager	Current FWP		Identify candidate sites		Publish FWP		Identify candidate sites		Publish FWP		Identify candidate sites	15	Publish FWP	RAMM, SPM and dTIMS data inform candidate sites
Technical Services & Programme Manager				Site validation, prioritisation and clash detection				Site validation, prioritisation and clash detection			Site validation, prioritisation and clash detection	16		
Group Manager Assets & Maintenance			Maintenance contractors undertake renewals FWP and maintenance work				Maintenance contractors undertake renewals FWP and maintenance work				Maintenance contractors undertake renewals FWP and maintenance work		17	SAP updated by Finance operations support
AT networks			Work done – network changes				Work done – network changes				Network change		18	
Asset Information Manager			RAMM and SPM updated from maintenance and asset management contracts				RAMM and SPM updated from maintenance and asset management contracts			19	M and SPM updated from maintenance and asset management contracts		20	Performance management updated by all
Asset Systems Manager			RAMM, SPM and performance management systems				RAMM, SPM and performance management systems				RAMM, SPM and performance management system		21	

15.7 Appendix 7 : Conditions of funding for AT’s 2018-2021 programme

Specific Funding Conditions applicable to AT:

Condition	AT actions
WC 212 and WC 214 subject to implementing a robust field validation and challenge process and reporting on progress.	Implement project justification form/process (see section 15.8) for all pavement renewals Consider improvements to the project justification form to ensure it captures: • Justification for the timing of renewals • Justification for choice of treatment • Robust NPV analysis, including realistic maintenance costs • Consistent decision making across management and contract areas Support improvements required to allow advancement to a five year rolling forward works programme.
WC 215 Subject to peer review and validation of the proposed programme by Transport Agency structures advisors.	NZTA to peer review bridges and structures Forward Works Programme
WC 212 subject to adopting the 2017 audit recommendations and updating the AMP accordingly.	Justify choice of AC for all AC reseals, and separately identify costs associated with amenity objectives. Ensure pavement design process includes consideration of alternatives Ensure pavement design is based on actual and recent traffic count data. Review AT’s pavement condition rating programme to better manage network risk.
Whole programme subject to full transparency of both the amount and application of Auckland Council funding of the programme, over and above matching Transport Agency share, on both eligible and ineligible activities.	Provide details to NZTA of all spending on road maintenance and renewals, distinguishing eligible and ineligible spending

General conditions applicable to all approved organisations

Condition (exact wording)	Recommended AT actions
Ensuring the organisation's business systems, planning documents, management practises and reporting integrate the One Network Road Classification framework into all transport related decision making. This is to ensure robust evidence investment decisions are made which deliver value for money on a best whole of life basis.	Continue to integrate ONRC into decision making at all levels Update ONRC classification of AT roads
Delivering and reporting of the organisation's ONRC and your own key performance indicators.	Deliver and report on key performance indicators.
Delivering and reporting the planned improvements that form part of the programme as submitted and accounted for in the Transport Agency's approved funding.	Deliver and report on the programme as submitted.
Ensuring that the organisation's investment decisions within the approved NLTP allocation are focused on delivering the outcomes as set out in the GPS and the submitted programme of works set out as the basis for the Transport Agency's approval of your programme	Ensure the approved NLTP funding allocation is used to achieve the outcomes of the agreed programme.
Ensuring the organisation advises the Transport Agency at the earliest opportunity of any changes that materially affect the planned programme of works and expected outcomes to be achieved over the NLTP period.	No surprises approach to any changes to the agreed programme.

15.8 Appendix 8 : Project justification template

Project Justification Summary– Renewal Projects

<table>
<tr><th>Description</th><th colspan="3"></th></tr>
<tr><td>Road Name and location</td><td colspan="3"></td></tr>
<tr><td>Road classification</td><td colspan="3"></td></tr>
<tr><td>Treatment type</td><td colspan="3"></td></tr>
<tr><td>Treatment cost</td><td colspan="3"></td></tr>
<tr><td>Problem description</td><td colspan="3"></td></tr>
<tr><td>Main driver/s of the treatment
(Tick all applicable)</td><td>Performance failure (Safety/ Travel Time Reliability/Resilience/Accessibility/Amenity)</td><td>High maintenance costs</td><td>Asset preservation</td></tr>
<tr><td>Traffic volume:</td><td>AADT:</td><td colspan="2">Heavy:</td></tr>
<tr><td>Net Present Value of treatment (NPV)</td><td colspan="3"></td></tr>
<tr><td>Benefit/Cost Ratio of treatment (B/C)</td><td colspan="3"></td></tr>
<tr><td>Historical maintenance costs per annum - Actual</td><td colspan="3"></td></tr>
<tr><td>Future maintenance costs per annum - Predicted</td><td colspan="3"></td></tr>
<tr><td>Age of previous treatment</td><td colspan="3"></td></tr>
<tr><td>Type of previous treatment</td><td colspan="3"></td></tr>
<tr><td>Roughness**</td><td>Average:</td><td colspan="2">Maximum:</td></tr>
<tr><td>Rutting depth**</td><td>Average:</td><td colspan="2">Maximum:</td></tr>
<tr><td>Skid resistance**</td><td colspan="3"></td></tr>
<tr><td>% Cracking**</td><td colspan="3"></td></tr>
<tr><td>Overall Asset condition</td><td colspan="3">Grade 1/2/3/4/5</td></tr>
<tr><td>FWD assessment (If applicable)**</td><td colspan="3"></td></tr>
<tr><td>Remaining life (FWD)**</td><td colspan="3"></td></tr>
<tr><td>Any other comment:</td><td colspan="3" rowspan="2"></td></tr>
<tr><td></td></tr>
</table>

** Note: Not all fields are necessary for all Renewals- E.g. for reseals FWD adds little value

15.9 Appendix 9 : Asset Management Business Improvement Tasks

15.9.1 Road asset management business improvement tasks

Improvement Theme	No.	Description of Improvement Initiative	Potential Consequences if initiative not carried out
ISO 55001 Alignment	1	Formalise all elements of an ISO 55001 aligned AM System and produce supporting documentation. Finalise the AM Policy and AM Strategy. Document the risk management processes as part of the AM System. Document the internal audit processes as part of the AM System. Describe and align all Maintenance strategy documents in the AM Strategy Update delegations and authorities. Recognise the role that people have as "stewards" of the community's transport assets.	Not aligned with ISO 55001 Not able to certify to ISO 55001 Business inefficiencies
Strategic themes, KPIs and performance measures	2	Include an additional Strategic Theme – Sustain and maintain the resilience and integrity of existing infrastructure. Create a clear, easy to understand service and performance framework graphic that is consistent across all documents, with clear demarcation of the different levels of performance reporting appropriate to the audience. Develop a consistent set of forward looking indicators of asset integrity which forecast the condition and performance of AT key infrastructure, and include appropriate targets (taking into account the risk appetite and funding constraints specific to AT) in the SOI, Annual Report, AMP, ACMPs and quarterly/monthly board reports Determine the level of performance expected from the "existing road" network. Develop more relevant outcome measures for asset performance and health – which are linked back to AMPs, the SOI and RLTP.	Misaligned targets / goals at different levels of AT AMPs not well aligned with RLTP Network performance and health not well recognised / understood
AMPs enhancements	3	Continue to enhance, produce and update an annual AMP that forecasts the 30 year (and beyond) costs associated with operating, maintaining and renewing the entire portfolio of AT Assets and facilities, taking into account both Auckland Council and NZTA requirements for AM Plans. Include in the AMP a framework map which describes the hierarchy of performance measures – this should clearly demarcate those which are of a strategic (public / Board reporting) nature, and those which are more relevant to those managing the activity. Include all investment needs in the AMP: Ensure all asset classes are included in the AMP (physical and financial information) and that the AMP is consistent with the AcMPs.	Investment needs not well understood / explained. Incomplete picture of the assets and their management needs. Persistence of information gaps.

Improvement Theme	No.	Description of Improvement Initiative	Potential Consequences if initiative not carried out
		Update and complete all AcMPs, and establish a process to ensure these plans are used to inform the overarching AMP for 2021. Review the purpose of Asset Strategy documents. Develop risk-based strategic approach for Bridges and Structures (including retaining walls).	
Responding to heavy vehicle growth	4	Put more focus on future demand which is not specifically population oriented (such as Port access, quarries, forestry, rural land-use, etc). Address the risks of degradation on roads which are subject to (especially sudden) major load increases.	More unexpected pavement failures and costly remedial / renewal works
Capex / Opex integration	5	Ensure close liaison across the organisation when developing the overall capital investment programme Ensure whole-of-life costs of the assets are included in the project design process and ensure they are linked to the subsequent operations and maintenance budgets and the AMPs Ensure that a standardised approach is adopted on all projects to incorporate an assessment of the whole-of-life-cost of the assets into the Options Analysis and Design phases. Ensure the ongoing operations, maintenance and renewals costs are reflected in the AMP and subsequent Operations and Maintenance budgets Identify, as soon as possible, when specialised resources are required to deliver projects and factor their availability into project programming	Whole of life costs not understood or properly budgeted. Potential investment in new expensive to maintain assets.
ROM enhancements	6	The assumptions and limitations of ROM need to be clearly communicated in the AMPs and funding requests, especially when being considered by the ELT / Board. Develop means to forecast customer facing performance measures and take account of LoS in ROM. Further improve ROM to inform both the 10-year AMP view and longer term 30-year view for strategic planning purposes.	Renewals "story" misunderstood. No improvement in renewal forecasting / trade-offs ability.
Lifecycle analytics	7	Introduce a culture of "root cause analysis", both of failures and the effectiveness of treatments, in order to adapt forward AM strategies ("reliability engineering"). More focused attention on monitoring the effectiveness of what is done. Improve the way in which pavement data is used in treatment decision-making. Shift the focus to address maintenance as a risk mitigation/cost optimisation activity rather than a cost saving opportunity. Use data to improve intelligence and forward planning.	Failure to learn from past mistakes. Inefficient use of funds. Not positioning for the future.

Improvement Theme	No.	Description of Improvement Initiative	Potential Consequences if initiative not carried out
		Look at how technology (smart vehicles, smart systems, big data, etc.) can be used to make transport more efficient and help drive asset management efficiencies.	
Maintenance / renewals management	8	Plan for transition to retendering of maintenance contracts – review form of contract to align incentives to ONRC and optimised risk-based lifecycle principles. Achieve cost efficiencies and optimal outcomes for AT through more rigorous approaches to pavement renewals decision-making. Modify contract specifications when retendering to reduce the contractor's incentive for high cost / low risk solutions. Review the approach to defining and approving Day- works across contract areas. Improve delivery practices associated with the provision and maintenance of sight rails and barriers, as required by the maintenance contracts. Address rural stormwater culvert design and maintenance practices, relating to inlet and outlet efficiency and resilience.	Cost inefficiencies Inconsistency Funding not allocated as per ONRC priorities Potential safety implications from poor maintenance Potentially more culvert washouts / blockages
Information systems	9	Prepare/complete an Asset Information Strategy which should then feed into the EAM business case. Provide more clarity around EAM i.e. the drivers and cost benefits. If RAMM is likely to remain in use for the next 1-2 years, review underlying processes to identify gaps or shortcomings particularly around contractor involvement in the updating of RAMM.	No resolution of future direction RAMM not used to full potential
Asset data and information	10	Develop and implement a detailed data improvement plan. Confirm what Asset Information Standards to adopt or comply with. This could be a documented hybrid set of standards. Maintain an accurate and up-to-date inventory of AT assets and facilities including location, type and material, age, condition, inspection plans and procedures, historic maintenance costs and activities, probability, consequence and risk of asset failure, and levels of performance required by each asset. Review / develop asset criticality ratings across all asset classes. Improve Bridge QA and work completed data process. Improve processes to ensure asset data records are updated following any significant changes to asset details. Review process for capturing inspection records in RAMM, including the completion of work and the scheduling of forward inspections – in particular, bridges and structures	Data gaps and inconsistencies remain or get worse Issues "slip through the cracks" Poor records about work done (or not done) on assets

Improvement Theme	No.	Description of Improvement Initiative	Potential Consequences if initiative not carried out
		Improve the quality of maintenance history and maintenance costs data against all assets (also an EAM improvement). Asset ownership clarification (AT vs. Council).	
AM Culture	11	Define AM purpose and goals across the organisation and demonstrate how roles relate to the AM business cycle. Elevate the AM culture. Foster a culture of using all “eyes and ears” to highlight issues on the network.	Working in silos Status quo prevails
Collaboration	12	Strengthen the feedback loop between S&P and the AM team. Drive cross organisational collaboration for more efficient business processes. Reduce process “hand-over” risk – close the potential for “slipping through the cracks”; clarify “asset by asset ownership” / accountability.	Opportunities not realised More “surprises”
Capability and competence	13	Review the organisation structure to ensure that responsibility for AM/FM across the organisation is afforded a more central role. Formalise resource needs for using AM to get best long term value from the network for customers and stakeholders. Develop and implement AM competences framework Develop leadership skills in managing poor performance. Review the allocation of technical resources to managing and monitoring Bridges and Structures assets – to become more proactive and risk-focused.	Asset management story “not heard” People not able to carry out the tasks expected of them Internal understanding of asset risks diminished
Risk management	14	Enhance risk management processes, including risk profiling and natural hazard risks. Continue to develop risk-based understanding of Bridges and Structures, including internal risk-based failure management processes, and develop programmes accordingly. Review the whole criticality framework to see if it can be standardised over the entire asset portfolios, to enable organisation-wide understanding of which are the most important assets – linked to the risk management framework. Develop root cause analysis and diagnostics processes, for learning from previous asset failures and how they have been treated.	Unexpected asset failures Not learning from past asset failures
Resilience	15	Adopt a more proactive approach to resilience including cross-network resilience prioritisation. Include Lifelines information in the AMP. Formalise what resilience means to the transport system and initiate	Resilience outcomes not understood or communicated

Improvement Theme	No.	Description of Improvement Initiative	Potential Consequences if initiative not carried out
		a Resilience assessment process. Update Business Continuity Plans. Senior AM level involvement in Auckland Engineering Lifelines Group. Improve risk-based understanding of coastal infrastructure.	Not aligned with AELG BCPs may become outdated – reducing effectiveness should a major disaster event occur
Board reporting	16	Simplify and rationalise the overall suite of performance measures used by AT with the SOI and core strategic themes forming the highest level of measures on which asset planning is based. (It is recognised that other measures will be required beyond the scope of the SOI strategic themes to meet statutory, regulatory and day-to-day operational requirements). This would give the SOI more relevance within the organisation and better line-of-sight between the board direction and on-the- ground implementation. Build on the corporate risk reporting process to more explicitly include asset failure risk so that the Board better understands and can make decisions about the relative levels of risk across the road network. Produce an annual “State of the Assets Report” that provides an annual snapshot of the condition, performance and risks associated with AT facilities and assets and reviews longer term trends.	Status quo prevails – Board has little visibility of asset failure risks
Customer / stakeholder engagement	17	Further development of the Infrastructure Viewer tool to provide better information to customers. Develop ways to summarise / aggregate all customer information for interpretation in AMPs / strategies – eg “what is all this information telling us about our levels of service”? Consider developing journey experience and service design approaches	Customer views and expectations not fully recognised in LoS decisions

15.9.2 Public transport asset management business improvement tasks

Improvement theme	No.	Description of improvement initiative	Potential consequences if initiative not carried out
ISO 55001 Alignment – Formalising the AM/FM system	1	Update the 2016 ISO 55001 Project Darwin assessment. Develop an overarching framework and summary document to show all elements of the AM/FM System. Include monitoring of its implementation and effectiveness in achieving AM/FM objectives. Finalise the AM/FM Policy and Strategy. Adopt at senior management / Board level and communicate both across AT. Describe in the AM/FM Strategy how the asset condition, risk, performance and cost based approach is to be applied across all asset groups. Document the risk management processes as part of the AM/FM System. Document the internal audit and review processes.	Not aligned with ISO 55001 Not able to certify to ISO 55001 Business inefficiencies
Strategic Planning	2	Review the current structure of the overall planning process, to ensure more integrated working between the various initiatives, and the development of the AMP as the single document which reflects a 'whole-of-life' view of the assets. Review the strategic levels of Service Framework to clarify the "line-of-sight" and consider adding a Strategic Theme or Level of Service which measures the '*Effective stewardship of the existing asset base*'. Include more leading KPIs on the management of the existing facilities assets. Review and update existing strategies developed for all the Ferries, Railways, Buses and Parking and develop specific strategies for those not yet completed.	No single document which reflects the whole-of-life view of the assets Misaligned targets / goals at different levels of AT AMPs not well aligned with RLTP and ATAP Incomplete asset class strategies
AMP & ACMP enhancements	3	Review the number, value & condition of car parking buildings reported in the AMP and the ACMP and ensure consistency. Include all investment needs in the AMP – Operations, Maintenance and all capital investment needed to support Asset Renewals, Growth and Levels of Service. Ensure all asset classes are included in the AMP and are consistent with the ACMPs. Include Resilience and Lifelines sections in the AMP and all ACMPs. Update all ACMPs to align with the 2018 AMP. Continue to develop and improve the ACMPs. Identify all costs associated with providing the PT services and provide a comparison with funding to demonstrate there are no gaps.	Investment needs not well understood / explained. Incomplete picture of the assets and their management needs. Persistence of information gaps.

Improvement theme	No.	Description of improvement initiative	Potential consequences if initiative not carried out
PT Levels of Service	4	Develop some or all of the following PT measures, in addition to those currently utilised; - SLA performance (work orders completed on time to required performance level) - Percentage of assets in each condition grade. - Expenditure against budget (planned and reactive maintenance). - The level of maintenance and renewals backlog. - LTI incidents / health and safety incidents. - Energy efficiency	PT performance and asset health not well recognised / understood
Demand analysis	5	Put more focus on future demand impacts of investment in public transport initiatives i.e. potential for boosting passenger numbers beyond growth predictions.	Continue trying to "catch-up" with PT demand. AT seen as being unable to invest at the right time.
Whole-of-asset life approach	6	Increase the transparency of how the consequential Operations and Maintenance costs of new assets are incorporated into the AMP. Ensure that operations are involved in the design process and an understanding of how the assets will be operated and maintained is developed. Ensure that a standardised approach is adopted on all projects to incorporate an assessment of the whole-of-life-cost of the assets into the Options Analysis and Design phases. Ensure the costs of mitigating residual safety-in-design risks are included. Consider the need for an appropriate operation, maintenance and renewals plan to be included as part of the asset handover. Ensure the ongoing operations, maintenance and renewals costs are reflected in the subsequent budgets. Review the maintenance histories of assets constructed in the last five years to see if there is a trend of reducing quality resulting in an increasing maintenance requirement	Whole of life costs not understood or properly budgeted. Potential investment in new, expensive to maintain, assets. Inadequate budgets to maintain new assets
ROM enhancements	7	Clearly communicate the assumptions and limitations of ROM when determining the AMP long term renewals investment programme. Review the renewals priorities to ensure that the conditions of critical 'back of house' assets are not being compromised and backlogs are not building up. Further improve ROM by: - Drilling to a more asset component granular - Providing information on performance outcomes - Being able to link back to specific assets in SPM	Renewals "story" misunderstood. No improvement in renewal forecasting / trade-offs ability.

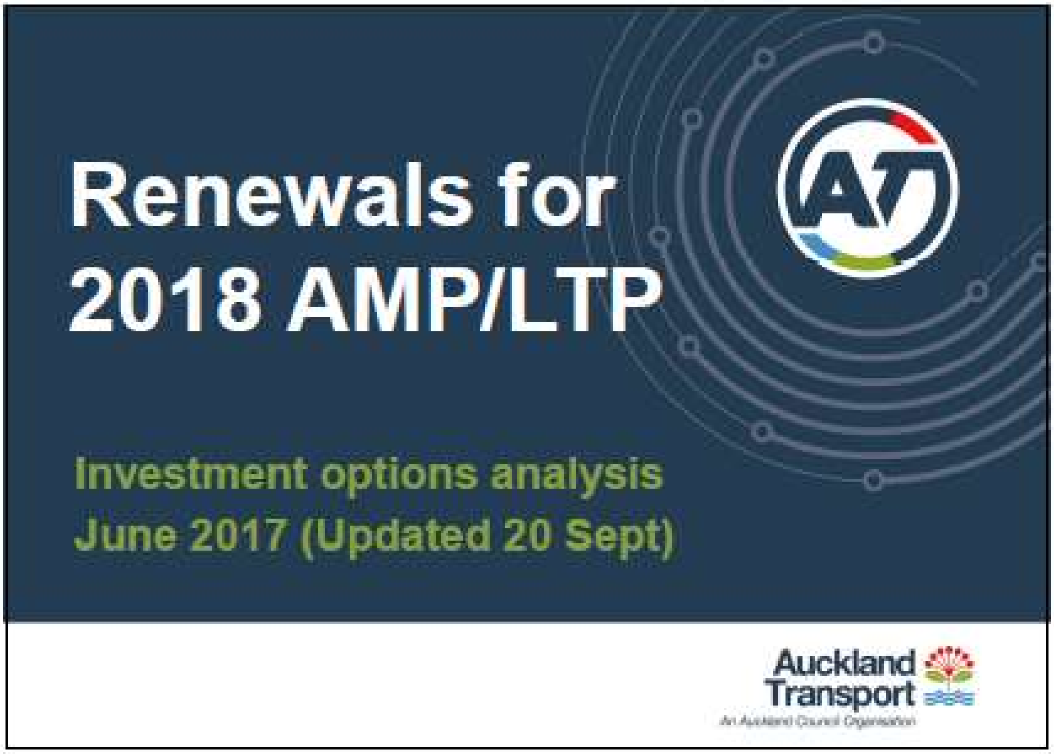
Improvement theme	No.	Description of improvement initiative	Potential consequences if initiative not carried out
		- Enabling it to forecast the effects on levels of service.	
Improving Facilities Maintenance and Management	8	Develop an overarching strategy for asset maintenance. Develop Operation and Maintenance Plans for all facilities. Compare current budgets with the actual cost of maintaining PT facilities. Review the maintenance contract KPIs and introduce 'lead' rather than 'lag' indicators and output focused provisions. Establish if leaving the decision on planned vs reactive maintenance should be left with the contractor. Review the use of rebates within the maintenance contracts. Review the maintenance activities included in the contracts and adjust schedules to suit. Formalise the collection of asset condition data by the maintenance contractor. Undertake on-site inspections rather than using CCTV. Improve the collection and quality of the maintenance history of assets.	Cost inefficiencies Lack of consistency Lack of opex budget to maintain assets Increasing maintenance backlog Increasing risk Lack of understanding of asset performance and health
Technical Standards	9A	***Develop FM Standards*** Develop a suite of technical specifications and design standards for all facilities assets. Develop a comprehensive set of well-defined facilities maintenance specifications and standards that relate to the expected operation of the asset, (e.g. downtime, effective asset operation). Ensure whole-of-asset life assessments are incorporated into the design standards. Update the delegations and authorities registers.	Lack of quality and consistency in new assets Assets not fit for purpose Potential for investment in expensive to maintain assets
	9B	***Develop Asset Data Standards*** Confirm and document the Asset Information Standards AT wants to adopt or comply with. Review the current asset hierarchies in the SPM system and develop a preferred/ideal asset hierarchy which can be considered for the EAM project.	Inability to hold as-built and other information Poor and inconsistent data completeness and quality Inability to analyse data

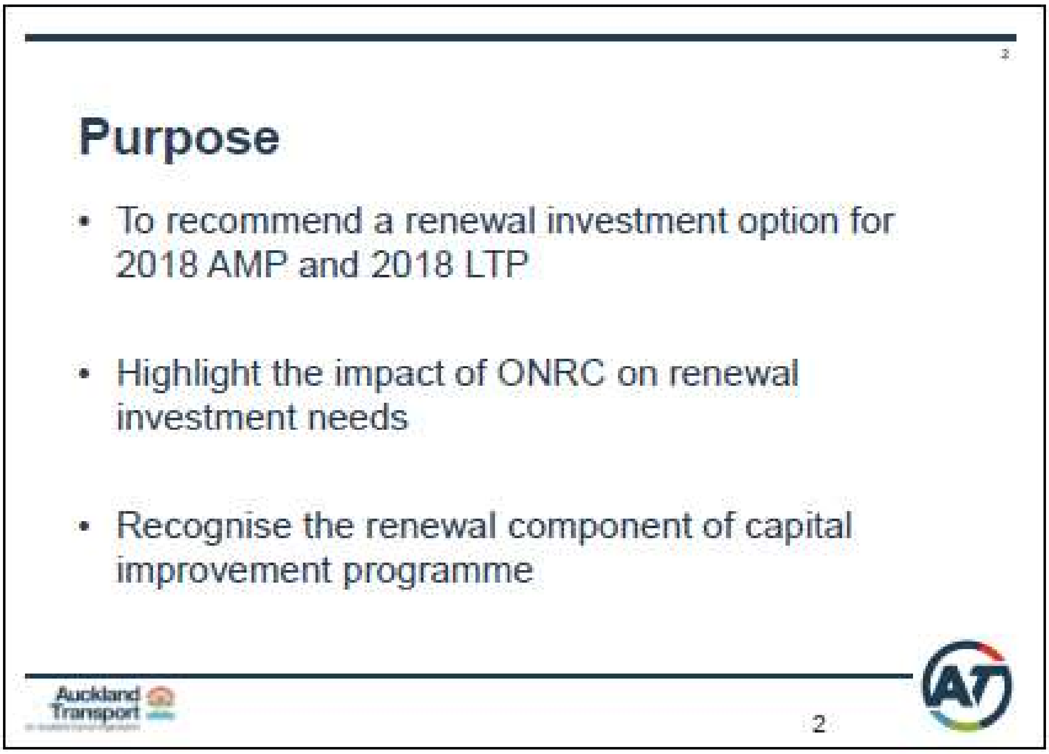
Improvement theme	No.	Description of improvement initiative	Potential consequences if initiative not carried out
Data and Information systems improvements	10	Prepare / complete an Asset Information Strategy which should feed into the EAM Business Case. Ensure a Business Case for the EAM is completed. Ensure a system is developed to enable AT to hold and manage BIM information and other as-built data for facilities. Introduce an automated work order system to enable the tracking of asset maintenance, repair and renewals costs against assets, linked to the finance system and asset register. Investigate the possibility of utilising the SPM system capability for asset maintenance and renewals. Document the processes and procedures around the use made of SPM at AT. Develop a detailed data improvement plan that includes the monitoring and measurement of accuracy and completeness. Further develop the Infrastructure Viewer Tool to include PT works on facilities.	No resolution of future direction SPM system not used to its full potential Poor records about work done (or not done) on assets Data gaps and inconsistencies remain or get worse Issues "slip through the cracks" No ability to hold and manage BIM information
Board Reporting	11	Develop a PT asset health and performance dashboard at a governance level to form the basis for high level reporting Introduce the regular reporting of maintenance backlog. Include reporting of Very High (and possibly High) asset class specific risks to the Board.	Status quo prevails – Board has little visibility of asset failure risks and maintenance contract performance
Improving the AM/FM Leadership and Culture	12	Define the AM/FM purpose and goals and demonstrate how all roles relate to the AM/FM lifecycle. Elevate the AM/FM culture, e.g. "it's what we all do around here", "our assets exist to deliver services to customers". Recognise the role that people have as "stewards" of the community's assets. Ensure that responsibility for AM/FM across the organisation is afforded a more central role. Ensure staff in the FM area receives clear and consistent leadership, guidance and support.	Asset management story "not heard" Working in silos Status quo prevails
Resilience	13	Define what resilience means to the PT system and facilities. Prioritise a comprehensive assessment of resilience across the PT networks and facilities. Consider the application of Resilience Scorecards, e.g. MCDEM tool, ResOrgs. Update the Business Continuity Plans and ensure they reflect FM	Resilience outcomes not understood or communicated Not aligned with AELG

Improvement theme	No.	Description of improvement initiative	Potential consequences if initiative not carried out
		practices. Ensure all asset classes are included in the Auckland University's resilience project. Consider including both asset related and organisational resilience in the study scope.	BCPs may become outdated – reducing effectiveness should a major disaster event occur
Improving Resources, Capability and Competence	14	Review the resources available to manage the PT assets and to improve the necessary systems and processes to enable them to be managed more efficiently. Develop and implement a comprehensive succession planning process. Develop and implement an AM/FM competencies framework. Improve leadership skills in managing poor performance.	Insufficient resources available to drive improvements People not able to carry out the tasks expected of them Internal understanding of asset risks diminished Poor performance not adequately addressed
Business process improvements	15	Further encourage cross organisational collaboration to drive more efficient business processes. Reduce the process "hand-over" risk – close the potential for issues to "slip through the cracks", and complete the review of the risk of duplication of effort. Complete the current work to clarify asset ownership. Define the management processes and procedures for changes made to PT assets.	Opportunities not realised More "surprises" Duplication of effort
Risk management	16	Build on the corporate risk management process to explicitly include asset failure risk. Develop asset class based risk frameworks and incorporate in the ACMPs. Specifically include natural hazard risks in the risk assessments – align with Auckland Engineering Lifelines. Expand the potential consequence areas to include all those relevant – such as economic and environmental. Provide more specific information around the risk management process within the Risk Management Plans. Provide more visibility of the detailed risk register / assessment model.	Unexpected asset failures Not learning from past asset failures

Improvement theme	No.	Description of improvement initiative	Potential consequences if initiative not carried out
		Develop root cause analysis and diagnostics processes, for learning from previous asset failures and how they have been treated.	
Customer / stakeholder engagement	17	Develop ways to summarise / aggregate all customer information and feedback for interpretation in AMP's / Strategies. Develop links with the Facilities Management industry.	Customer views and expectations not fully recognised in LoS decisions Inability to network with and learn from other FM organisations

15.10 Appendix 10 : ROM renewals options analysis for 2018 AMP





Background - Mandate

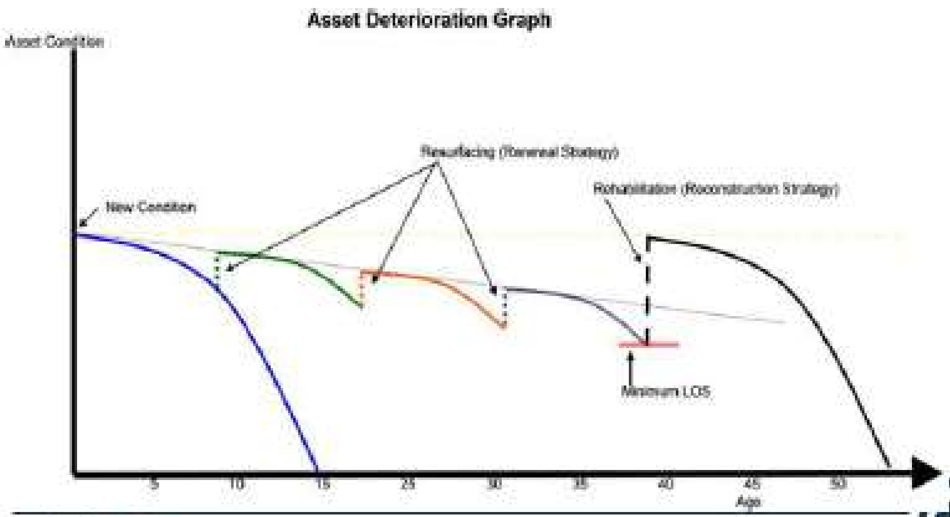
- Under the LGA, AT is required to provide fit for purpose transport network infrastructure and levels of service (LOS) at the least ongoing cost to funding stakeholders and users.

- Asset management optimises renewals expenditure across the network to ensure that assets are maintained in a fit-for-purpose state while minimising whole-of-life costs.

3

4

Background - Road Treatment decision-making



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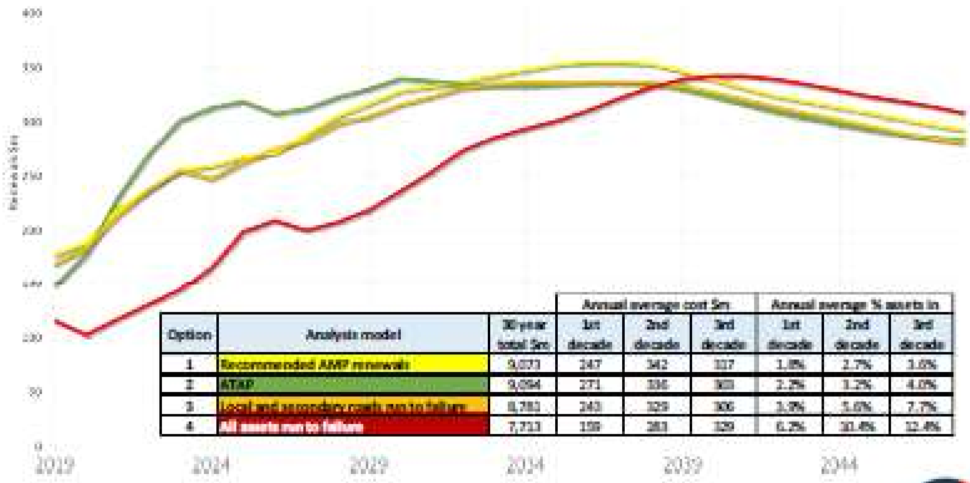
2018 AMP - Potential Renewals Investment Options
Summary of four options considered



Option	Analysis model	30 year total $m	Annual average cost $m 1st decade	2nd decade	3rd decade	Annual average % assets in 1st decade	2nd decade	3rd decade
1	Recommended AMP renewals	9,073	247	342	317	1.8%	2.7%	3.0%
2	ATAP	9,094	271	336	303	2.2%	3.2%	4.0%
3	Local and secondary roads run to failure	8,781	243	329	306	3.9%	5.0%	7.7%
4	All assets run to failure	7,713	159	283	329	6.2%	10.4%	12.4%

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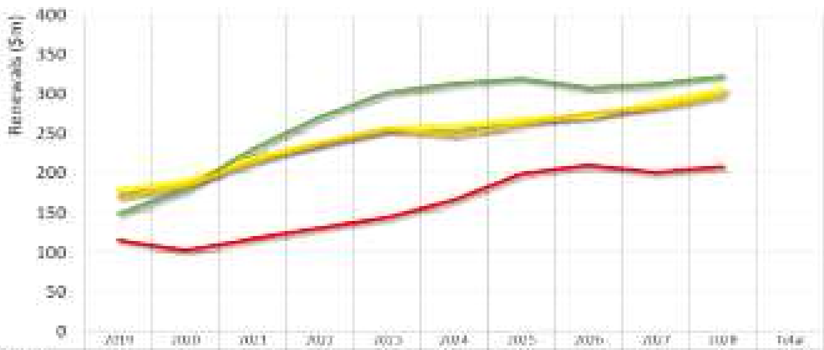
2018 AMP - Potential Renewals Investment Options
1st decade



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total
Recommended renewals - Option 1	178	190	211	238	257	255	260	272	288	300	2,475
ATAP	149	179	232	271	302	313	319	308	312	323	2,707
Local and secondary roads run to failure	170	180	214	238	256	248	263	276	283	299	2,430
Run to failure	116	101	117	131	148	166	199	210	205	208	1,591

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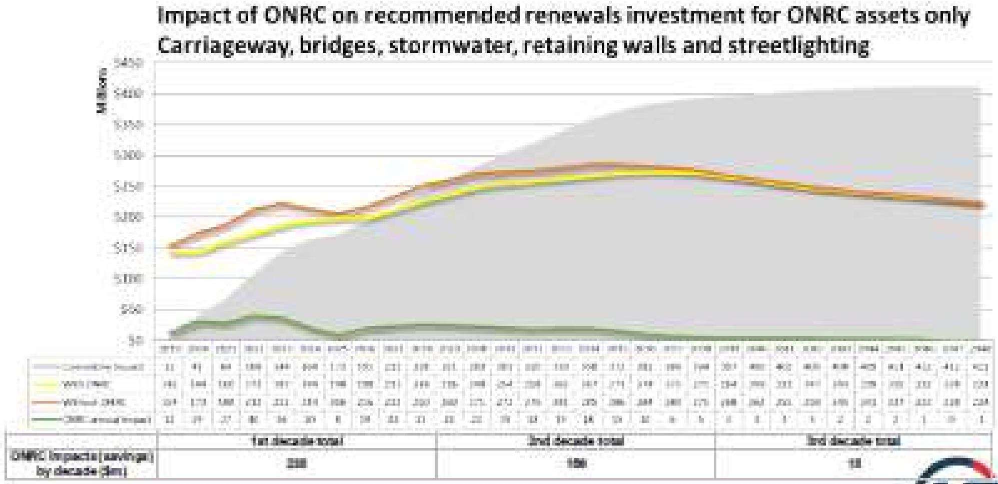
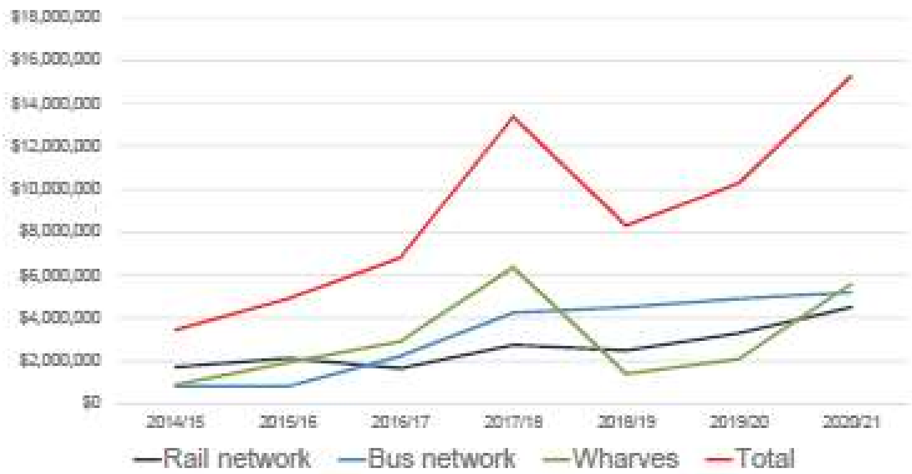
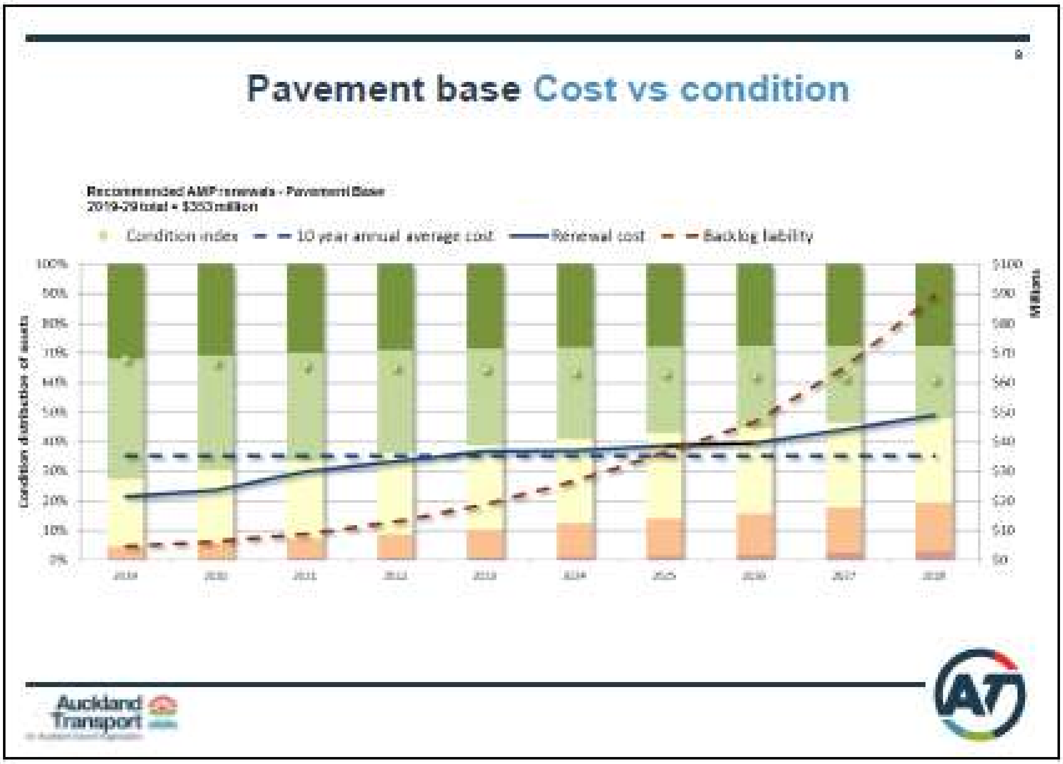
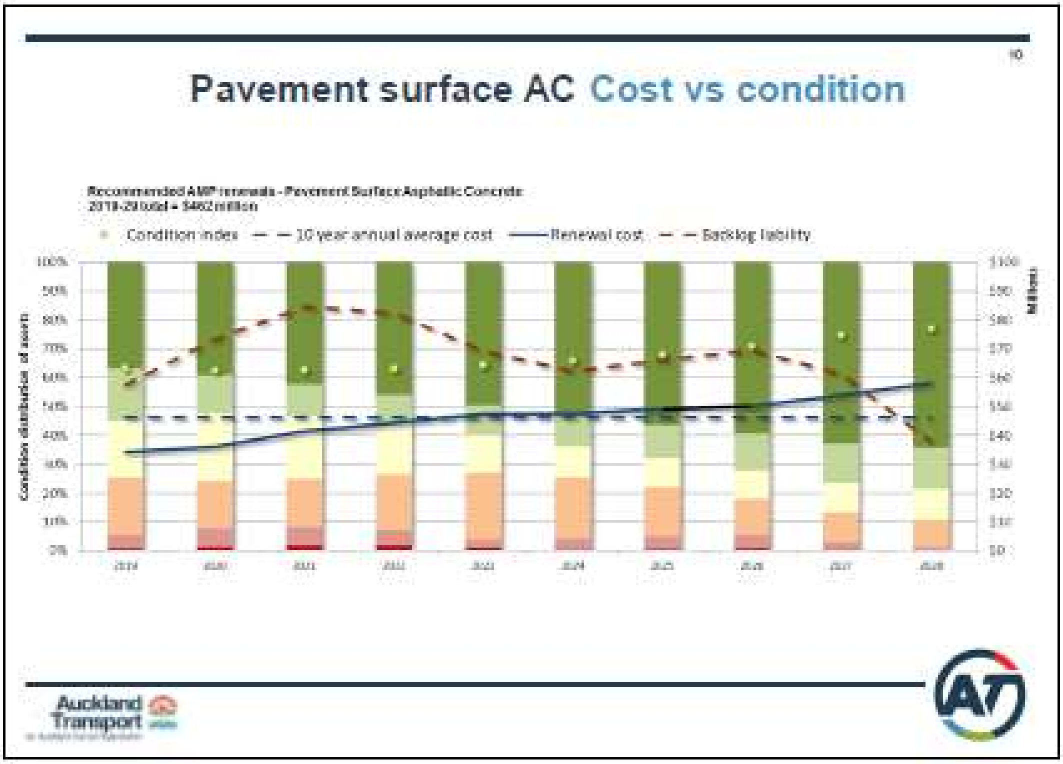
ONRC is Driving Later Renewals Interventions



Non Roading Renewal Profile

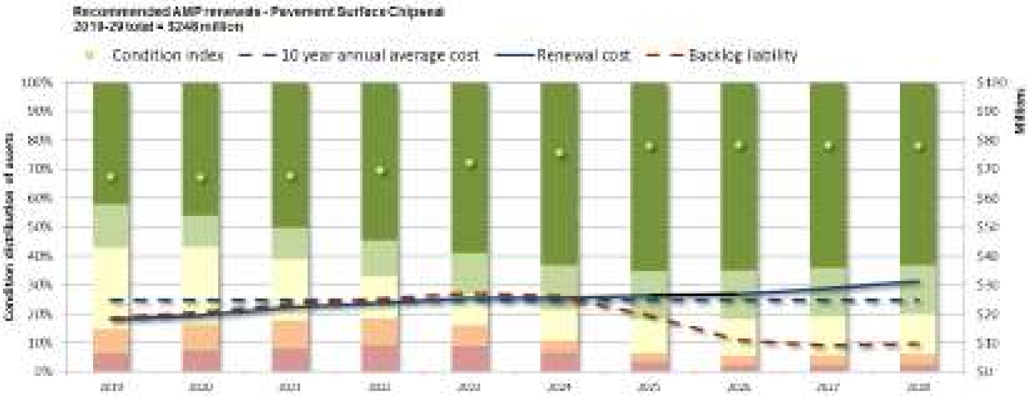



Pavement base Cost vs condition
Recommended AMP renewals - Pavement Base
2019-29 total = $353 million
Condition index
10 year annual average cost
Renewal cost
Backlog liability
Millions
Condition distribution of assets
Auckland Transport


Pavement surface AC Cost vs condition
Recommended AMP renewals - Pavement Surface Asphaltic Concrete
Condition index
10 year annual average cost
Renewal cost
Backlog liability
Millions
Condition distribution of assets
Auckland Transport

11

Pavement surface chipseal Cost vs condition



12

Renewals Included in Capital Improvements

- Asset renewals form part of capital improvements
- $ 150 million worth of renewals are included in the 2015 LTP capital improvement programme of $528m. On average, this equals to $ 15 million per year
- Only roading projects valued over 1 million were considered material to establish this renewal portion of capital improvements and no PT projects were considered
- This provides an opportunity to reduce the recommended roading renewal programme by $ 15 million/year.

13

Option 1 – Recommended renewals – Decade 1

Renewals $m	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Decade total
Option 1 Recommended renewals	178	190	219	238	257	259	268	272	288	306	2,475
Other committed renewals*	10.8	10.9	11.1	11.3	11.4	11.6	11.7	11.9	12.1	12.2	115
Reduction from new capital renewals	-15	-15	-15	-15	-15	-15	-15	-15	-15	-15	-150
Recommended total	**174**	**186**	**215**	**234**	**253**	**256**	**264**	**269**	**285**	**303**	**2,440**

*Other committed renewals (not modelled) include AT/AC drainage collaboration, TSS costs and rolling stock but exclude corporate costs and CRL and Mass Transit which are now in decade 2.

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Key Risks

- Capital program variances
- Customer dissatisfaction and political engagement may increase with ONRC implementation
- Demand (consumption) changes

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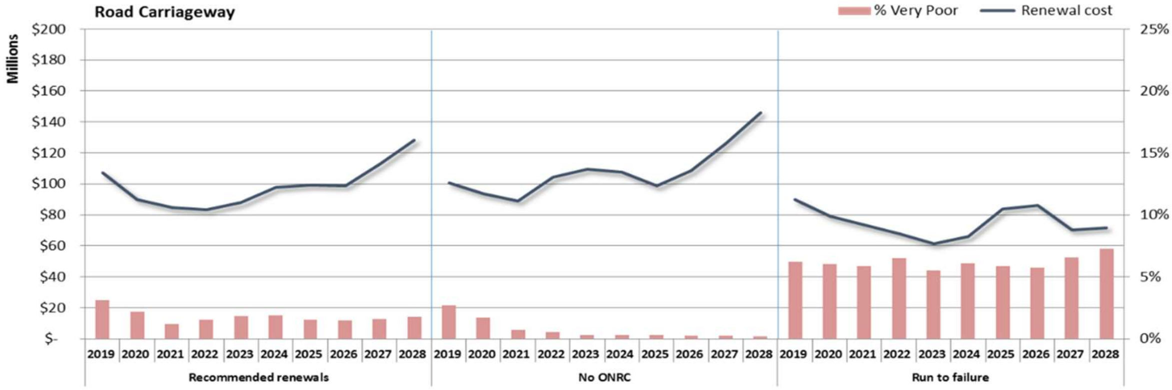
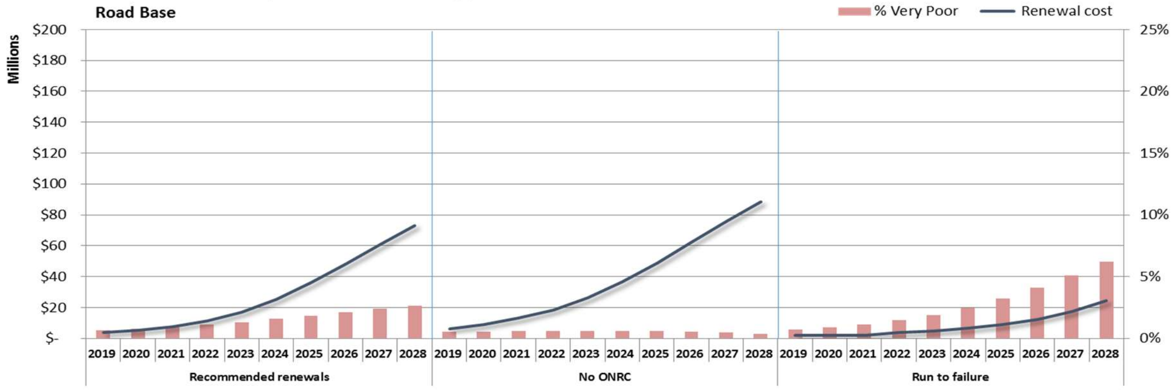
15.11 Appendix 11 : ROM options report

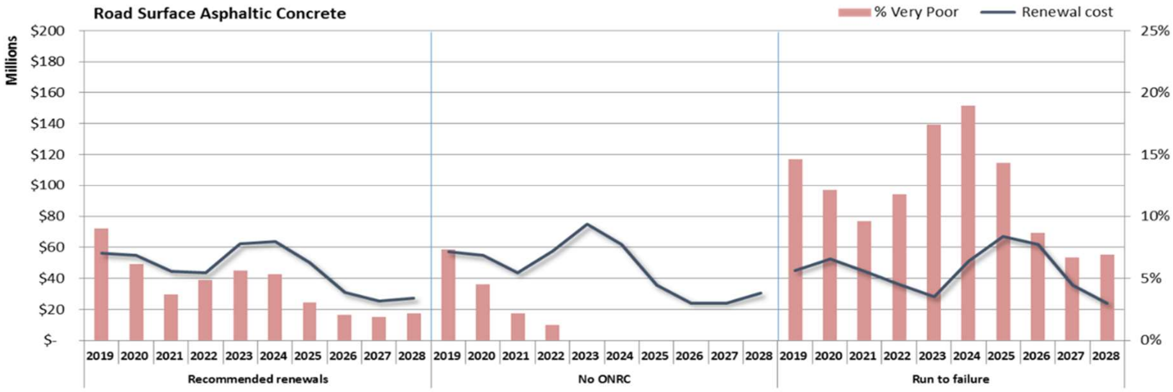
Renewal investment options vs. % asset in very poor condition
Road Carriageway



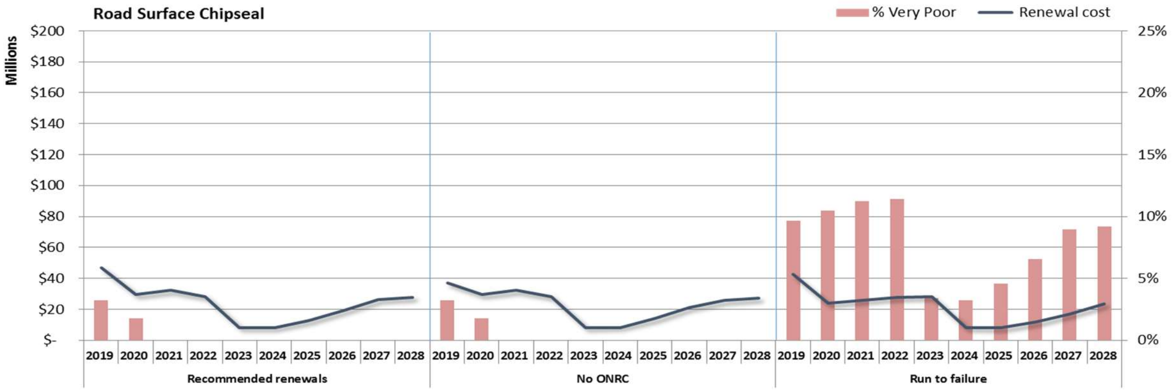
Renewal investment options vs. % asset in very poor condition
Road Base

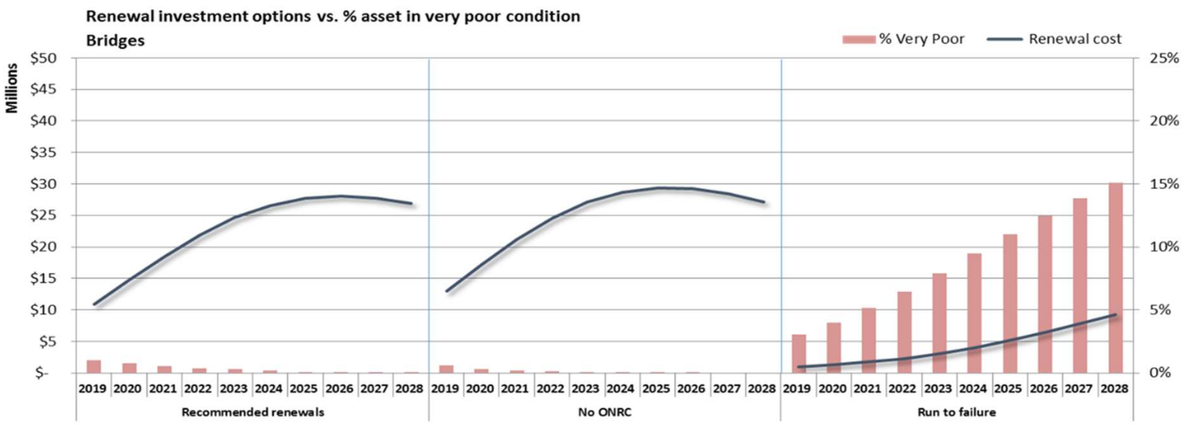


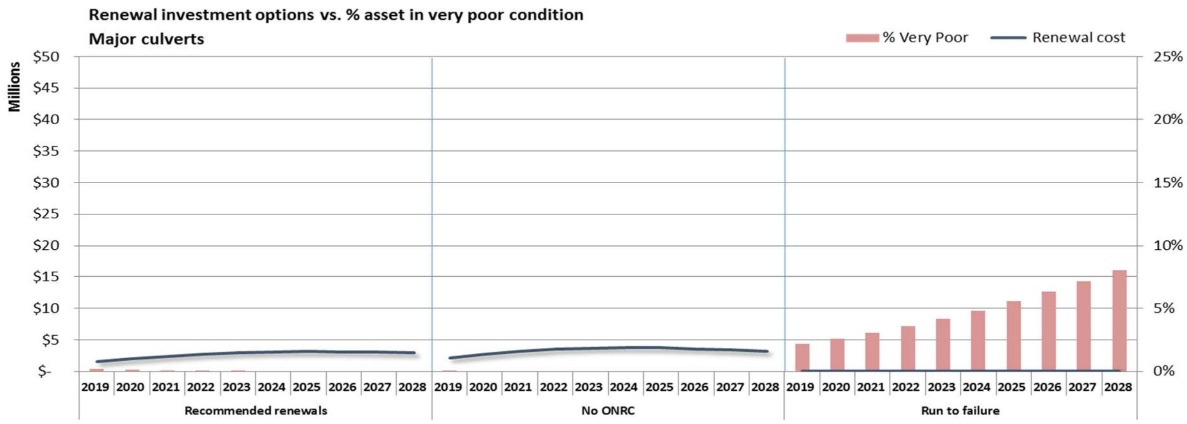
Renewal investment options vs. % asset in very poor condition
Road Surface Asphaltic Concrete

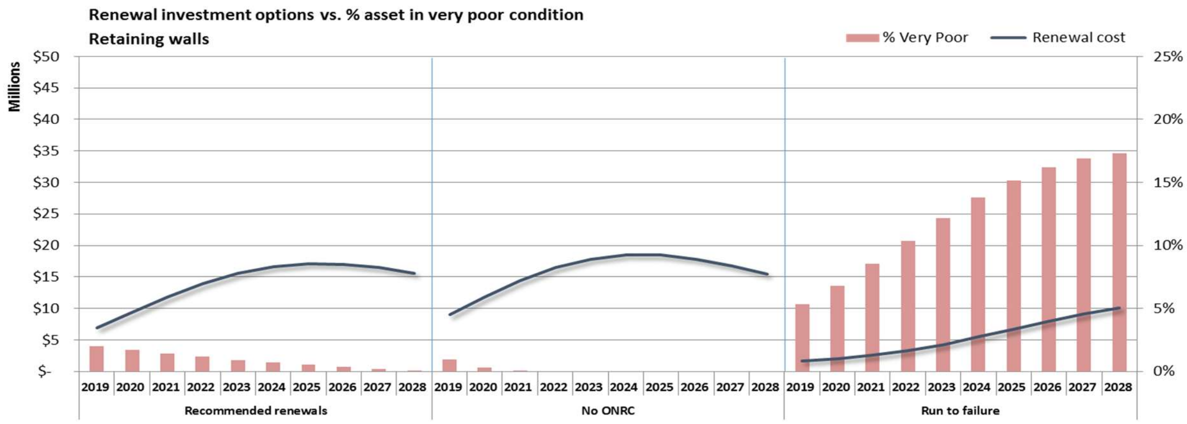


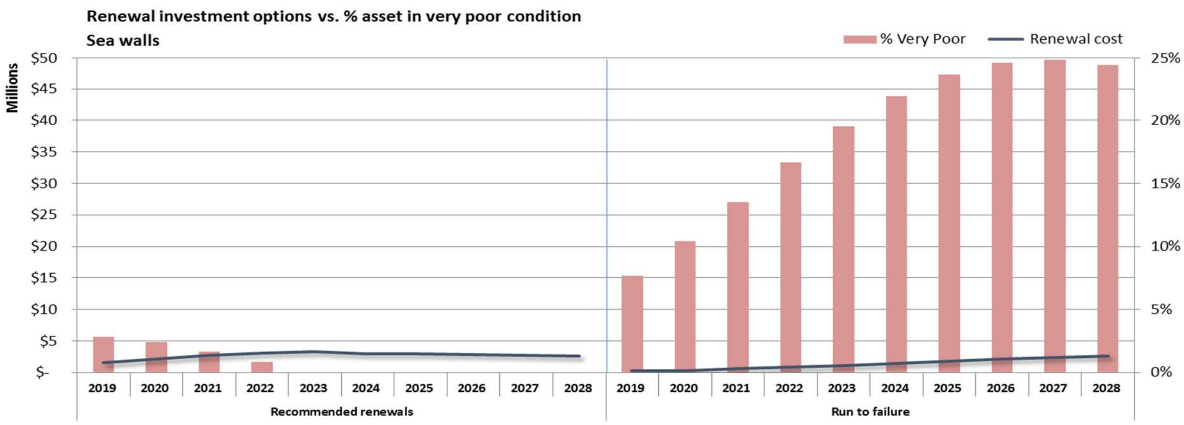
Renewal investment options vs. % asset in very poor condition
Road Surface Chipseal

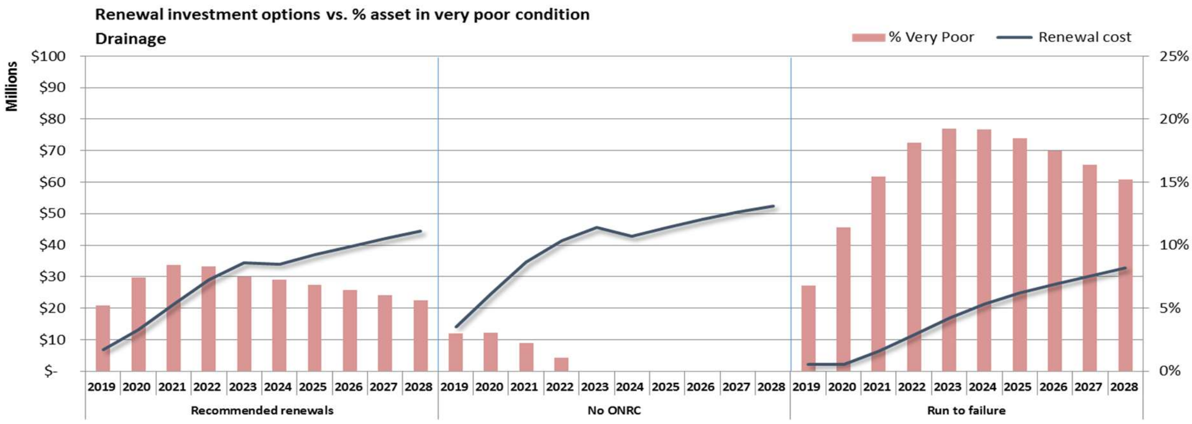


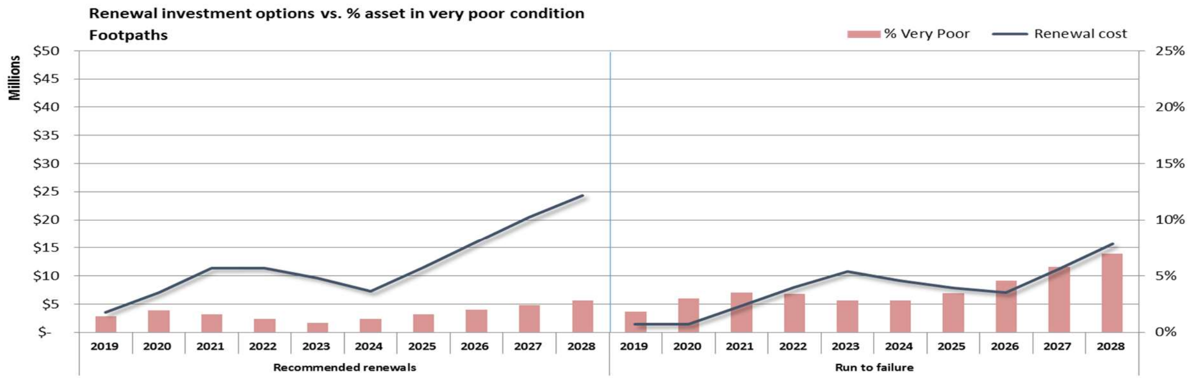

Renewal investment options vs. % asset in very poor condition
Bridges
% Very Poor
Renewal cost
Millions
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
25%
20%
15%
10%
5%
0%
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Recommended renewals
No ONRC
Run to failure

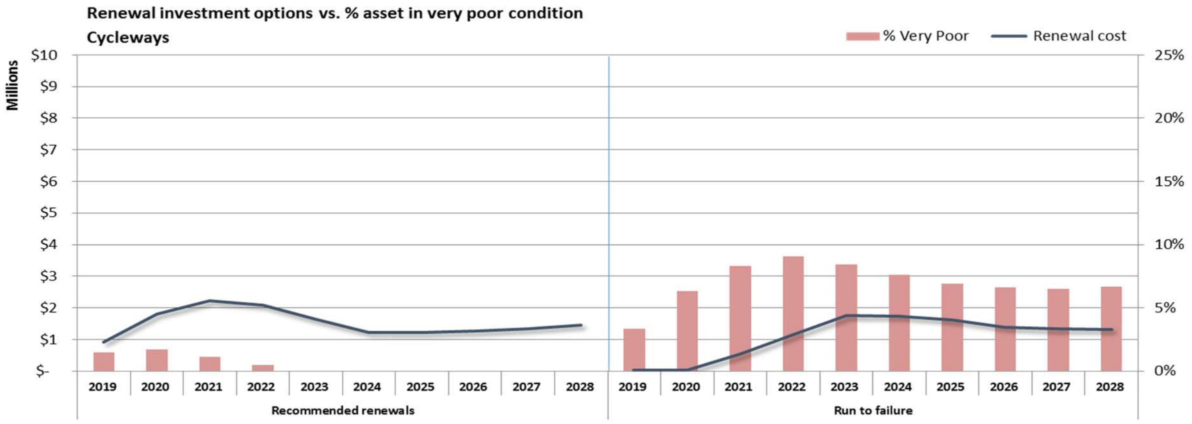

Renewal investment options vs. % asset in very poor condition
Major culverts
% Very Poor
Renewal cost
Millions
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
25%
20%
15%
10%
5%
0%
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Recommended renewals
No ONRC
Run to failure

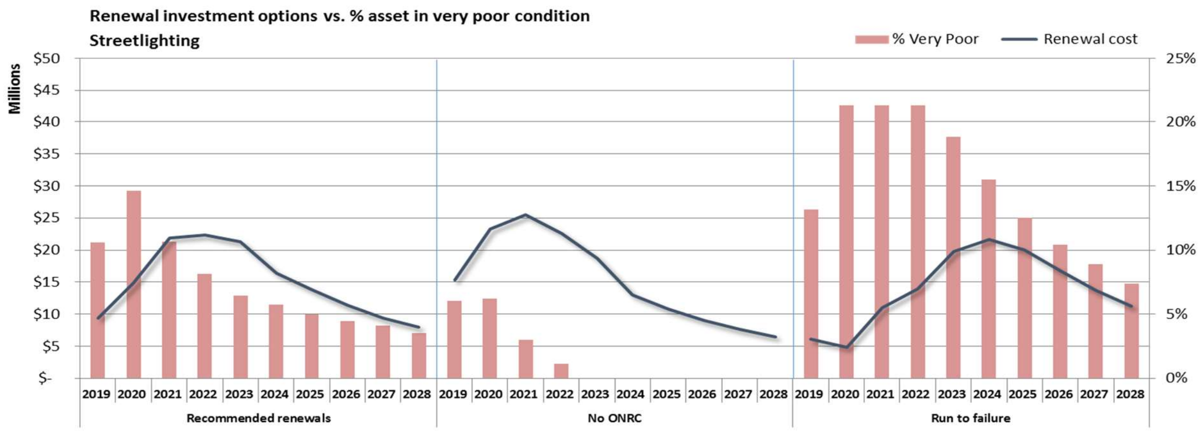

Renewal investment options vs. % asset in very poor condition
Retaining walls
% Very Poor
Renewal cost
Millions
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
25%
20%
15%
10%
5%
0%
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Recommended renewals
No ONRC
Run to failure

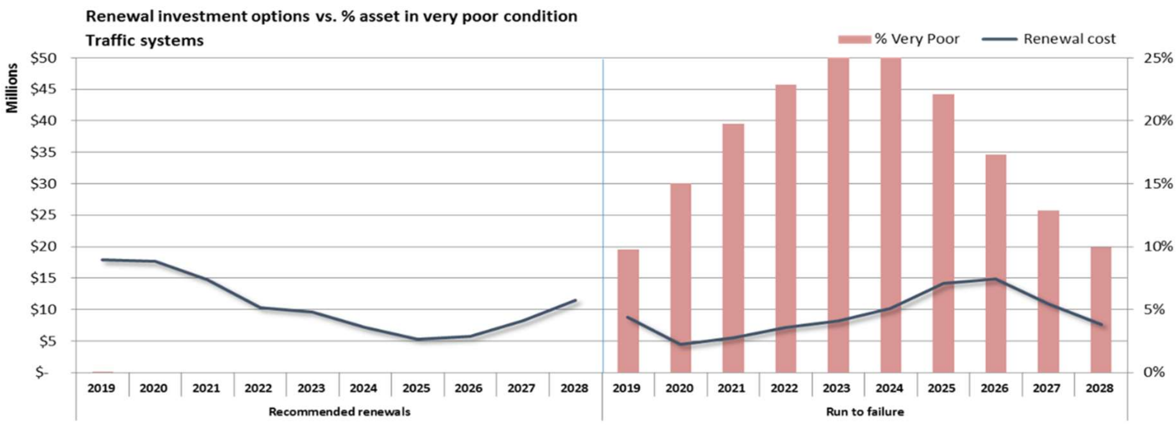

Renewal investment options vs. % asset in very poor condition
Sea walls
% Very Poor
Renewal cost
Millions
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
25%
20%
15%
10%
5%
0%
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Recommended renewals
Run to failure

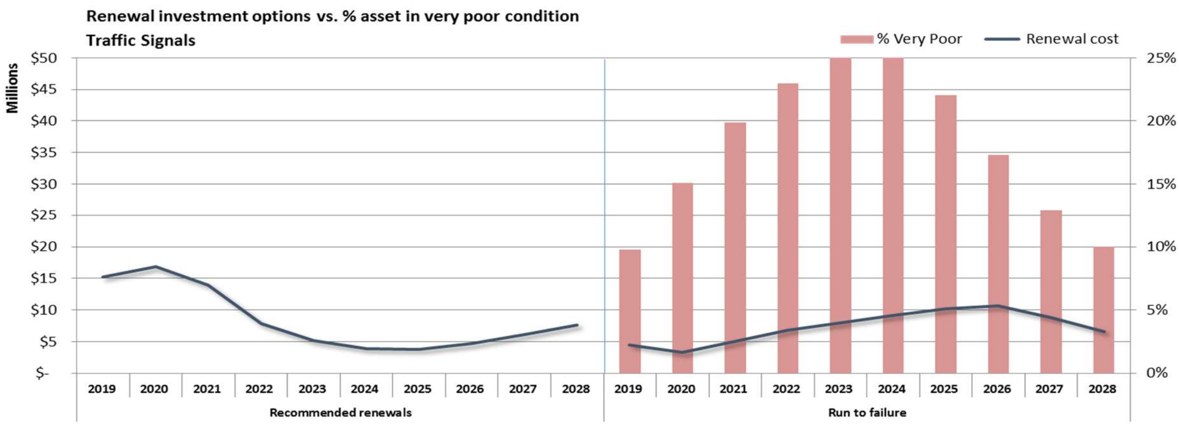

Renewal investment options vs. % asset in very poor condition
Drainage
% Very Poor
Renewal cost
Millions
Recommended renewals
No ONRC
Run to failure

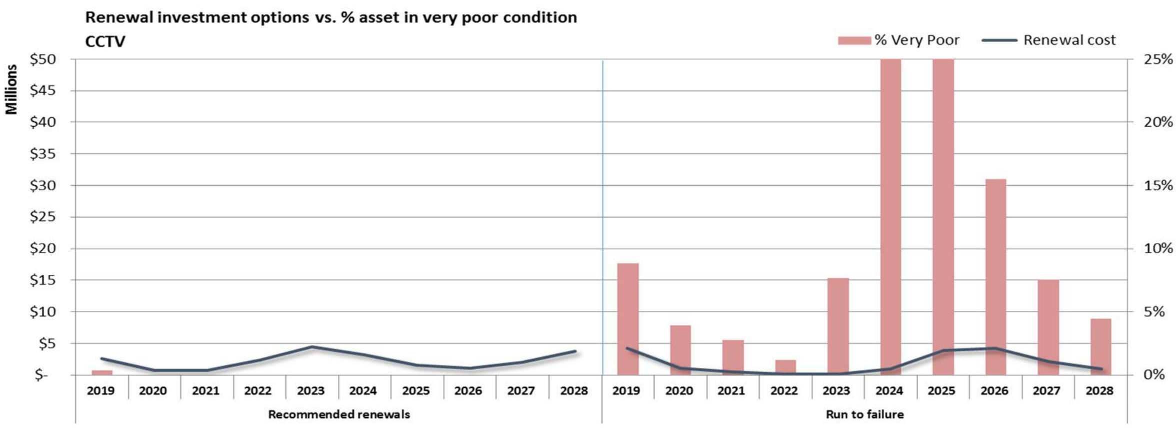

Renewal investment options vs. % asset in very poor condition
Footpaths
% Very Poor
Renewal cost
Millions
Recommended renewals
Run to failure

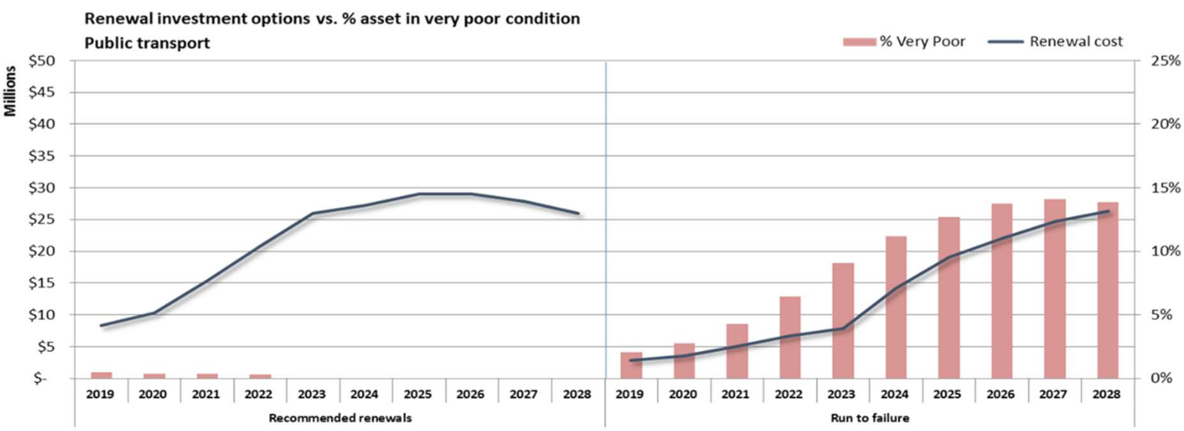

Renewal investment options vs. % asset in very poor condition
Cycleways
% Very Poor
Renewal cost
Millions
Recommended renewals
Run to failure


Renewal investment options vs. % asset in very poor condition
Streetlighting
% Very Poor
Renewal cost
Millions
Recommended renewals
No ONRC
Run to failure


Renewal investment options vs. % asset in very poor condition
Traffic systems
% Very Poor
Renewal cost
Millions
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
25%
20%
15%
10%
5%
0%
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Recommended renewals
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Run to failure


Renewal investment options vs. % asset in very poor condition
Traffic Signals
% Very Poor
Renewal cost
Millions
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
25%
20%
15%
10%
5%
0%
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Recommended renewals
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Run to failure


Renewal investment options vs. % asset in very poor condition
CCTV
% Very Poor
Renewal cost
Millions
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
25%
20%
15%
10%
5%
0%
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Recommended renewals
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Run to failure


Renewal investment options vs. % asset in very poor condition
Public transport
% Very Poor
Renewal cost
Millions
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
25%
20%
15%
10%
5%
0%
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Recommended renewals
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028
Run to failure

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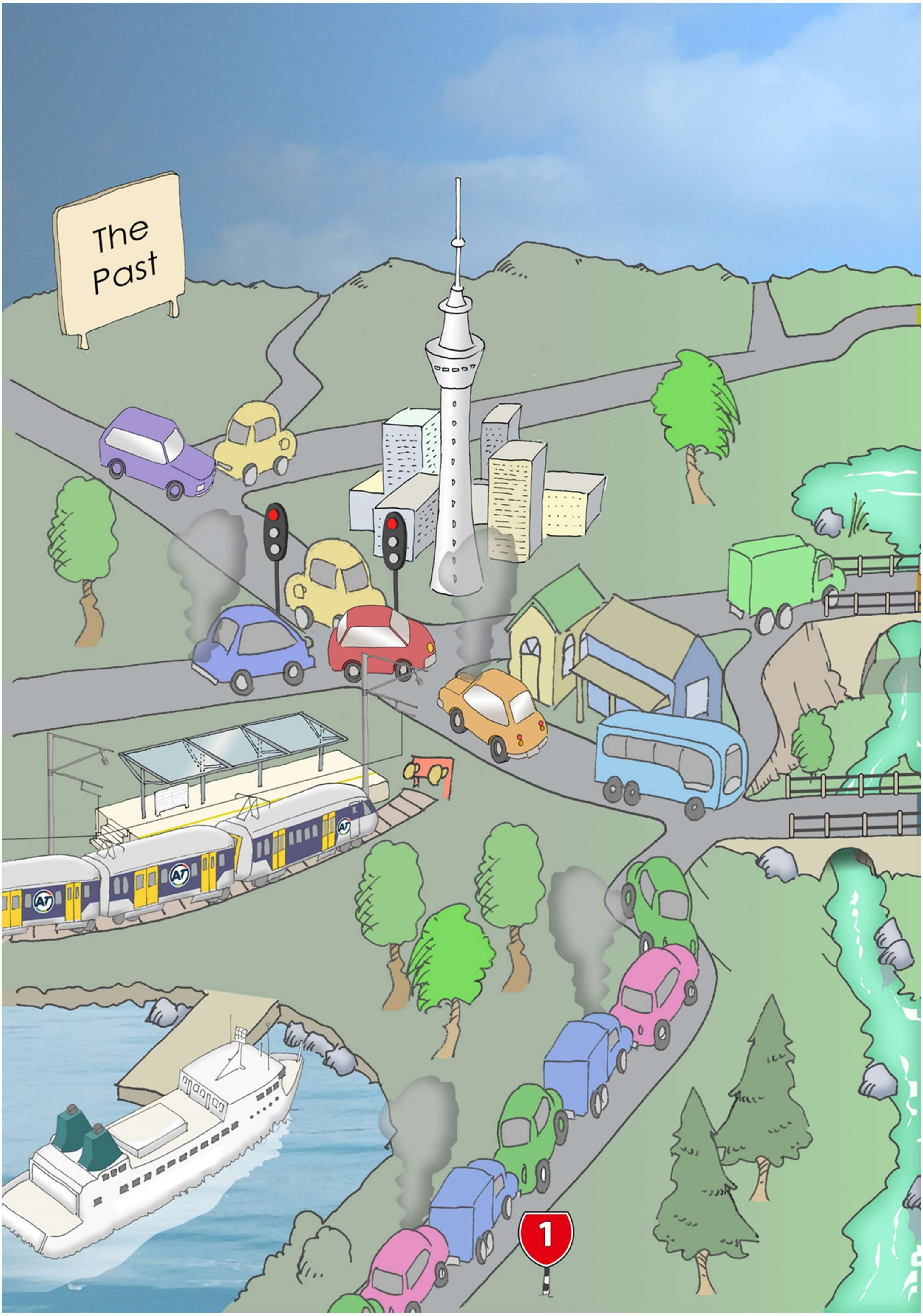
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