

Transport asset management plan

Programme business case

2021-2031



Asset management plan
Programme business case

Status of document: Submitted for Board approval July 2021

Prepared by	May Oo, Principal Asset Management Engineer Anna Percy, Senior Asset Specialist Sanchit Shukla, Asset Management Engineer Carmela Tamayo, Senior Asset Management Engineer	
Approved by	SB (Siri) Rangamuwa Asset Planning and Policy Manager	
Recommended:	Myles Lind Asset Manager	
Endorsed:	Murray Burt Chief Engineer	
Approved for submission to Board	Mark Lambert Executive General Manager Integrated Networks	

Table of Contents

1.0 Executive summary	1
1.1 <i>Transport assets and AT's asset management approach</i>	1
1.2 <i>Building the business case for asset management</i>	4
1.3 <i>Investment plan</i>	5
1.4 <i>Investment benefits</i>	9
Strategic case	11
2.0 Strategic context	11
2.1 <i>Our approach to asset management planning</i>	11
2.2 <i>The national strategic context for this plan</i>	14
2.3 <i>The regional strategic context for this plan</i>	18
3.0 Gap analysis	22
3.1 <i>Asset management</i>	22
3.2 <i>Safety</i>	33
3.3 <i>Travel choices</i>	37
3.4 <i>Access and connectivity</i>	38
3.5 <i>Growth</i>	41
3.6 <i>Climate change and the environment</i>	45
3.7 <i>Overall gap analysis</i>	46
4.0 Identifying the underlying problems	48
5.0 Strategic approach	49
5.1 <i>Strategic approach options</i>	49
5.2 <i>Recommended strategic approach</i>	55
Programme business case	57
6.0 Root cause analysis	57
6.1 <i>Root cause analysis – asset deterioration</i>	58
6.2 <i>Our overall approach to managing asset deterioration</i>	61
6.3 <i>Root cause analysis – road safety</i>	64
6.4 <i>Our overall approach to managing road safety</i>	66
6.5 <i>Root cause analysis – impacts of growth</i>	68
6.6 <i>Our overall approach to managing the impacts of growth</i>	70

6.7	<i>Root cause analysis – lack of resilience</i>	70
6.8	<i>Our overall approach to managing lack of resilience</i>	72
7.0	Multi-criteria analysis and asset needs	75
7.1	<i>Sealed roads</i>	75
7.2	<i>Unsealed roads</i>	89
7.3	<i>Stormwater</i>	93
7.4	<i>Bridges, walls and structures</i>	103
7.5	<i>Footpaths and cycleways</i>	113
7.6	<i>Street lighting</i>	123
7.7	<i>Traffic systems</i>	132
7.8	<i>Public transport assets</i>	144
7.9	<i>Parking and airfields</i>	157
8.0	Total asset investment needs	159
8.1	<i>Recommended operations and maintenance investment needs</i>	160
8.2	<i>Asset needs renewal programme</i>	161
8.3	<i>Forecast benefits from the recommended investment achievements</i>	165
9.0	The funding-constrained investment plan	167
9.1	<i>How Covid-19 is affecting assets</i>	167
9.2	<i>Operations and maintenance investment</i>	168
9.3	<i>Process to develop the constrained renewals investment plan</i>	168
9.4	<i>The constrained renewals programme</i>	169
9.5	<i>Asset investment needs by NZTA work category</i>	171
10.0	Asset management improvements	174

1.0 Executive summary

This *Transport Asset Management Plan 2021* sets out how Auckland Transport (AT) intends to manage its transport assets over the next 10 years, from 2021 to 2031.

It describes the transport assets we manage, the activities we carry out, and what it all costs. It also looks at other factors that affect how we manage the assets, such as government strategy, growth and demand, and risks and constraints on investment, in particular the impacts of the Covid-19 pandemic.

The approach we have taken in developing the plan is illustrated in Figure 1-1. The plan's structure reflects these steps.

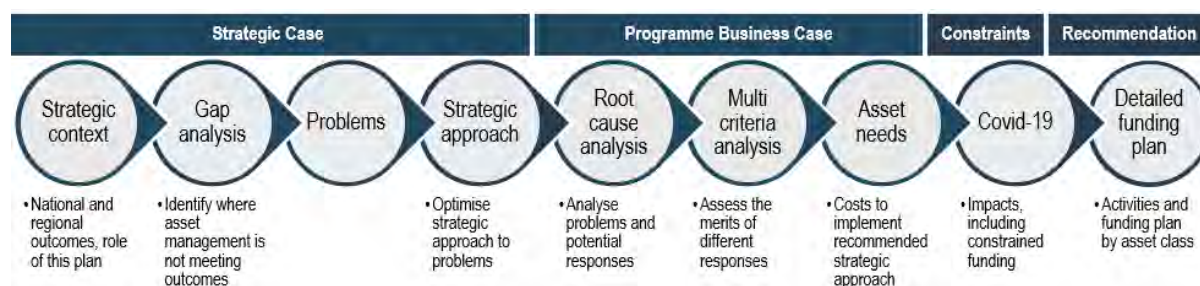


Figure 1-1: Steps in asset management planning and the structure of this plan

1.1 Transport assets and AT's asset management approach

The Auckland Council group is responsible for managing Auckland's public infrastructure, including the roads, water networks and community facilities that we use every day. AT is part of the group and is responsible for roads, footpaths and public transport links.

1.1.1 Transport assets

AT is the regional guardian of \$21.1 billion of publicly-owned assets. This Transport Asset Management Plan 2021 sets out how AT intends to manage its transport assets over the next 10 years, from 2021 to 2031. It describes the assets we manage, the activities we carry out, and what it all costs. It also looks at other factors that affect how we manage the assets, such as government strategy, growth and demand, and risks and constraints on investment, in particular the impacts of the Covid-19 pandemic.

AT manages (as at 2021 Annual Report):

- Road pavement assets with a replacement value of \$9.6 billion - 7,661 km of roads; 6,843 km sealed and 818 km unsealed
- Stormwater assets worth \$2.9 billion - 13,552 km of stormwater channel, 89,141 catchpits, 3,598 water quality treatment devices
- Bridges and structures worth \$1.9 billion - 1,248 bridges; 4,461 retaining walls and sea walls; 307 km of railings and fences
- Footpaths and cycleway assets worth \$1.5 billion - 7,460 km of footpaths, 350 km protected cycleways
- Street lighting assets worth \$0.3 billion – 122,347 street lights
- Traffic systems worth \$0.2 billion - 857 traffic signal controlled intersections and 163,004 signs
- Public transport assets worth \$1.7 billion - 7 bus stations, 1,482 bus shelters, 40 rail stations, 72 electric trains, 23 wharves, 5 ferry buildings

- Parking assets worth \$0.5 billion - 11 parking buildings, 250 off-street parking areas, 969 parking payment machines

These assets depreciate with time and use – at a rate of \$336 million per year or \$920,000 per day.

1.1.2 Strategic objectives

Planning and managing transport in Auckland is done as a partnership between the Auckland Council group, central government and the people of Auckland, and is coordinated through the Auckland Transport Alignment Project.

This asset management plan (AMP) is one of a set of plans adopted in 2021 that impact on how transport in the city is managed. Its preparation has been guided by key policy documents, including:

- [Government Policy Statement on Land Transport](#)
- [Transport Outcomes Framework](#), prepared by the Ministry of Transport
- [Auckland Plan 2050](#), prepared by Auckland Council
- [Arataki](#), prepared by the NZTA
- [One Network Framework](#), prepared by the [Road Efficiency Group](#)
- [Auckland Transport Alignment Project](#) documents.

AT has developed a set of objectives, with input from Auckland Council, Waka Kotahi, the Ministry of Transport and KiwiRail, to summarise the agreed strategic direction for transport in Auckland over the coming ten years. These objectives guide the 2021 Regional Land Transport Plan and its companion documents, including this Asset Management Plan.

Asset management Prudent management of Auckland’s transport assets

Safety



Make the transport system safe by eliminating harm to people

The latest road safety data shows a reduction in road trauma, but there is no room for complacency as we work with our Vision Zero partners towards a transport network free of death and serious injury.

Travel choices



Accelerate better travel choices for Aucklanders

Auckland’s agreed strategy to improve urban transport is to move more people and goods within the footprint of existing roads. Over time, this strategy requires AT to transform the existing road network, from one where typically 80 per cent of road space is devoted to cars, to a multi-modal network which is safe for all pedestrians and cyclists, gives priority to buses, and creates great public spaces while still providing for vehicle access.

Access and connectivity



Better connecting people, places, goods and services

We put our customers first by implementing our Future Connect plans for road, freight, public transport, walking and cycling so customers experience an effective, reliable, connected transport network.

Growth



Enabling Auckland’s growth through a focus on intensification in brownfield areas, with some managed expansion into emerging greenfield areas

Auckland’s growth is a sign of success – people want to live and do business here. But growth does add to the cost of managing transport assets, to keep up with an expanding transport network and with more people and freight on existing assets and services.

Climate change and the environment



Improving the resilience and sustainability of the transport system, and significantly reducing the greenhouse emissions it generates

We will prioritise actions that build resilience to current and future natural hazards, and that contribute to Auckland’s emissions reduction and environmental sustainability goals.

Value for money

Ensuring value for money across Auckland’s transport system through well-targeted investment choices

1.1.3 Population and employment drive transport asset growth

Auckland Council has recently revised its growth forecasts to take into account data up to August 2020, including the impacts of Covid-19. The new forecasts anticipate that Auckland will grow by around 26,000 people (10,000 households) each year from 2021 to 2031. Compared with its 2018 forecasts, Auckland Council’s new growth forecasts project similar population and household numbers, but are more optimistic about the economy, with employment growth revised upwards to over 10,500 new full-time jobs each year between 2021 and 2031.

To support this growth, AT is investing in new transport assets, and private developers also construct new roads in new growth areas.

Growth forecasts are shown alongside the forecast growth in transport assets in Figure 1-2.

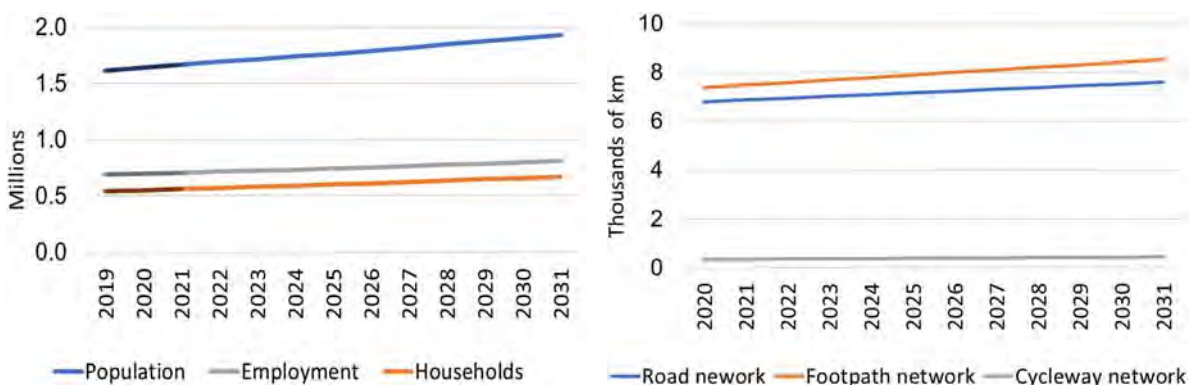


Figure 1-2: Population, employment and household growth forecasts, and growth in transport assets

This population and economic growth will increase demand for transport and pressure on the transport network. To accommodate this, AT forecasts that transport assets will need to grow by:

- 74km new sealed roads each year (1.1 per cent)

- additional stormwater drainage, street lights and road structures in proportion to sealed road growth (1.1 per cent per year)
- 104km new footpaths per year (1.4 per cent)
- 10km new protected cycleways per year (2.9 per cent)
- 15 new signalised intersections per year (2.3 per cent)
- Additional public transport facilities to support a growing role for public transport in connecting people and places

These additional assets will have flow-on effects for future maintenance, operations and renewals requirements and budgets.

1.2 Building the business case for asset management

AT follows national and international best practice to develop a business case for investment in transport asset management activities. Preparing a business case helps ensure that AT is delivering maintenance and renewals activities in the right place, at the right time, to achieve a level of service that aligns with the outcomes the community requires.

A key step in any business case is to define the problems (or root causes) that create the need for change. We have identified four key problems that this plan needs to address if we are to play our part in delivering the agreed strategic objectives.

Unlike a business case for building a new asset, there is no 'do nothing' option in this AMP. If AT were to neglect or ignore asset deterioration and fail to maintain and renew network assets in a timely way, this would create significant issues. Customers would notice a decline in levels of service, unplanned asset failures would become more common, and there would be a backlog of failed assets which would be more expensive to restore.

For AT, making best use of existing transport assets remains a higher priority than building new assets. In part, this is because the benefits from any new transport assets depend on connecting to an effective, efficient and safe existing transport network.


1.2.1 Problem statements

A key step in any business case is to define the problems (or root causes) that create the need for change. We need to ask: Why is AT doing well in some areas of asset management, while there are gaps in other areas?

In developing this AMP, we have identified four key problems that the plan needs to address if we are to close the gaps and deliver the required strategic outcomes. Our job as asset managers is to ensure our recommendations address each of the following four problems.



Asset deterioration: If AT does not address asset deterioration adequately, by maintaining and renewing assets in a timely and efficient way, then safety will be compromised, customer journeys will be affected, and significant problems will be created for the region and for future generations.



Road safety: Deaths and serious injuries on Auckland's roads are high by national and international standards, especially for vulnerable road users.

Growth and intensification: The network requirements to address the impacts of growth and intensification will be significant, and if not met, will accelerate asset deterioration and escalate costs.

Resilience: The transport network lacks resilience in the face of future challenges, including climate change, increasing the potential for significant disruption.

1.3 Investment plan

The asset management investment plan set out in this AMP comprises two parts:

- an asset operations and maintenance investment plan
- an asset renewals investment plan.

This AMP proposes a single investment plan for asset operations and maintenance. Effective operations and timely maintenance are especially important when funding is constrained, as neglecting these issues can exacerbate safety risks and accelerate long term asset damage. Allowing for inflation, the total cost of asset operations and maintenance over 10 years is forecast to be **\$2.53 billion**, detailed in Section 7.

The asset renewals investment plan has been developed in two stages:

- an asset needs renewals investment plan – this plan sets out our recommended optimal renewals programme: it balances cost, risk and levels of service, before constraints on funding are taken into account. Total investment (inflated) for the asset needs plan over 10 years is **\$4.83 billion**, detailed in Table 1-2.
- a constrained renewals investment plan – this second plan has been developed with input from AT executives. It has lower costs and, as a result, a higher level of managed risk and some targeted changes to levels of service. Total investment (inflated) for the funding constrained plan over 10 years is **\$3.931 billion**, detailed in Table 1-3. It is the constrained plan for renewals that is included in AT's proposed budget.

1.3.1 Asset operations and maintenance investment plan

Asset operations and maintenance are AT's second largest item of operational expenditure (the largest is the cost of operating public transport services).

Major items covered by operations and maintenance budgets include:

- maintaining the road pavement surface, for example by filling cracks and patching potholes
- maintaining road markings and replacing damaged road signs
- operating street lights and optimising traffic signals to improve network performance
- operating and maintaining rail and bus stations, ferry wharves and bus shelters.

The costs of maintaining and operating Auckland’s transport network will increase steadily as Auckland grows and new assets are added to the network. These costs, including inflation, are forecast to be \$228.2 million in 2021/2022, increasing to \$290.8 million in 2030/2031. Most of this increase is the consequential costs of maintaining and operating new assets built or vested in AT over the 10-year period.

The 10-year recommended investment plan to cover these asset operations and maintenance costs is shown in Figure 1-3 and Table 1.1.

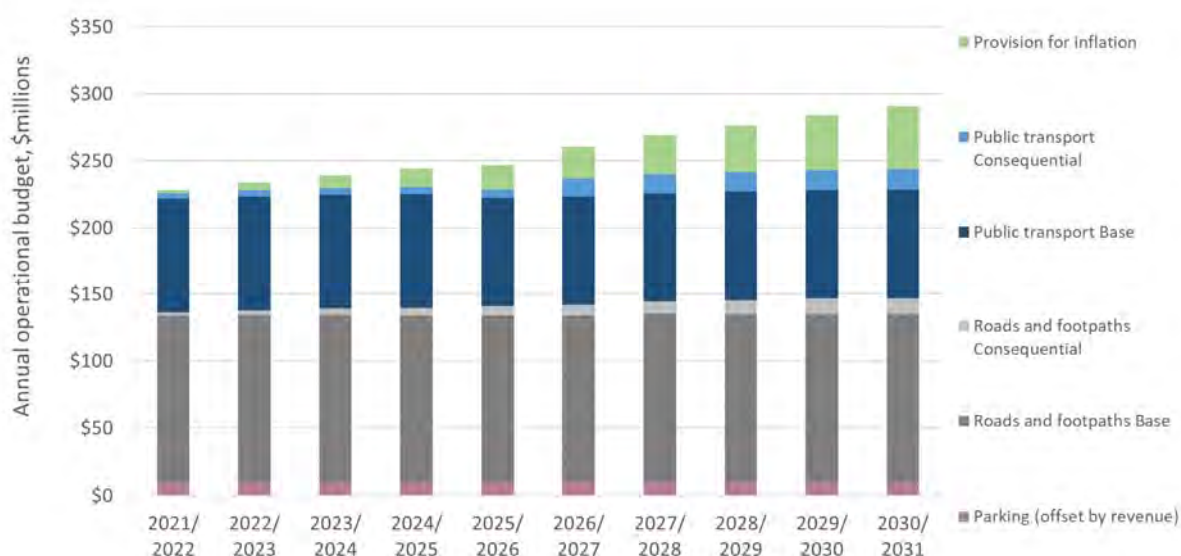


Figure 1-3: Recommended asset maintenance and operations investment (includes inflation)

Table 1-1: Recommended asset maintenance and operations investment (includes inflation)

Operations and maintenance \$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Roadings (base)	\$124.1	\$124.2	\$124.2	\$123.8	\$123.6	\$123.4	\$124.8	\$124.6	\$124.4	\$124.2
Roadings (consequential)	\$2.4	\$3.6	\$4.9	\$6.0	\$7.2	\$8.3	\$9.3	\$10.6	\$11.8	\$12.3
Public transport (base)	\$85.6	\$85.6	\$85.6	\$85.6	\$81.4	\$81.4	\$81.4	\$81.4	\$81.4	\$81.4
Public transport (consequential)*	\$3.9	\$4.6	\$4.8	\$5.2	\$6.3	\$13.4	\$13.9	\$14.5	\$15.1	\$15.6
Parking (offset by revenue)	\$9.9	\$10.0	\$10.0	\$10.1	\$10.2	\$10.3	\$10.4	\$10.4	\$10.5	\$10.5
Provision for inflation	\$2.3	\$5.7	\$9.5	\$13.9	\$18.1	\$23.9	\$29.5	\$35.1	\$40.9	\$46.8
Total opex*	\$228.2	\$233.7	\$238.9	\$244.6	\$246.8	\$260.6	\$269.4	\$276.6	\$284.1	\$290.8
10 year total (inflated)										\$2,573.8

Note: excludes opex requirements for City Rail Link

The maintenance and operations programme to be funded by this investment will address the following problems, identified in the root cause analysis.

- **Asset deterioration** will be addressed by providing adequate maintenance budgets so AT can find and fix small problems early. The programme is expected to significantly reduce long-term costs.
- **Road safety** can be partly be addressed through maintenance budgets. This is especially the case on rural roads, where clear signs and markings, skid resistant pavements and well-maintained road shoulders and sightlines can save lives. For urban roads, this plan provides for the maintenance of new urban safety assets including midblock crossings and protected cycleways.
- **Impacts of growth** are the main reason for increased operational costs. There will be more roads and related assets, and existing road assets will be used more intensively. The public transport network needs to grow even faster than the road network, as the only way to increase the capacity of certain key roads in the network is by moving more people in fewer vehicles.

Operational costs related to the [City Rail Link](#), which is due for completion in late 2024, are not included in the above recommendation.

1.3.2 The asset needs renewals investment plan

Our calculation of the 10-year asset renewals needs of AT’s transport assets is shown in Figure 1-4 and Table 1-2.

Asset renewals needs, in today’s dollars, are forecast to be \$338.5 million in 2021/2022, increasing to \$505.5 million in 2030/2031. The renewals costs for both road and public transport assets will increase over time, as assets age and reach the end of their useful lives.

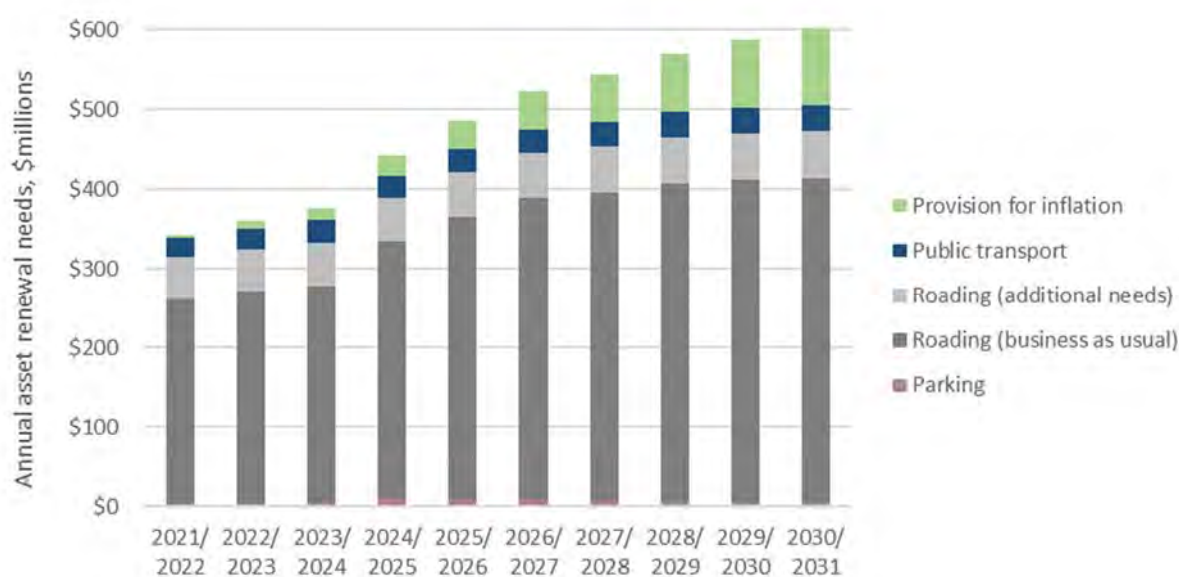


Figure 1-4: Asset needs renewals investment plan

Table 1-2: Asset needs renewals investment plan

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Roding (business as usual)	\$257.6	\$266.8	\$272.1	\$324.3	\$355.9	\$380.5	\$388.5	\$400.1	\$405.4	\$408.6
Roding (additional needs)	\$53.5	\$54.2	\$54.8	\$55.5	\$56.2	\$56.9	\$57.6	\$58.3	\$59.0	\$59.7

Public transport	\$23.6	\$25.5	\$29.6	\$27.4	\$28.8	\$29.2	\$30.9	\$32.0	\$32.2	\$31.8
Parking	\$3.8	\$4.1	\$5.2	\$9.9	\$9.2	\$8.4	\$7.7	\$6.9	\$6.1	\$5.4
Asset needs renewals	\$338.5	\$350.6	\$361.7	\$417.2	\$450.1	\$475.0	\$484.6	\$497.3	\$502.7	\$505.5
Provision for inflation	\$3.4	\$8.8	\$15.0	\$25.2	\$35.7	\$48.0	\$59.6	\$72.3	\$84.6	\$96.9
Asset needs renewals (inflated)	\$341.9	\$359.4	\$376.8	\$442.3	\$485.9	\$523.0	\$544.2	\$569.6	\$587.3	\$602.4
Ten year total (inflated)										\$4,832.8

The asset needs renewals programme addresses the following problems, identified in the root cause analysis.

- **Asset deterioration:** will be addressed by increasing our ability to respond promptly when road pavements are damaged, including in new growth areas and intensification areas. AT's ability to respond comprehensively to asset deterioration will also be improved by ensuring:
 - renewals complement other works; for example by arranging for kerb and channel, footpath and CCTV assets to be improved as part of road pavement rehabilitation projects
 - renewals respond to local needs, in particular any priority asset renewal needs that have been agreed with local boards.
- **Resilience:** will be improved through:
 - climate change strengthening measures for sealed roads, stormwater assets and bridges
 - seismic retrofitting for bridges and gantries
 - slip repairs for retaining walls.

1.3.3 The constrained renewals investment plan

AT must set its priorities for assets renewals taking into account the funding constraints it faces.

Transport investment needs have outstripped available funding for many years, and the Auckland Transport Alignment Project (which AT is part of) has been searching for more sustainable funding sources since 2018. Covid-19 has reduced available funding even further, but without having any great effect on our costs.

Unlike maintenance, asset renewals can be postponed, if necessary, in order to redistribute costs over time. However, taking this approach affects levels of service and increases the level of managed risk.

Taking into account current funding constraints, AT is recommending that the asset renewals plan set out in Figure 1-5 and Table 1-3 should be adopted. This constrained renewals investment plan will:

- restrict the impacts on levels of service to less critical assets
- ensure that assets are safe and serviceable
- avoid additional costs caused by unexpected asset failure.

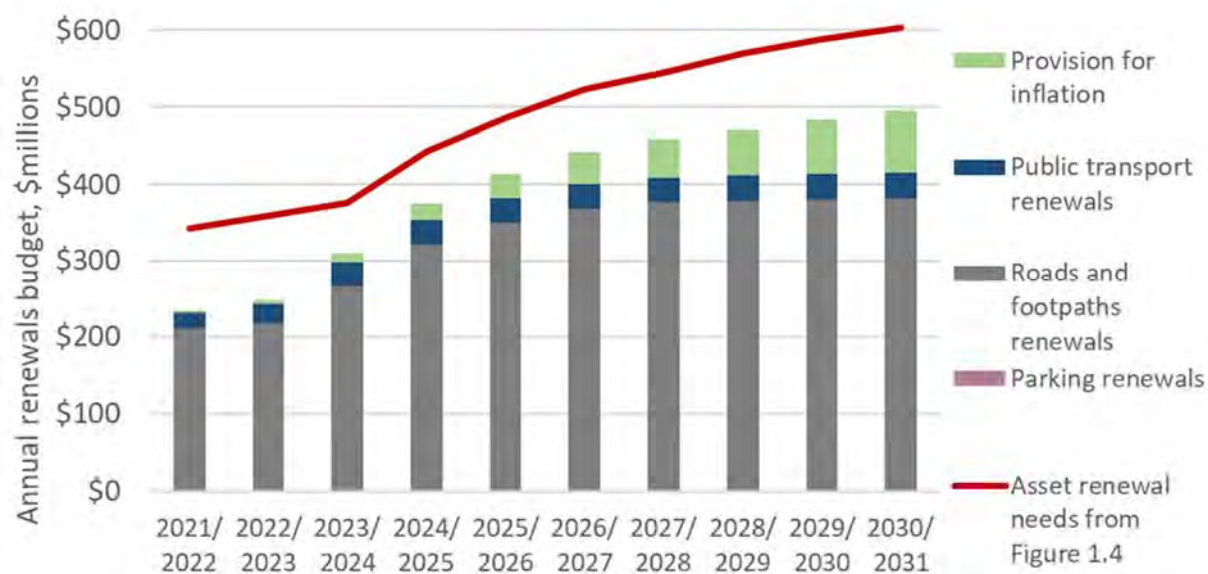


Figure 1-5: Constrained asset renewals investment (included in proposed AT budget)

Table 1-3: Constrained asset renewals investment (included in proposed AT budget)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Roads and footpaths	\$207.5	\$214.2	\$261.3	\$318.8	\$347.5	\$366.2	\$373.3	\$375.2	\$377.2	\$379.2
Public transport	\$20.7	\$24.7	\$31.3	\$31.7	\$32.3	\$31.9	\$32.7	\$33.0	\$33.2	\$33.4
Parking	\$3.8	\$4.1	\$5.2	\$3.0	\$3.0	\$3.0	\$3.0	\$2.9	\$2.9	\$2.8
Provision for inflation	\$2.3	\$6.1	\$12.4	\$21.3	\$30.4	\$40.5	\$50.3	\$59.8	\$69.6	\$79.7
Total	\$234.4	\$249.1	\$310.1	\$374.7	\$413.1	\$441.5	\$459.3	\$470.9	\$482.8	\$495.1
10-year total (inflated)										\$3,931.0

The funding-constrained renewals programme postpones most of the required initiatives to target climate change, seismic strengthening, improved resilience or local needs beyond the first 3 years.

AT undertakes to review its renewals forward works programme and to prioritise these activities within the constraints of available funding, before adopting its final AMP in early 2021.

1.4 Investment benefits

AT has assessed the anticipated benefits of its asset operations, maintenance and renewals activities using the [benefits framework](#) adopted by NZTA.

Table 1-4: Anticipated benefits from the implementation of this AMP

Investment benefits	Performance or service measure	Target 2024
---------------------	--------------------------------	-------------

Impact on system reliability	The road and public transport networks offer a reliable level of service	Maintain or improve levels of service
	Assets are in a fit-for-purpose condition	99%
Impact on social cost and incidents of crashes	Deaths and serious injuries on Auckland local roads reduce	<500
Impact on system safety	More rural travel is on roads with a three star or better safety rating	Increase
Impact on network productivity and utilisation	Average traffic speed on the freight network during the inter-peak is at least half the posted speed limit	Achieved for 85% of the freight network
Impact on mode choice	Total public transport boardings	Increase
	Active and sustainable mode share at schools and workplaces where Travelwise programme is implemented	Increase
Impact on resource efficiency	Percentage of AT street lights that are energy efficient LED	TBA
Impact on user experience of the transport system	Road roughness, as measured by smooth travel exposure for rural roads	92%
	Road roughness, as measured by smooth travel exposure for urban roads	81%

Strategic case

2.0 Strategic context

This *AT Asset Management Plan 2021* explains how Auckland Transport (AT) intends to manage its transport assets over the next 10 years.

It describes the transport assets we manage, the activities we carry out, and what it all costs. It also looks at other factors that affect how we manage the assets, such as government strategy, growth and demand, risks and constraints on investment, in particular the impacts of the Covid-19 pandemic.

This asset management plan (AMP) covers the 10 years from 2021 to 2031. It will be reviewed in 3 years, along with other key plans that guide Auckland's future. This plan itself builds on and replaces the [AT Asset Management Plan 2018](#).

2.1 Our approach to asset management planning

The approach we have taken in developing this AMP plan is illustrated in Figure 2-1.

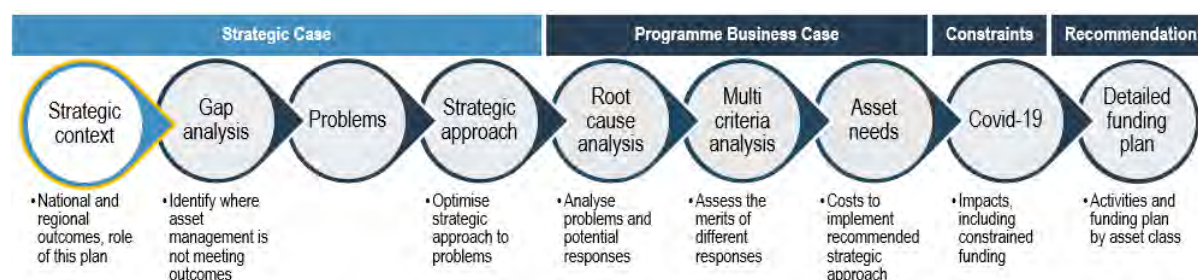


Figure 2-1: Steps in asset management planning and the structure of this plan

The plan's structure reflects these steps, with this first part of the plan discussing the strategic context within which our asset management planning activities occur, and the particular role that this AMP plays.

The AMP is itself supported by 10 detailed [asset class management plans](#): one for each of the 10 major asset classes that AT manages.

2.1.1 Assets we manage











AT is responsible for managing and controlling Auckland's local road network and public transport system, and the assets within them.

These assets are extensive, with a replacement value of \$21.1 billion, and include:

- local roads, from fence-to-fence, including the road, berm and footpath
- road assets, including bridges, retaining structures, street lights, signs and traffic signals
- public transport assets, including rail and bus stations and ferry wharves
- diesel and electric trains

Our full asset inventory is shown in Table 2-1. You can find more information about these assets in section 7.0 of this plan, and in the individual asset class management plans.

Table 2-1: AT's asset inventory

	Valuation (as at 30 June 2020)	Condition						Annual depreciation
		unknown	5 V poor	4 Poor	3 Moderate	2 Good	1 V good	
Road pavement  7,661 km of roads: 6,843 km sealed and 818 km unsealed	Replacement value \$9.392 B Depreciated value \$6.830 B	62% rated moderate or better condition						\$134 M/year
Stormwater  13,552 km of stormwater channel 89,141 catchpits 3,598 treatment devices	Replacement value \$2.862 B Depreciated value \$1.670 B	33% rated moderate or better condition						\$41 M/year
Bridges, walls and structures  1,248 bridges 4,461 retaining walls 307 km railings and fences	Replacement value \$1.816 B Depreciated value \$1.007 B	64% rated moderate or better condition						\$26 M/year
Footpaths and cycleways  7,460 km of footpaths, 350 km protected cycleways	Replacement value \$1.521 B Depreciated value \$0.863 B	98% rated moderate or better condition						\$30 M/year
Street lighting  122,347 street lights	Replacement value \$0.285 B Depreciated value \$0.165 B	93% rated moderate or better condition						\$12 M/year
Traffic systems, signs and markings  Traffic systems, including 857 controlled intersections and 163,004 signs	Replacement value \$0.211 B Depreciated value \$0.108 B	86% rated moderate or better condition						\$15 M/year
Bus network  7 bus stations 1,482 bus shelters 7 bus park-and-rides 3 electric buses	Replacement value \$0.124 B Depreciated value \$0.096 B	88% rated moderate or better condition						\$ 4 M/year
Rail network  40 rail stations 72 electric trains 5 stabling yards/ depots 22 rail park-and-rides	Replacement value \$1.364 B Depreciated value \$1.091 B	99% rated moderate or better condition						\$60 M/year
Wharves  23 wharves 5 ferry buildings	Replacement value \$0.157 B Depreciated value \$0.089 B	88% rated moderate or better condition						\$ 4 M/year
Parking  11 parking buildings, 250 off-street parking areas, 969 parking payment machines	Replacement value \$0.426 B Depreciated value \$0.249 B	87% rated moderate or better condition						\$8 M/year
Total roads and public transport assets	\$18.159 B total replacement value \$12.169 B total depreciated value							annual depreciation \$336 M/year
\$12.1 B depreciated value + 9.0 B land, corporate assets etc = AT total asset value in Annual Report of \$21.1 B								

2.1.2 How this plan fits with other transport projects and plans

AT is preparing this AMP at an exciting time in our city’s history. Auckland’s population and economy are growing faster than was predicted when the last round of plans was prepared in 2018.

Every 3 years, a new set of plans is prepared to support Auckland’s growth and success. Some of these plans focus on transport; some have a broader planning scope. Multiple agencies and documents are involved. For transport, the key documents are:

- the Auckland Transport Alignment Project, which sets out Auckland Council’s and central government’s agreed strategic direction for transport in the Auckland region
- the Regional Land Transport Plan, which sets out what AT, Waka Kotahi NZ Transport Agency (the NZTA) and KiwiRail will do over the coming 10-years to deliver on this agreed strategic direction.

This AMP is one of a set of documents that support the Regional Land Transport Plan, as shown in Figure 2-2.

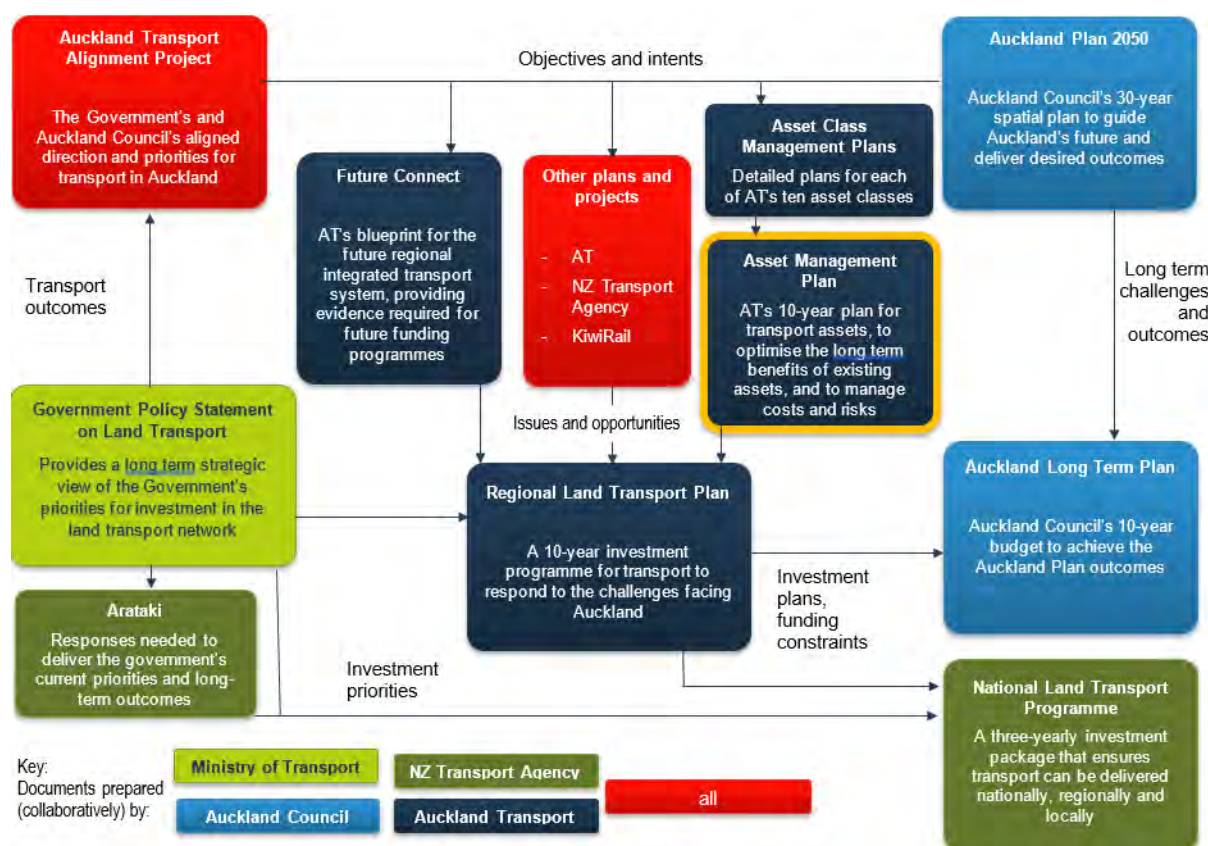


Figure 2-2: How this AMP feeds into broader strategic transport planning for Auckland

2.1.3 Role of the asset management plan

AT is committed to providing a transport network that is sustainable, fit-for-purpose and provides value for money for users and stakeholders.

To do this, we must prudently manage the network’s existing assets.

That is the function of this AMP, which sets out the business case for investing in the maintenance, operations and renewals of existing assets, so that levels of service are maintained and the investments of past generations are safeguarded for the future.

The business case in this AMP then informs the Regional Land Transport Plan.

In the 2021 Regional Land Transport Plan, as in past plans, the cost of renewing AT’s assets (as set out in this AMP) is the biggest single item in AT’s capital investment programme.

Asset management is also a significant component of operational budgets. The total cost of operating and maintaining the assets covered in this AMP is the second largest item of operational expenditure that AT faces over the coming years, the largest being the cost of contracted bus, rail and ferry services as set out in the Regional Public Transport Plan.

AT uses internationally recognised practices to guide its asset management activities. These practices are described in our [Asset Management Policy](#) and [Draft Strategic Asset Management Plan](#), which along with this AMP and the 10 asset class management plans make up AT’s asset management planning framework, as shown in Figure 2-3.



Figure 2-3: Asset Management Planning Framework

2.2 The national strategic context for this plan

2.2.1 Transport outcomes framework

The government’s transport outcomes framework makes it clear what the government is aiming to achieve through the transport system.

The framework sets strategic outcomes for the transport system, as shown in Figure 2-4. These outcomes are enduring and interconnected, and align with the Treasury’s living standards framework.

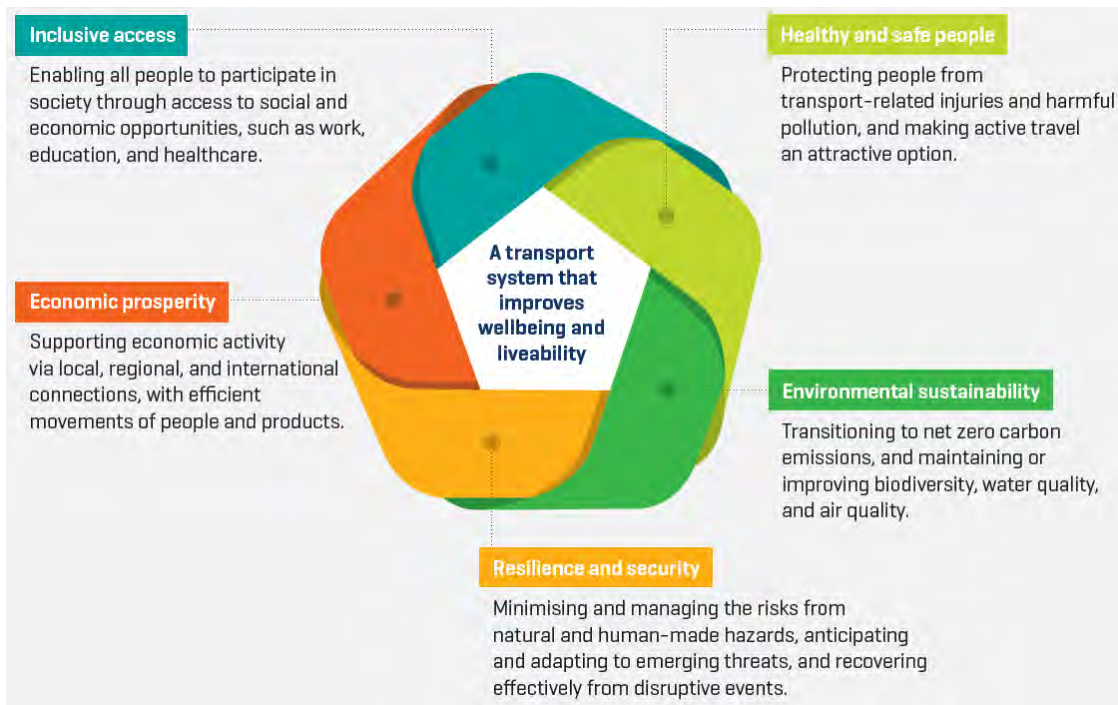


Figure 2-4: Transport outcomes framework

2.2.2 Government Policy Statement on Land Transport

The [Government Policy Statement on Land Transport](#) presents the government’s priorities for transport the next 10 years. The policy statement is reviewed every 3 years.

The 2021 policy statement has four strategic priorities, as shown in Figure 2-5.

Each priority has an associated outcome, a range of benefits, and a set of key indicators. The investment benefits and key indicators are used throughout the NZ transport sector including within this AMP, as shown in Table 1-4.

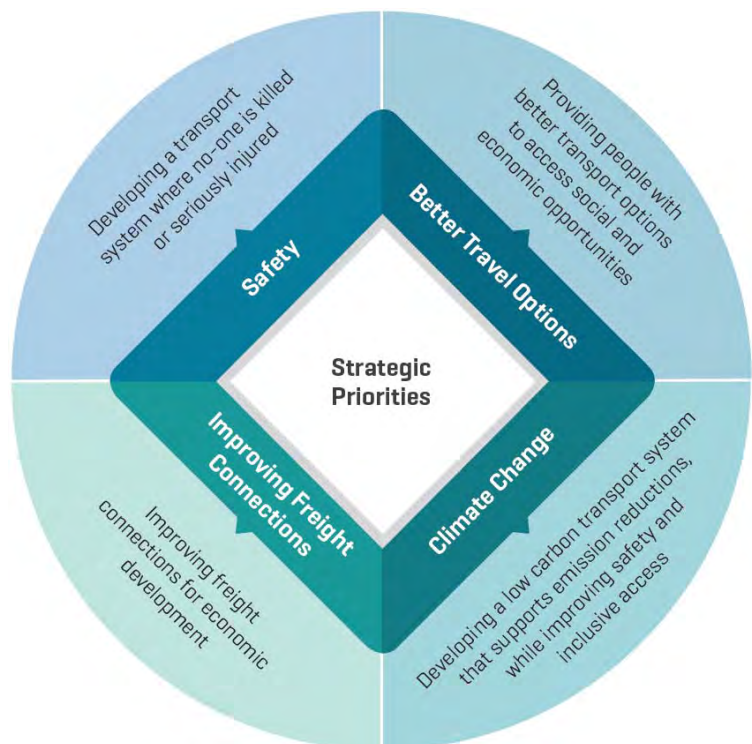


Figure 2-5: Government Policy Statement on Land Transport – priorities and outcomes

2.2.3 Waka Kotahi NZ Transport Agency – Arataki

Auckland Council and the NZTA share responsibility for Auckland’s road network.

The NZTA manages the state highway network throughout the country, including Auckland’s urban motorways and rural state highways. The NZTA also invests in approved activities to deliver the government’s transport outcomes.

The NZTA has developed Arataki; a strategic initiative to identify the challenges and responses for delivering the government’s priorities and long-term outcomes for the land transport system. Figure 2-6 provides an overview of Arataki.

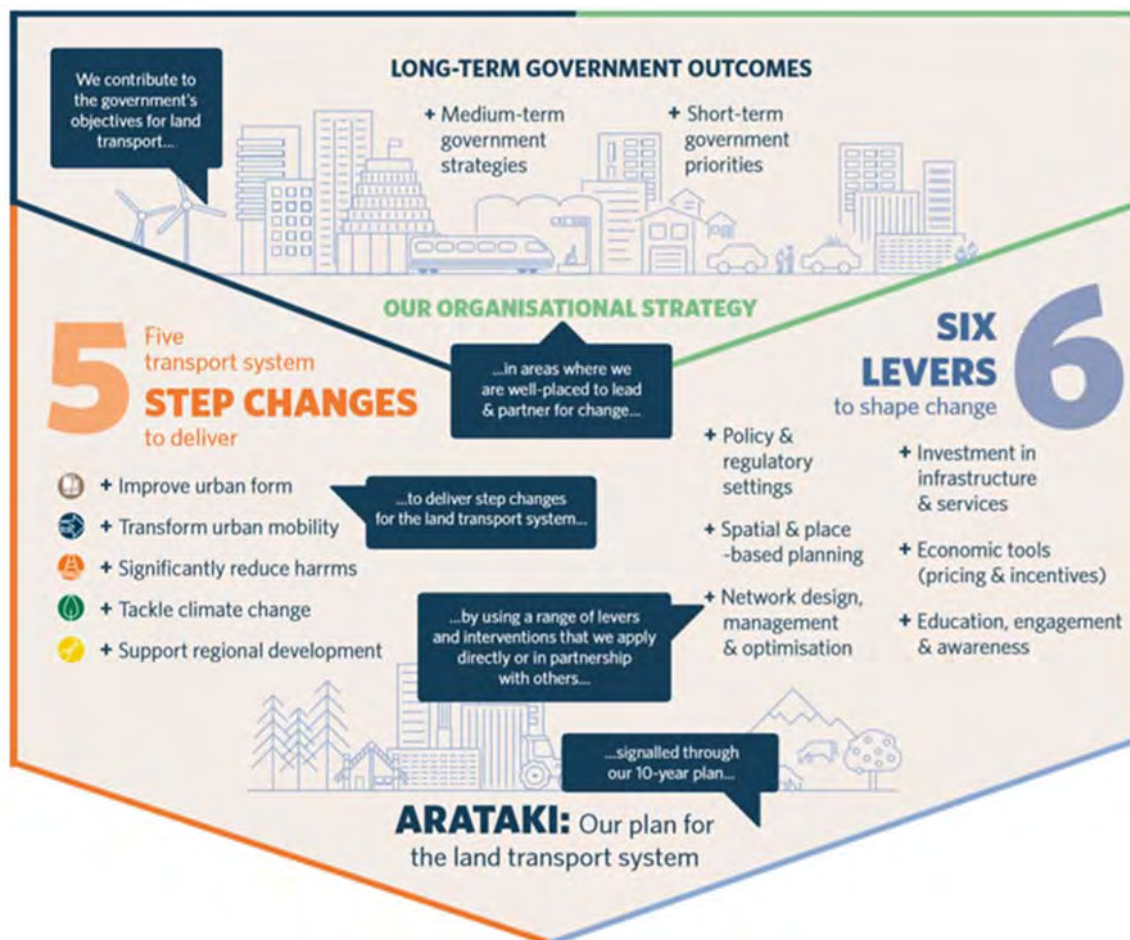


Figure 2-6: Arataki – the NZTA’s strategic plan for the land transport system

Arataki also includes a section specific to Auckland, which is consistent with the Auckland Transport Alignment Project, as described in section 2.3.3.

2.2.4 One Network Framework

The One Network Framework is a continuous improvement project, led jointly by the NZTA and Local Government New Zealand. It has three key components:

- [One Network Framework](#) – a method of classifying roads based on place and movement
- [One Network performance measures](#) – nationally agreed indicators of customer levels of service for NZ roads, based on six customer outcomes
- [One Network road classification](#) – classifies local roads into six classes based on:

- o traffic volumes
- o importance as freight routes
- o connections to important destinations like hospitals, airports or ports
- o public transport usage
- o use as tourist routes
- o provision of access for communities.

2.2.5 One Network Framework

The One Network Framework expands on the One Network road classification, to look at the importance of urban roads in a more comprehensive way. The classification of Auckland roads in the One Network Framework is not yet complete, but will balance:

- place – by recognising the importance of adjacent land use and the significance of particular places to people and communities
- movement – by expanding on data about vehicle movements, to quantify the importance of roads for freight, deliveries, public transport, walking and cycling.

By aligning with the One Network Framework, we can demonstrate that proposed investments represent the right activity, in the right place, at the right time.

2.2.6 One Network performance measures

The One Network performance measures are a nationally agreed set of measures that align to the customer outcomes shown in Figure 2-7. AT regularly measures and reports on these performance measures, and the results are published nationally by the [Road Efficiency Group](#).

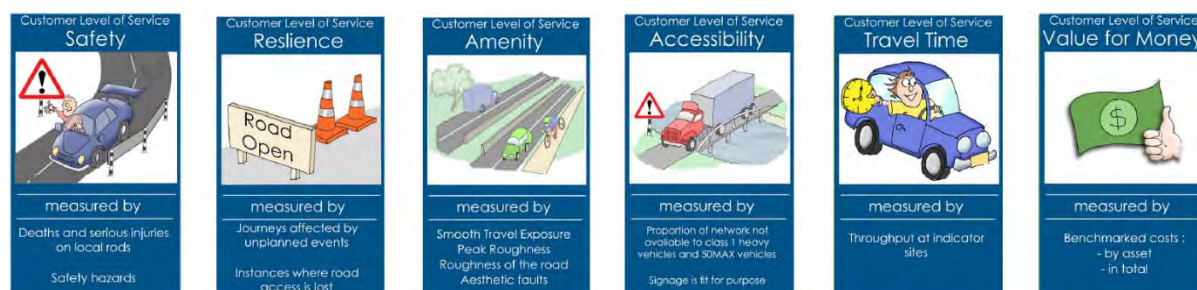


Figure 2-7: One Network customer outcomes and performance measures

2.2.7 One Network road classification

The One Network road classification for Auckland roads, as at July 2029, is summarised in Table 2-2. Traffic volumes and road classifications are reviewed annually.

Table 2-2: One Network road classification of Auckland roads

Class	Regional	Arterial	Primary collector	Secondary collector	Access	Low-volume
Length	372km	1,079km	982km	2,108km	1,759km	1,256km
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

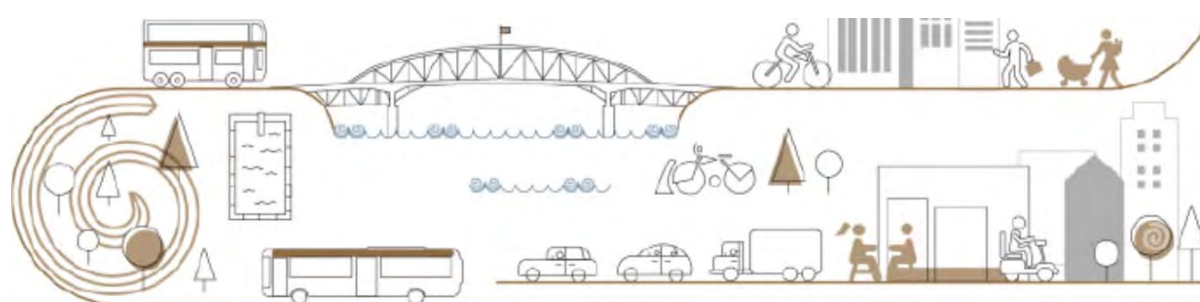
A key objective of the One Network Framework is to focus effort on those roads where it will make the most difference. As can be seen from Table 2-2, the roads with the two highest classifications in the Auckland network – regional and arterial roads – make up only 19 per cent of the network by length, but carry more than three-quarters (78 per cent) of the traffic.

2.3 The regional strategic context for this plan

2.3.1 Auckland Plan 2050 transport and access outcome

The Auckland Plan 2050 has six outcomes, one of which is ‘transport and access’, as summarised in Figure 2-8.

This AMP aims to help deliver the transport and access outcome, with a particular focus on the first of the seven focus areas – to make better use of existing transport networks.



DIRECTION	FOCUS AREA
Direction 1 Better connect people, places, goods and services	Focus Area 1 Make better use of existing transport networks
Direction 2 Increase genuine travel choices for a healthy, vibrant and equitable Auckland	Focus Area 2 Target new transport investment to the most significant challenges
Direction 3 Maximise safety and environmental protection	Focus Area 3 Maximise the benefits from transport technology
	Focus Area 4 Make walking, cycling and public transport preferred choices for many more Aucklanders
	Focus Area 5 Better integrate land-use and transport
	Focus Area 6 Move to a safe transport network, free from death and serious injury
	Focus Area 7 Develop a sustainable and resilient transport system

Figure 2-8: Auckland Plan transport and access outcome – strategic directions and focus areas

2.3.2 Te Aranga Māori – Māori design principles

AT has developed a [Māori Responsiveness Plan](#) to guide how it contributes to the outcome in the Auckland Plan 2050 that: 'A thriving Māori identity is Auckland's point of difference in the world'.

One of the ways that AT will do this is through use of Te Aranga Māori or Māori design principles. Recent AT capital projects, including Ōtāhuhu Transport Interchange and Manukau Bus Station, have set a new standard for integrating Te Aranga Māori into Auckland's transport infrastructure.

The Māori artworks and design features in these locations are not just decoration. Most hubs on Auckland's transport network were important places long before the arrival of cars, buses or trains. By bringing the stories of the past into the present, AT acknowledges the role of the tangata whenua who have the longest and deepest connection to these significant places.



Figure 2-9: Detail of Ōtāhuhu Rail Station

The need to apply Te Aranga Māori principles continues after the building's construction is complete. Everyone who works in these buildings is advised to take time to learn about the place and about the stories which the artworks and Māori design features tell.

All AT staff, wherever they work, are encouraged and supported to learn the skills and competencies they need to engage confidently and effectively with Māori.

2.3.3 The Auckland Transport Alignment Project

The [Auckland Transport Alignment Project](#) brings together central government and Auckland Council to strategically align transport objectives and investment priorities for Auckland. It includes an agreed ten year, \$31.4 billion investment package that guides the Auckland Regional Land Transport Plan and the National Land Transport Programme.

The investment package focuses on encouraging the shift from private cars to public transport, walking and cycling and addressing Auckland's longer-term challenges of climate change and housing development. The great majority of investment will be in assets which AT will be required to maintain and, eventually, to renew. The programme therefore includes a significant investment in AT's maintenance and renewals programme, as well as increased operating expenditure for public transport.

Table 2-3: Auckland Transport Alignment Project 2021 investment package

Investment Area	ATAP 2021-2031
Operational Cost (net of Revenue)	9,124,000
Asset Renewals	4,491,000
Projects	
Rapid Transit	7,568,000
Strategic & Local Roads	4,166,000
Walking & Cycling & Local Board Initiatives	1,466,000
Safety	1,118,000
Bus & Ferry	1,167,000
Optimisation & Technology	742,000
Spatial Priorities	1,273,000
Planning for the future	276,000
TOTAL	31,391,000

The Auckland Transport Alignment Project has developed a set of objectives to guide the 2021 Regional Land Transport Plan and its companion documents, including the preparation of this AMP. The strategic objectives are:

Asset management	Prudent management of Auckland's transport assets
Safety	Make the transport system safe by eliminating harm to people
Travel choices	Accelerate better travel choices for Aucklanders
Access and connectivity	Better connecting people, places, goods and services
Growth	Enabling Auckland's growth through a focus on intensification in brownfield areas, with some managed expansion into emerging greenfield areas
Climate change and the environment	Improving the resilience and sustainability of the transport system, and significantly reducing the greenhouse emissions it generates
Value for money	Ensuring value for money across Auckland's transport system through well-targeted investment choices

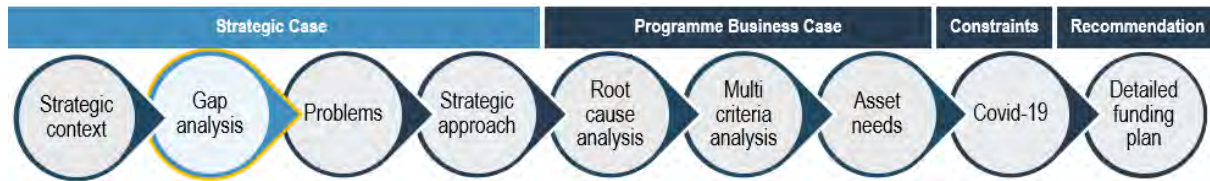
These principles are a shorthand way of expressing our overall strategic direction for transport in Auckland – a direction that is already well aligned with that being sought by central and local government and supported by the Auckland community.

This alignment is demonstrated in Table 2-4.

Table 2-4: Strategic alignment between ATAP, Government investment benefits, and AT's key performance indicators

ATAP/RLTP outcomes	Govt investment benefits	Key performance indicators
Prudent management of Auckland's transport assets	Auckland Council Group requirements	AT is responsive to customers
		AT is responsive to local boards
Make the transport system safe by eliminating harm to people	Impact on social cost and incidents of crashes	Deaths and serious injuries are reduced
	Impact on system safety	Assets meet Vision Zero safety standards
		AT staff and suppliers work safely
		Hazards are eliminated or minimised
Impact on perception of safety and security	Customers feel safe	
Accelerate better travel choices for Aucklanders	Impact on mode choice	Increased public transport boardings
		Effective Rapid and Frequent public transport networks
	Impact of mode on physical and mental health	Increased walking and cycling
Better connecting people, places, goods and services	Impact on user experience of the transport system	Customers are satisfied with assets
		Customers are satisfied with their PT service
		Road assets are in acceptable condition
		Assets are renewed when appropriate
		The transport system is reliable
		Assets are in acceptable condition
		The movement of freight is facilitated
Improving the resilience and sustainability of the transport system, and significantly reducing the greenhouse emissions it generates	Impact of air emissions on health, Impact on greenhouse gas emissions	Emissions to air are reduced
		Customer appreciate air pollution initiatives
	Impact of noise and vibration on health	Customer appreciate noise pollution initiatives
	Impact on water	Stormwater is well managed
Ensuring value for money across Auckland's transport system through well-targeted investment choices	Impact on resource efficiency	Resources are used efficiently
	Value for money	Costs are reasonable for the work done
		Costs are recovered from users where appropriate

3.0 Gap analysis



In this section we develop the strategic case that underpins this AMP and identify how our asset management activities can best achieve national and regional strategic outcomes.

We begin this process with a gap analysis, where we assess our progress against key principles and analyse where we are falling short.

From the gap analysis we can identify problems that are affecting Auckland's transport network.

In the final step of the strategic case we develop a recommended strategic approach for addressing the problems, filling the gaps, and ultimately achieving the strategic outcomes.

From the strategic analysis, we move into the programme business case, looking in more detail at the separate asset classes and what actions are needed.

AT assesses how well it is doing in delivering on strategic outcomes against five headings, which are our shorthand way of expressing the Auckland Transport Alignment Project objectives in Table 2-4: Strategic alignment between ATAP, Government investment benefits, and AT's key performance indicators Table 2-4.

- Asset management
- Safety
- Travel choices
- Access and connectivity
- Growth
- Climate change and the environment
- Value for money

In this section, we provide a high-level summary of how our assets and services are currently delivering against each of the principles, and identify any areas where there are gaps or shortfalls in our asset management practices.

3.1 Asset management

AT's approach to prudent management of Auckland's transport assets is informed by the Māori concept of kaitiakitanga.



Kaitiakitanga encompasses the need for people to be actively involved in maintaining those things that previous generations have left in our care, so we can be proud of what we leave for future generations. The concept is not limited to physical objects, but includes knowledge and skills, and has a spiritual dimension.

The responsibilities of asset management include the following key tasks:

- Looking after assets for the long term, balancing costs and benefits across the whole life of the asset

- maintaining assets in a fit-for-purpose condition
- managing risks and resilience

If AT neglected or ignored asset deterioration and failed to maintain and renew network assets in a timely way, this would create significant issues for the future, including declining levels of service, increased asset risks and a significant backlog of damaged or deteriorated assets which it would be more expensive to rectify in the future.

3.1.1 Using whole-of-life asset management

AT adopts a whole-of-life approach to asset management. The approach acknowledges that any decision to construct a public asset brings with it the responsibility to operate, maintain, renew and dispose of that asset, as shown in Figure 3-1.



Figure 3-1: The asset management lifecycle

Source: National Asset Management Support (NAMS+)

For a given asset, there will be an optimal balance between the construction cost, the costs of operations and maintenance, the cost and timing of renewals, and the disposal method or residual value, to deliver the benefits of that asset and manage the risks of asset failure at the best whole-of-life cost.

Acquisition – the impact of new assets

Over the next 10 years, the number and extent of assets in Auckland’s transport network will increase due to growth and of the capital investment programme. This increase will create a corresponding increase in AT’s requirements for operations, maintenance and renewals funding each year.

One of the major sources of new assets will be the Auckland Transport Alignment Project, which sets out a 10-year, \$31 billion capital investment programme to address Auckland’s transport challenges by constructing new public transport facilities, walking and cycling connections, and roads.

While some of the new facilities created under the project will be government investments and maintained by KiwiRail or the NZTA, the majority of investment will be in assets which AT will be required to maintain and, eventually, to renew. The programme therefore includes a significant investment in AT's maintenance and renewals programme, as well as increased operating expenditure for public transport, as summarised in Table 3-1.

Table 3-1: Auckland Transport Alignment Project 2018 – capital investment with AT opex impacts

Investment Area	ATAP 2021-2031
Operational Cost (net of Revenue)	9,124,000
Asset Renewals	4,491,000
Projects	
Rapid Transit	7,568,000
Strategic & Local Roads	4,166,000
Walking & Cycling & Local Board Initiatives	1,466,000
Safety	1,118,000
Bus & Ferry	1,167,000
Optimisation & Technology	742,000
Spatial Priorities	1,273,000
Planning for the future	276,000
TOTAL	31,391,000

Source: [Auckland Regional Land Transport Plan](#)

In addition to these public investments, new roads and other assets will be constructed by developers in major development areas, both within urban Auckland (brownfields developments) and on the urban fringe (greenfields developments).

Overall, AT estimates that there will be 74km of new roads added to the network each year over the coming decade, a growth rate of 1.1 per cent. Other road assets, including kerb and channel, footpaths and catchpits will be added at a similar rate. Existing roads will also become busier, and need to be made safer, so other assets including street lights, traffic signals and off-road cycleways will increase at an even faster rate than overall road growth.

Two vital asset management functions that need to be in place when new assets are acquired are:

- design advice – by influencing the detailed design of assets we can better manage their whole-of-life costs and the benefits they deliver. This advice begins with the [Transport Design Manual](#), and includes specialist design advice on individual projects, whether constructed by AT or private developers
- asset handover processes – where capital projects are completed and the asset handed to AT for ongoing maintenance and eventual renewals. The quality of asset information captured at this stage can have a material impact on the costs and benefits of the asset over its lifecycle, and supports ongoing asset management.

Operations activities and costs

The past costs of operations for AT's existing road, public transport and parking assets are shown in Figure 3-2.

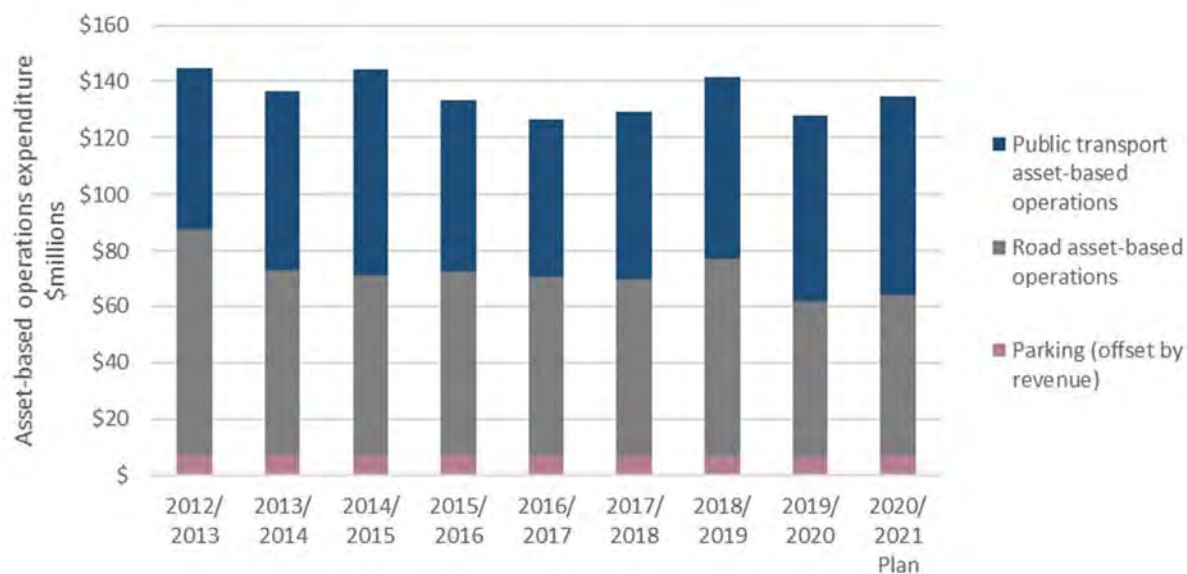


Figure 3-2: Past (actual) and current (planned) costs to operate road and public transport assets

Three main trends are evident from the data.

- Public-transport asset-based operations have increased steadily since 2016/2017, with the expansion of the public transport network. These costs cover staff and security, cleaning, electricity costs and other operating costs for bus, rail and ferry stations. Before 2016/2017, costs appear higher because some maintenance costs were not budgeted separately and appeared as operations costs.
- AT’s total spending on road-asset-based operations decreased in June 2013 and again in June 2019, when AT and Auckland Council agreed to transfer responsibilities for mowing, street gardens and town centre cleaning to Auckland Council. AT’s current responsibilities for road-asset-based operations include sweeping roads, clearing stormwater channels, providing electricity to run street lights and running the AT Operations Centre, including controlling Auckland’s traffic lights.
- There has been no significant change over time in the operations costs of carparking.

Future operations costs will increase as AT’s road and public transport assets grow, as shown in Table 3-2.

These increases are the inevitable consequence of new assets being created through AT’s capital investment programme and acquired when new subdivisions are completed. Our modelling indicates that by 2030/2031, 13.7 per cent of road operations budgets, and 18.8 per cent of public transport operations budgets, will be spent on operating assets that have been added to the network since 2018.

Table 3-2: Consequential operations costs, as percentage of operations budgets

	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Road consequential operations	3.6%	4.9%	6.1%	7.3%	8.7%	9.9%	11.1%	12.4%	13.7%	13.7%
Public transport consequential operations	4.6%	5.2%	5.3%	5.8%	7.4%	16.4%	17.0%	17.6%	18.2%	18.8%

The costs in Table 3-2 do not include any provision for inflation or for operation of the City Rail Link's three new, underground stations.

Maintenance activities and costs

AT's key maintenance activities include:

- fixing potholes and other localised faults in road pavements
- emptying catchpits, and repairing damaged kerb and channel and minor culverts
- painting and making minor repairs to bridges, walls and structures
- repairing cracks and trip hazards in footpaths and cycleways
- replacing street lights, traffic signal lights and other traffic system components
- maintaining buildings including bus, rail and ferry stations
- conducting scheduled maintenance for mechanical and electrical assets, including lifts, escalators, pumps, ventilation systems and fire control systems.

Unlike operations, where costs can be incurred from day one, maintenance costs can be low for new assets. These costs typically increase as an asset nears the end of its useful life, and eventually a point is reached where it is more cost effective to renew the asset, than to continue maintaining it.

AT's public transport network is still relatively new, with most assets constructed in the decade between the openings of Britomart in 2003 and Panmure Station in 2014. Since 2012, maintenance costs for public transport assets have increased steadily, due to the expanding public transport network and ageing infrastructure. Maintenance costs for bus, rail and ferry stations will continue to increase over time as assets within these stations wear out and the need for repairs and minor replacements grows.

For road assets, total maintenance expenditure actually reduced from \$50.7 million in 2012/2013 to \$46.7 million in 2018/2019, as shown in Figure 3-3.

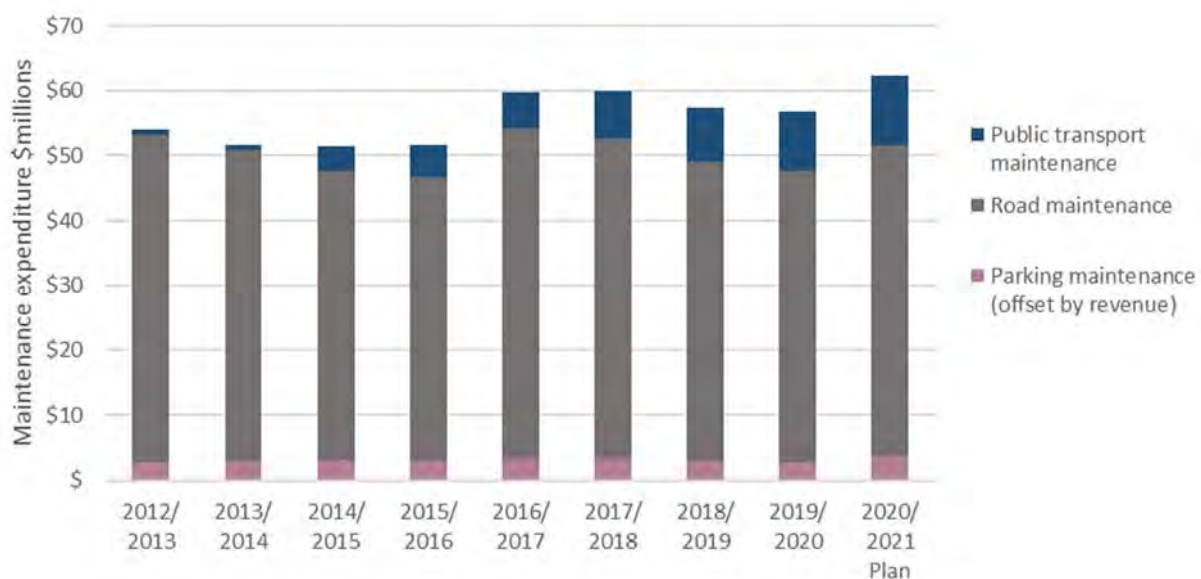


Figure 3-3: Past (actual) and current (planned) costs to maintain road and public transport assets

Source: AT financial model

Trends over time in road maintenance costs are shown more clearly in Figure 3-4, where the budgets in Figure 3-3 have been adjusted by:

- removing expenditure on slips and retaining walls, which varies year-on-year depending on major storms
- adjusting for inflation, by converting budgets to \$2019/2020 figures using factors from the [Reserve Bank of NZ](#)
- adjusting for growth in the total length of the road network.

With these adjustments, there is a clear trend of declining expenditure on road maintenance, from \$7,200 per kilometre of road in 2012/2013 to \$6,000 in 2019/2020. In practice, this means that proactive maintenance – sealing road cracks, for example, or clearing catchpits – has had to be delayed in order to deal with customer complaints and immediate safety risks. Over time, the apparent savings in maintenance expenditure are likely to result in shorter asset life and higher whole-of-life costs.

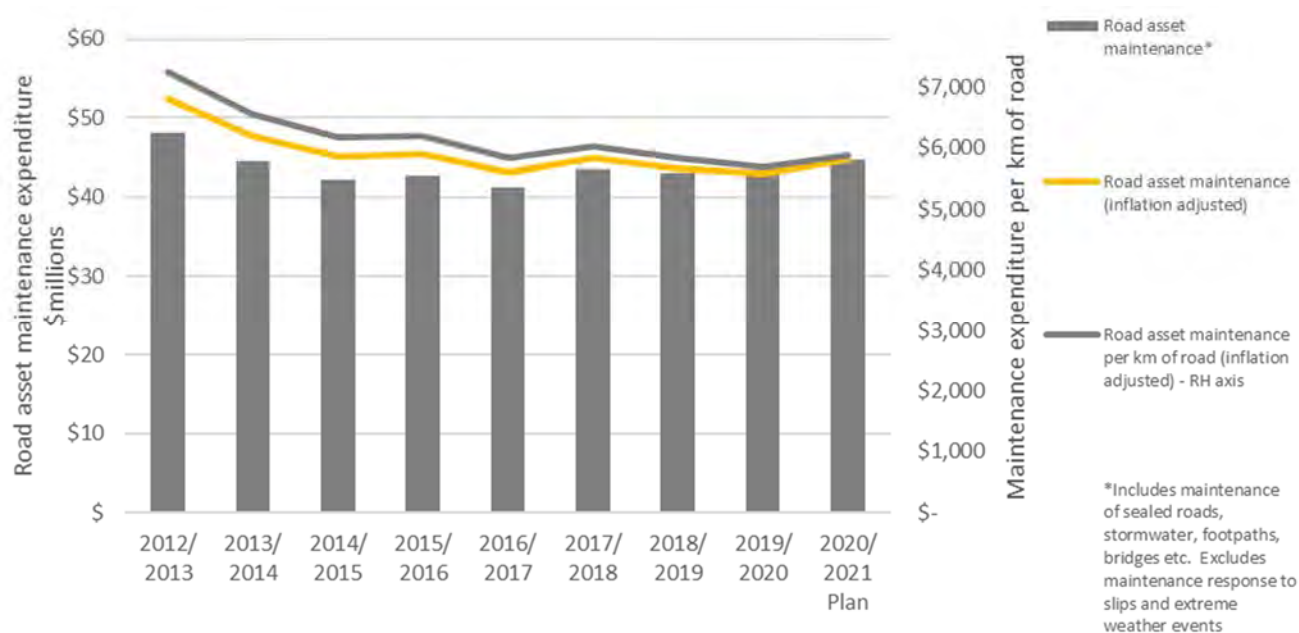


Figure 3-4: Past (actual) and current (planned) road asset maintenance costs, adjusted for inflation and asset growth

The two most significant areas of concern are routine maintenance for sealed roads and stormwater maintenance. It is a false economy not to invest in these activities, as neglecting maintenance issues can exacerbate safety risks and accelerate long-term asset damage.

Looking to the future, maintenance needs will inevitably increase as new assets are added to the road and public transport networks and as existing assets age.

The proportion of forecast maintenance expenditure which will be spent on new assets is shown in Table 3-3. By 2030/2031, 7.7 per cent of total road maintenance budgets, and 11.4 per cent of total public transport maintenance budgets will be spent on maintaining assets that have been added to the network since 2018.

Table 3-3: Consequential maintenance costs, as a percentage of forecast maintenance budgets

	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Road consequential maintenance	0.7%	1.1%	1.6%	2.1%	2.6%	3.2%	3.7%	4.5%	5.2%	5.7%
Public transport consequential maintenance	1.0%	2.5%	3.5%	4.4%	5.5%	6.8%	8.0%	9.1%	10.2%	11.3%

Renewals

In most years, renewals for road and public transport assets is the largest item of expenditure in AT’s budget, at around \$200 million per year. Road asset renewals peaked in 2017/2018 at \$225 million, as shown in Figure 3-5.

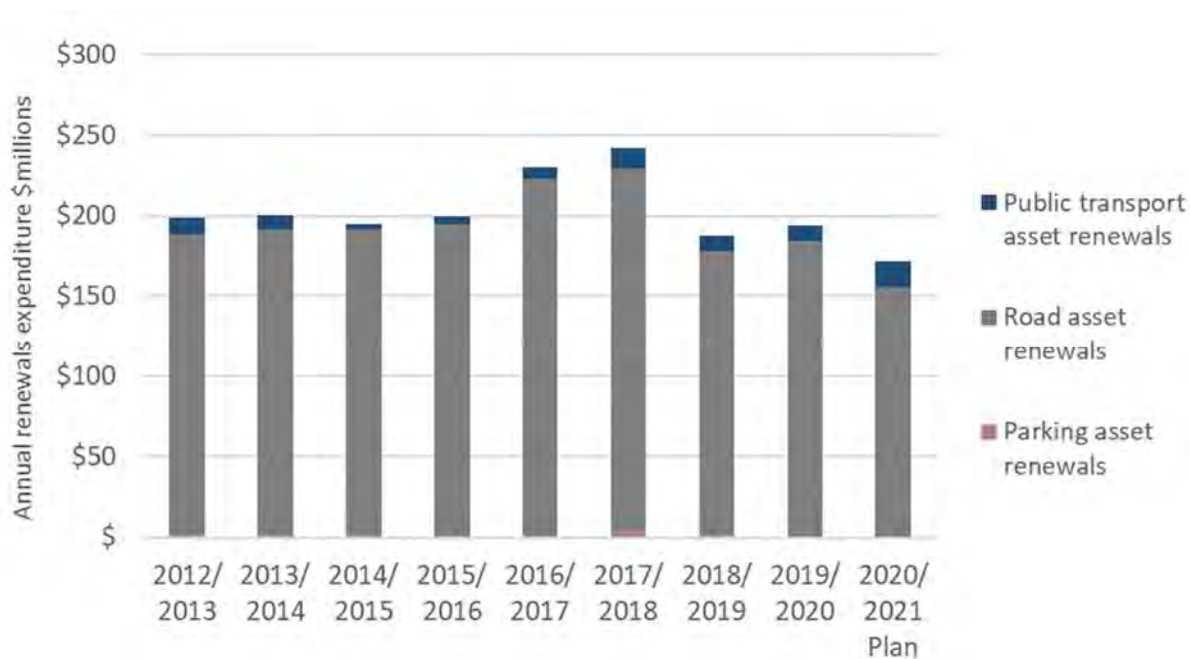


Figure 3-5: Past (actual) and current (planned) costs to renew road and public transport assets

AT’s renewals programme for roads was adjusted downwards for the 3 years from 2019/2019 to 2020/2021. This was done by using the One Network road classification to focus renewals on roads where they would make the most difference. Regional and arterial roads carry the bulk of Auckland’s traffic. By prioritising these roads for renewal, AT was able to make significant cost savings with minimal impact on customer experience.

Less busy roads will still need renewal eventually, so the impact of these changes was only to postpone expenditure in the short term, not reduce it in the longer term. As a result, we expect renewal requirements for road assets will return to the upward trends of past years.

Disposal

Although asset disposal is an important part of whole-of-life asset management, it is a relatively minor aspect of AT’s operations. In a growing city, relatively few assets are physically removed from the road network. When assets are removed, they are disposed of safely and in accordance with good environmental practice.

3.1.2 Maintaining assets in fit-for-purpose condition

Prudent asset management includes ensuring that assets are in a fit-for-purpose condition for current customers, and that future generations will not bear an undue cost due to asset deterioration.

AT regularly assesses asset condition through specialist inspections, following protocols and frequencies that are appropriate to the asset. Details of how the condition of particular assets is defined and measured is contained in the individual asset class management plans. All inspections are designed to provide a measure of condition for particular assets: graded from 1 (very good) to 5 (very poor).

Currently, asset condition is known for 71 per cent of AT’s assets (by value). Of these, 87 per cent are in very good, good or moderate condition, with 9 per cent in poor condition, and 4 per cent in very poor condition. These proportions vary by asset class, as shown Figure 3-6.

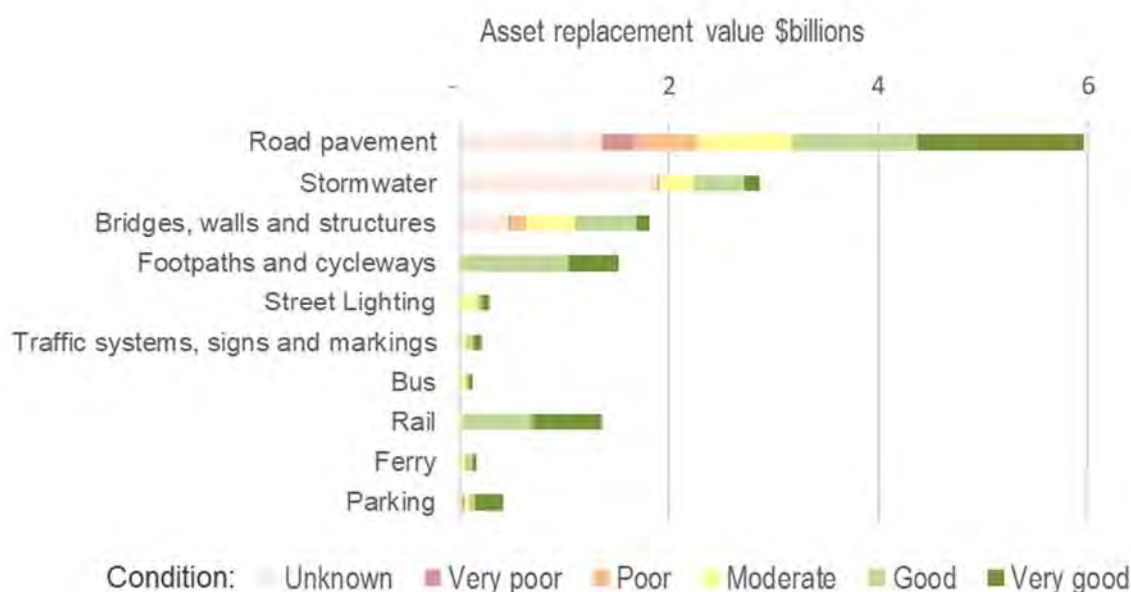


Figure 3-6: Asset condition by value, for each asset class

Source: Inventory and condition reports June 2020, Asset valuation 2020

Almost a third (29%) of AT assets, by value, are in unknown condition. For bridges, a condition survey is underway of footpath bridges, which make up the majority of bridges in unknown condition. The two asset classes for which there are significant gaps in condition data which will not be closed in time for the final AMP are pavement base and stormwater.

Condition of road pavement base assets

The road pavement base is AT’s most valuable asset, and also has the most significant value of assets (\$275 million) in very poor condition.

The driving surface of most sealed roads in Auckland consists of a flexible asphalt or chipseal surface over a basecourse of crushed rock. Renewing the surface (resurfacing) is a relatively simple process, but renewing the pavement base (road rehabilitation) is a significant project, involving removing the surface and re-laying the pavement base.

Car traffic has almost no effect on the pavement base, provided that the road is well designed and the drainage system is effective. However, sustained use of a road by heavy trucks or buses will compact the crushed rock that makes up the basecourse, leading to rutting and deformation. An emerging problem is damage to the road pavement base on the urban fringe, due to the large volume of heavy vehicles servicing land development and building.

Since 2018, AT has increased its monitoring of parts of the southern road network, with data now collected every 6 months. These surveys show rapid deterioration in pavement condition, due to increased loading from development and intensification. Figure 3-7 shows some examples of pavement failure in these areas.




<p>Brookby Road (1,255 heavy vehicles per day counted in Nov 2018): Access to Brookby Quarry. Failure modes include extensive flushing, failed maintenance patches, cracking and pumping of fines, and rutting.</p> 	<p>Hunua Road through Hunua Gorge (1,121 heavy vehicles per day counted in Nov 2018): Access road to Hunua Quarry. Failure modes at this site include fatigue cracking, flushing, potholes and shoving.</p> 
<p>Whitford Park Road (1,266 heavy vehicles per day counted in Nov 2018): Access road to Whitford landfill. Failure modes include fatigue cracking, with pumping of fines.</p> 	<p>Mill Road (3,111 heavy vehicles per day counted in March 2019): Failure modes at this site include fatigue cracking, pumping of fines and extensive flushing.</p> 

Figure 3-7: Impacts of heavy vehicles on selected roads in the southern rural road network

Condition of stormwater assets

Road stormwater services on the road corridor are a joint collaborative effort between Auckland Transport (AT) and Auckland Council Healthy Waters. AT has overriding responsibility for catchpits, subsoil drainage, and kerb and channel assets in the road corridor, with Healthy Waters delivering operations and maintenance services on these assets. Healthy Waters has overriding responsibility and is the specifier for stormwater services.

AT and Healthy Waters are working together to develop an effective programme for inspecting AT's underground stormwater assets. As a result, stormwater assets with a total value of \$1.9 billion are in unknown condition, which is a very significant concern.

3.1.3 Managing risks and resilience, and responding to climate change

Risk management is a central aspect of asset management. It is our task as asset managers to recommend the best achievable balance between costs, risks and levels of service as shown in Figure 3-8. AT's overall approach to risk is set out in its [Risk Management Policy](#).



Figure 3-8: Balancing cost, risk and levels of service

As asset managers we are most concerned about risks that physically damage assets. These include natural hazards and extreme weather. Sea-level rise and other natural hazards are forecast to become both more frequent and more extreme over the coming decade due to climate change.



Figure 3-9: Waves overtop the Tāmaki Drive seawall during Cyclone Ita in 2014

AT already experiences significant costs in years with extreme storm events. As these events become more common, and as the impacts are exacerbated by sea-level rise, it is important to invest in improving the transport network's resilience.

The most significant resilience investment proposed in this AMP is an accelerated programme of retaining wall improvements, which has both a capital and a renewals component.

More detail of proposed resilience improvements are contained in sections 3.6, 0 and 7.0 of this plan. These improvements were developed using our Risk Management Framework, government guidance and the wider body of scientific evidence available.

3.1.4 Gap analysis – asset management


Asset management is the science of looking after assets for the long term, balancing costs and benefits across the whole of the life of each asset. Auckland is a growing city with an ambitious programme of transport investment, and a growing asset base. This in turn inevitably leads to increased costs.

Overall, AT is demonstrating that we manage Auckland's transport assets prudently. We understand and manage asset condition, and maintain assets in a suitable condition for current customers and future generations. However, damage to the road pavement base from heavy trucks, and the level of

knowledge about underground stormwater assets, are two significant gaps in our efforts to maintain assets in fit-for-purpose condition.

With respect to risk and resilience, AT’s work on asset criticality has identified significant opportunities to proactively manage risk and improve resilience. This will become ever more important as Auckland experiences more frequent extreme weather events, and forecast sea-level rise, driven by climate change.

The key gaps with respect to asset management are summarised below.

RLTP outcome		How AT’s asset management is currently performing
Asset management 	Delivering	AT is delivering the outcome of maintaining the condition and value of its asset portfolio.
	Gap	<p>We must improve the timeliness of road pavement renewals, especially in new development areas, and on key quarry and landfill routes where heavy vehicles are causing cracks, rutting and other damage.</p> <p>We must improve our knowledge of stormwater assets, and how stormwater risks will increase with urban intensification and climate change.</p>

3.2 Safety

AT puts safety front and centre of everything we do. Decisions made in this AMP need to contribute to [Vision Zero for Tāmaki Makaurau](#), our multi-agency road map towards a safe transport system, free from death and serious injury.



3.2.1 Safety is a major issue for Auckland’s transport network

Auckland has a transport safety problem. There is an increasing long term trend of death and serious injury on our roads, as shown in Figure 3-100.

Although fewer people were killed or seriously injured in 2019 than in any of the previous five years, there were still 533 deaths or life-changing injuries on Auckland local roads.

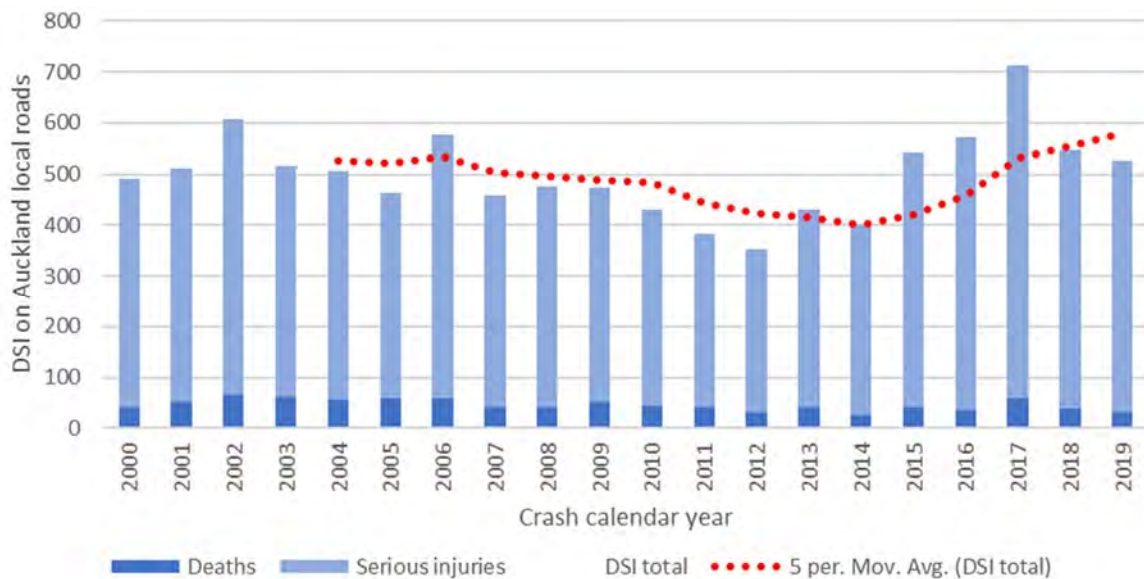


Figure 3-10: Death and serious injury on Auckland roads 2000-2019

Source: Crash Analysis System / AT records

Nearly half of the people who die or are seriously injured on Auckland roads are either walking, cycling or riding a motorbike, and this proportion has increased significantly over the past decade.

It is important to compare these statistics with road safety statistics for across New Zealand and the world, so we can learn from other regions. The One Network Framework recommends two measures for comparing road trauma:

- collective risk – deaths and serious injuries per kilometre of road
- personal risk – deaths and serious injuries per kilometre of travel (by mode).

Using collective risk as a measure, Auckland has the highest rate of deaths and serious injuries per kilometre of road in New Zealand, as shown in Figure 3-11.

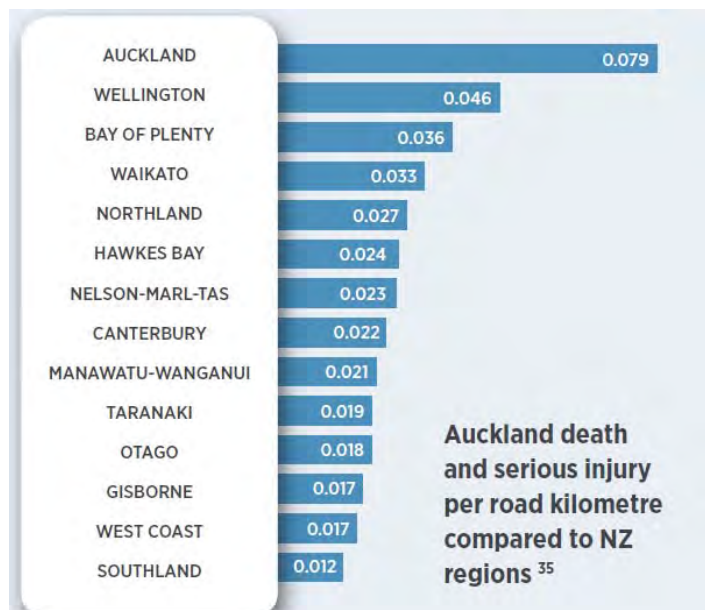


Figure 3-11: Collective risk – deaths and serious injuries per kilometre of road for New Zealand communities

Source: Vision Zero for Tāmaki Makaurau

Auckland also has the busiest roads in New Zealand, so the personal risk per km of travel for vehicle drivers is generally low compared with other regions.

Using data from the NZTA's Communities at Risk Register, we can create a profile of the risk factors that contribute to road trauma in Auckland, as shown in Figure 3-12. This profile shows that crashes typically involve intersections or distractions, and that on average 304 pedestrians, cyclists and motorcyclists were injured out of a total of 652 deaths and serious injuries. On rural roads, a high proportion of crashes involve loss of driver control, which can have deadly consequences.

Crash factors	Auckland deaths and serious injuries
Total deaths plus serious injuries	652
Young drivers 16 to 24	183
Alcohol and/or drugs involved	122
Speed (too fast for conditions)	157
Urban intersections	193
Rural intersections	33
Loss of control on rural roads	125
Motorcyclist involved	134
Cyclist involved	51
Pedestrian involved	119
Distraction a factor	56
Fatigue a factor	28
Older road users 75+	47
Seatbelt not worn	37

Figure 3-12: Contributing factors for deaths and serious injuries on Auckland roads (5-year average to December 2019)

Source: NZTA [Communities at Risk Register](#). A single crash can involve multiple crash factors.

3.2.2 Vision Zero for Tāmaki Makaurau strategy

The government has set a 'Road to Zero' target to reduce deaths and serious injuries on New Zealand roads by 40 per cent between 2017 and 2030. AT's Vision Zero for Tāmaki Makaurau strategy is working to achieve this, and in the longer term to achieve a road network free from death or serious injury.

The strategy acknowledges that the direct impacts on families and communities of road trauma is only part of the picture. When people feel unsafe walking, cycling or riding a motorbike around Auckland this undermines our purpose of connecting people and communities.

People have valid concerns about their safety, and this in turn means more people choose to drive, and more children are being driven to school. More car travel, and especially short car journeys, leads to unsustainable levels of pollution and congestion, lower levels of physical activity, and an even riskier environment for those who continue to walk, cycle or motorcycle. As managers of the road network, we need to improve the road environment to better protect vulnerable road users.

Public transport is a much safer way to travel than driving, walking or cycling. From January 2014 to December 2018, one person died while travelling on public transport: a bus passenger in 2018. While any death is unacceptable, there were over 400 million safe public transport trips in this period.

Buses and trains can, however, be involved in crashes with other transport system users. Over the same period 2014 to 2018, seven people died following crashes involving a bus, and 22 people (including 15 people on foot) were killed while on the railway corridor, as shown in Figure 3-13.

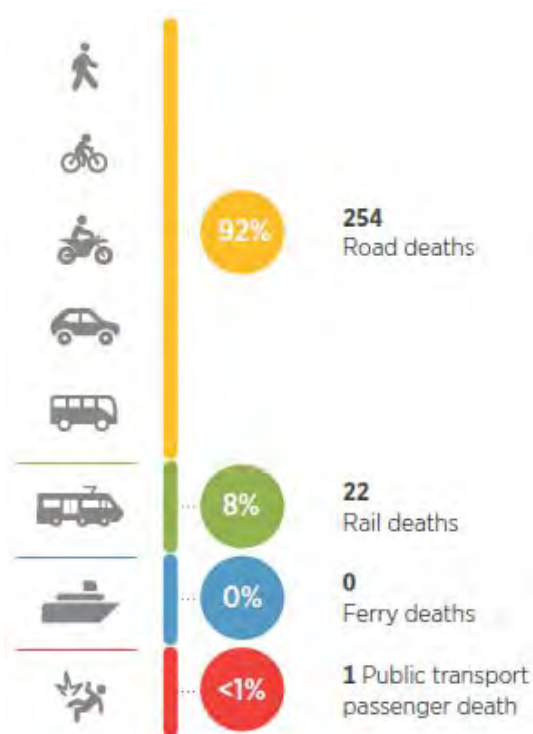



Figure 3-13: Transport deaths in Auckland, 2014 to 2018

Source: [Vision Zero for Tāmaki Makaurau](#)

3.2.3 Gap analysis – safety

The key gaps between the Auckland transport network’s current performance and our vision zero goals are summarised below.

RLTP outcome		How AT’s asset management is currently performing
Safety 	Delivering	AT is delivering the outcome of providing safe travel for our public transport customers. The latest road safety data shows a reduction in deaths and serious injuries, but there is no room for complacency as we work with our Vision Zero partners towards a transport network free of death and serious injury.
	Gap	We must improve the protection of pedestrians, cyclists and motorcyclists on urban roads, and we must manage rural roads in ways that better protect road users from death or serious injury.

While asset management makes a difference to transport safety, it is rarely the only significant factor in a crash. The role of asset management in improving safety is considered in more detail in Section 6.4.

3.3 Travel choices



AT is very aware that traffic congestion is a problem for many Aucklanders, but options to move more vehicles at peak times are very constrained. Effectively all of the land designated as transport corridors in urban Auckland is already being used, so there is no land on which AT could build additional urban road capacity.

In the Auckland Transport Alignment Project, central government and Auckland Council have agreed that expanding urban road networks to keep pace with Auckland’s growth, let alone improve on existing travel times, is neither affordable nor realistic. Accordingly, AT is focussed on improving transport choices for travellers in Auckland and reducing the impact that transport has on the environment.

3.3.1 Improving urban transport choices

Auckland’s agreed strategy to improve urban transport is to move more people and goods within the footprint of existing roads, by improving the attractiveness of public transport, walking and cycling. When more people choose to travel in ways that take up less road space, this benefits everyone, including freight operators, small businesses and individuals who still choose to drive.

Over time, this strategy requires AT to transform the existing road network, from one where typically 80 per cent of road space is devoted to cars, to a multi-modal network. Future streets will continue to provide for vehicle access and will also give priority to buses or light rail, be safe for all pedestrians and cyclists, especially children and the elderly, and provide shade and visual interest.

What this strategy could mean for a typical arterial road in the future is shown in Figure 3-14.

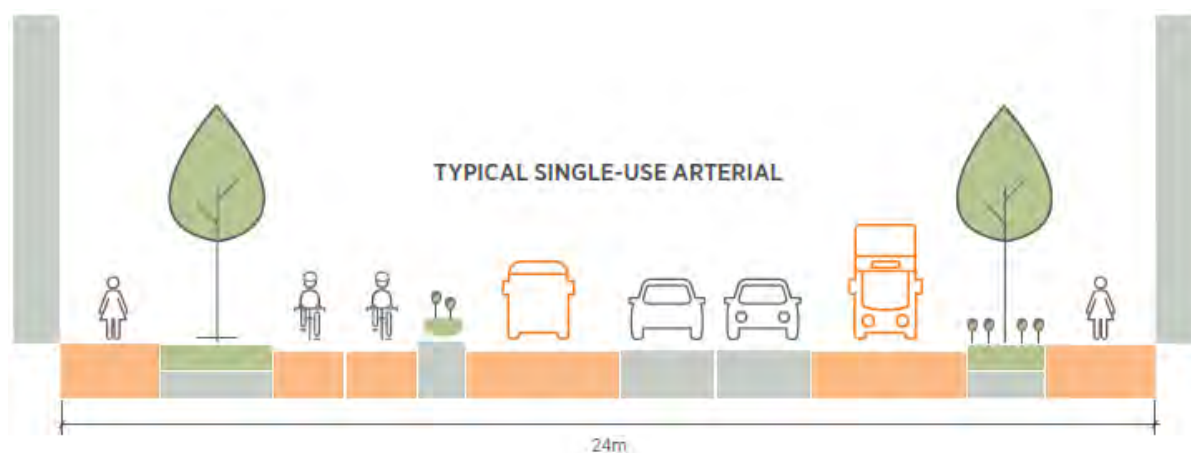



Figure 3-14: Cross-section of a future Auckland arterial road

Source: [AT Urban Street and Road Design Guide](#)

To support this strategy, road renewals need to consider how road space can be allocated more effectively. Road assets have long useful lives, so we need to design roads now that will contribute to New Zealand achieving net zero greenhouse gas emissions by 2050. This will likely mean more road renewals that are integrated with planned capital improvements, rather than simply replacing like with like.

3.3.2 Gap analysis – travel choices

RLTP outcome		How AT’s asset management is currently performing
Travel choices 	Delivering	AT is successfully managing a wider range of assets to support an increasingly multi-modal urban transport network.
	Gap	We must continue to improve how the existing network provides for public transport, walking and cycling for many reasons – to improve safety, to move more people and goods in limited road space, and to contribute to environmental goals.

3.4 Access and connectivity

AT is here to enable everyone to get the most out of Auckland’s transport system, with a clear focus on creating a great experience for the millions of customers we support every day.



Transport is about making connections, and our success depends on being responsive to customers, building effective partnerships with stakeholders, and using smart technology and good processes.

3.4.1 Customer perspectives of the transport network

AT regularly surveys Auckland residents, by phone, to assess their satisfaction with road journeys. Participants rate their satisfaction on a 10-point scale, with ratings of 6 or above counting as ‘satisfied’. Ratings are influenced by participants’ experiences as vehicle drivers and passengers, pedestrians and cyclists, and as bus passengers.

By this measure, satisfaction with the quality of roads has not changed significantly since June 2017, as shown in Figure 3-15. Participants tend to rate their satisfaction with the surface of sealed roads, and with road safety, at a similar level to their overall satisfaction. Satisfaction with traffic flow is ranked much lower.

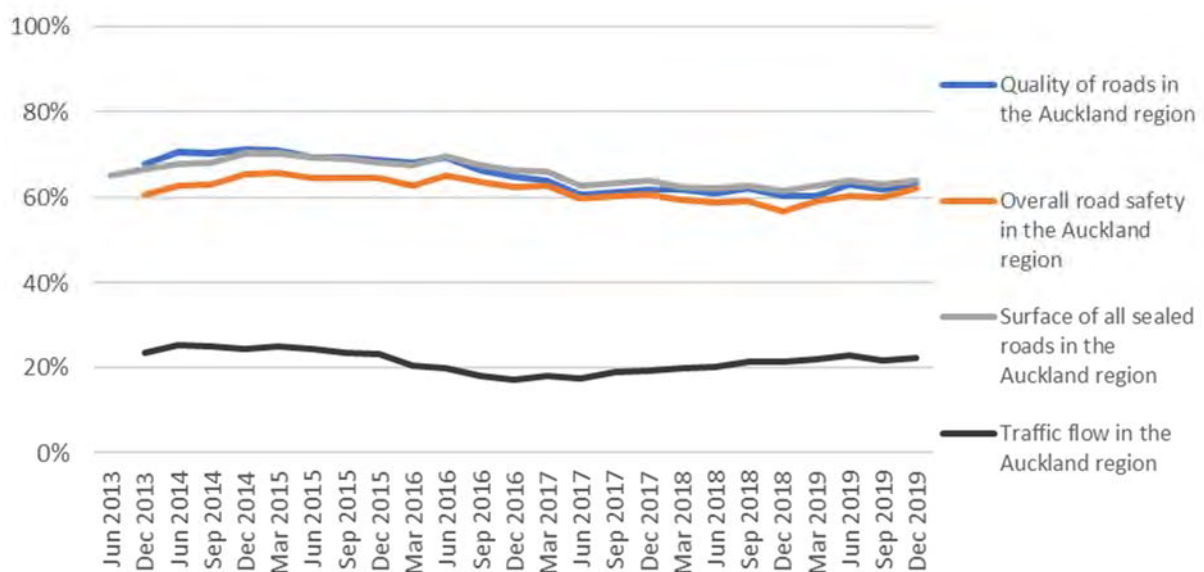


Figure 3-15: Customer satisfaction with the quality of roads in the Auckland region

Customer satisfaction with public transport is measured via regular surveys of bus, train and ferry passengers. The survey asks a range of questions including whether customers are satisfied with the bus stop, train station or ferry wharf where they began their public transport journey. Customer responses to this question are a good measure of whether AT is managing these assets appropriately.

Overall, customers are happy with the facilities that AT manages, as shown in Figure 3-16. Survey results also demonstrate that bus, train and ferry infrastructure is making a positive difference to overall customer satisfaction and therefore to patronage targets.

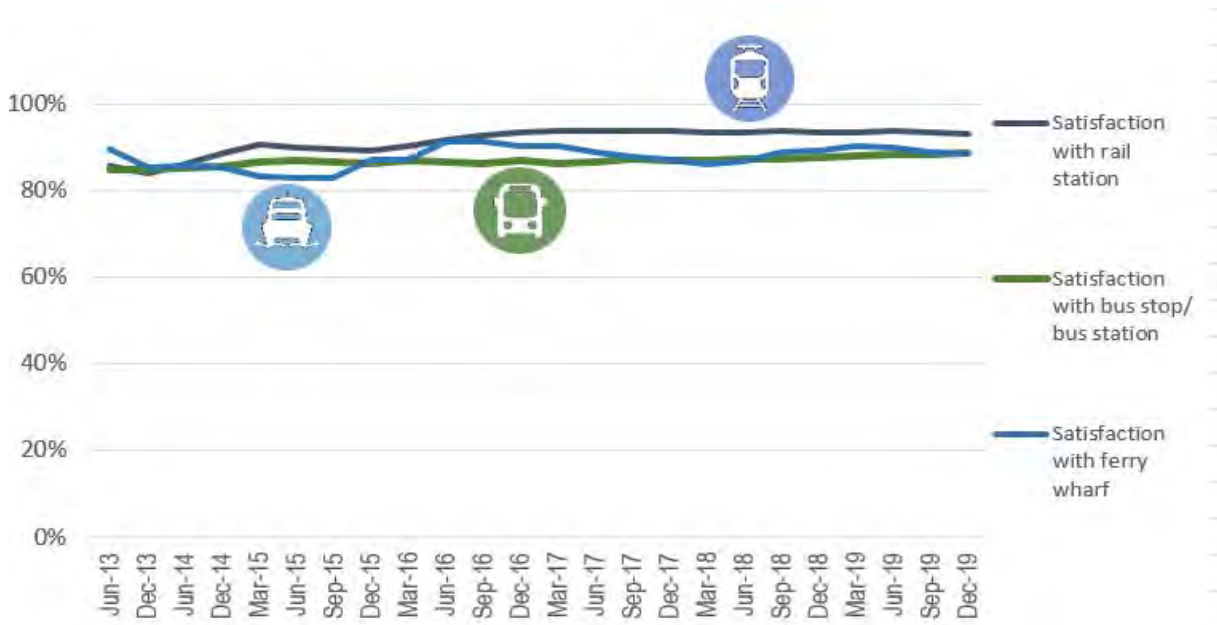


Figure 3-16: Customer satisfaction with the stop, station or wharf

An example of AT’s efforts to be more responsive to customers is our new customer relationship management system. This system supports over 5,200 customers a week to raise concerns via phone, web, or within the AT Mobile app, receive a prompt response and initiate actions. A high proportion of the concerns raised through the system relate to infrastructure assets, as shown in Figure 3-17.

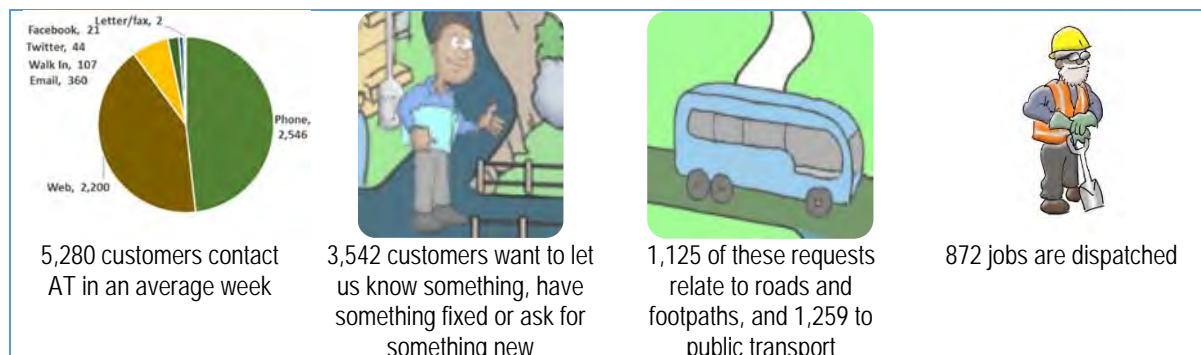


Figure 3-17: An average week in AT's customer relationship management system

Source: Customer relationship management cases for August, September and October 2019

3.4.2 Stakeholder perspectives of the transport network

To move forward together, AT must build effective partnerships with its stakeholders.

An example of AT's partnership approach is the Tāmaki Makaurau road safety partnership, which includes the police and health representatives, as well as transport agencies, as shown in Figure 3-18.



Figure 3-18: Organisations represented on the Tāmaki Makaurau road safety governance group

These organisations have collectively developed the strategy [Vision Zero for Tāmaki Makaurau](#), and endorsed an ambitious new safety vision that there will be no deaths or serious injuries on our transport system by 2050.

An example of AT's responsiveness to Māori is the use of te reo on trains. This project recognises that te reo Māori is an official language of New Zealand and has been made possible by the strong connections that we have worked to create at all levels, led by the Independent Māori Statutory Board and AT Board.

3.4.3 Moving goods

In 2012, 63.25 million tonnes of freight were moved within, to, from and through Auckland. The Ministry of Transport forecasts that freight movements in Auckland will grow substantially over the next 30 years, with the total freight carried projected to increase to 108.63 million tonnes by 2046. Freight movements originating in Auckland are primarily transported by road (95 per cent).

AT has prepared a [freight plan](#) in consultation with freight industry partners. These partners' core concern is their customers' demand for the timely pickup and delivery of goods. To adapt to a more demanding market, freight companies are moving towards smaller vehicles for deliveries, and larger, heavier vehicles for long-haul freight. This means that the nature of freight in Auckland is changing as well as growing.

One goal of the freight plan is to improve the level of service for heavy vehicles on the motorway and key arterial routes, hence discouraging these vehicles from using local roads.

3.4.4 Opportunities to improve access and connectivity


In general, improving access and connectivity is achieved through capital investments as set out in the Regional Land Transport Plan. These have been summarised in Section 2.3.3.

This Asset Management Plan provides directions on renewals funding, and the majority of renewals work is focused, appropriately, on replacing exiting assets like for like at the end of their useful life. However there are important exceptions to this, where renewed assets need to meet different standards for design, safety or to provide for the changing needs of customers.

Increasingly, in a very different Auckland than even 20 years ago, a number of assets not only need to be renewed but improved to meet current objectives. Where practicable, and funds exist to complement renewals funding, the work that occurs will take account of the future needs of the network.

3.4.5 Gap analysis – access and connectivity

AT is up to date with what its customers are experiencing and has overall good relationships with stakeholders and investment partners.

RLTP outcome		How AT’s asset management is currently performing
Access and connectivity 	Delivering	AT is up to date with what its customers are experiencing, and has overall good relationships with stakeholders and investment partners.
	Gap	We need to increase provision , in a changing and growing Auckland, for assets to not only be renewed but improved to take account of the future needs of the network.

3.5 Growth



Transport is playing a key role in the transformation of our fast growing region – a transformation which will see the way people move and live change. This plan is about existing assets, but also about the new assets that the Regional Land Transport Plan will create to support Auckland’s growth and development in Auckland. This plan is also influenced by Auckland’s rapid and continuing population growth, the current construction boom and the associated growth in freight movements in and out of the city.

Growth affects AT’s costs in three main ways.

- More assets are added to the transport network, creating consequential maintenance, operations and renewals costs.
- The sheer weight of material being transported by road in order to construct new homes and buildings has a physical impact on road pavements
- The unit costs for most of the items that AT purchases in order to maintain the asset value of its road network are increasing, because:
 - the costs of raw materials, including aggregate and bitumen, are increasing due to increased demand
 - labour costs are increasing at all levels, from construction workers to designers and supervisors
 - fewer companies are competing when AT tenders for work.

3.5.1 Population growth and projections

Auckland Council has released population projections for the 10 years of this AMP, taking into account data to September 2020, including the impacts of Covid-19. The new forecasts anticipate that Auckland will grow by around 26,000 people (10,000 households) each year from 2021 to 2031, as shown in Figure 3-19. The new growth forecasts are broadly in line with previous forecasts.

Growth is both a consequence of Auckland’s success, and a contributor to further successes. While most population growth is due to natural increase (more people are born in Auckland than are dying), 2020 has for the first time seen more New Zealanders returning from overseas than leaving.

A high proportion of these returning New Zealanders are choosing to settle in Auckland. This is good news, as this group is on average highly educated and likely to be self employed or employing others.

It is not yet clear what will happen when international travel becomes easier again, but if the reversing of New Zealand’s ‘brain drain’ becomes a long-term trend, then this brings huge opportunities.

Compared with its 2018 forecasts, Auckland Council’s current growth forecasts are more optimistic about the economy, with employment growth revised upwards to over 10,500 new full-time jobs each year between 2021 and 2031, as shown in Figure 3-19.

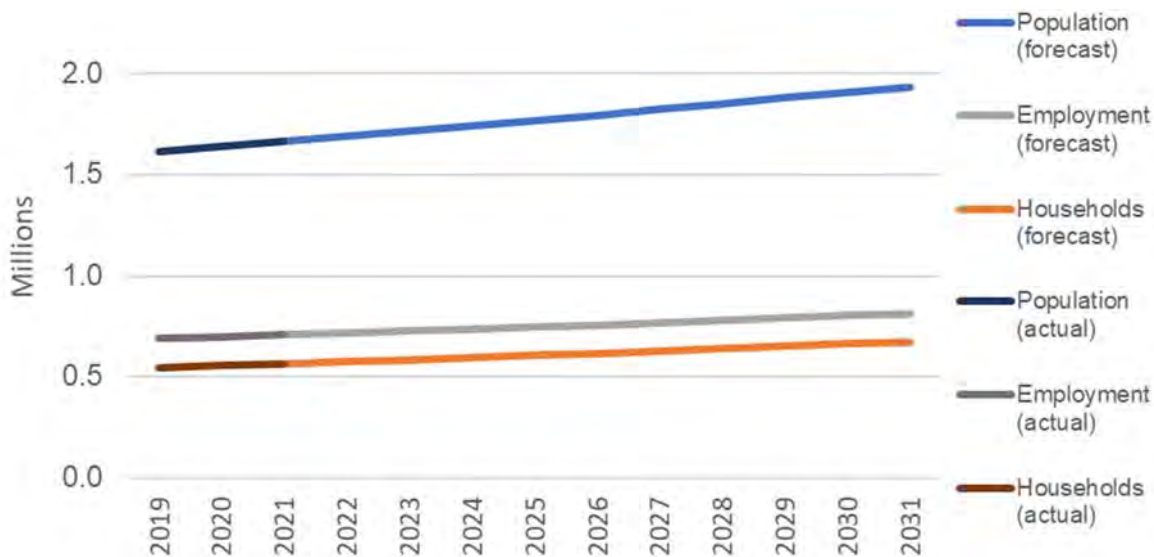


Figure 3-19: Population, household and employment projections

Source: Auckland Council model i11-6

3.5.2 Growth in the asset base

The expected rates of acquisition of road assets in the 10 years of this plan are shown in Figure 3-20 and Table 3-4.

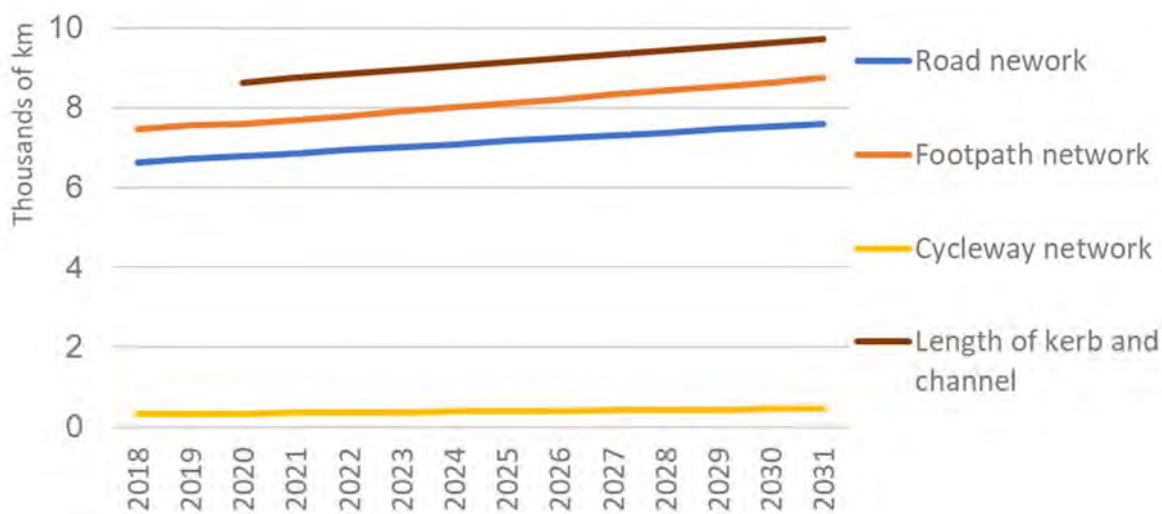


Figure 3-20: Actual and forecast growth in road assets

Table 3-4: Forecast growth in road assets

Asset type	Current inventory		Indicative quantities of new assets per year		Asset growth as percentage per annum
Carriageway	6,843km	sealed roads	74km	sealed roads	1.1%
Stormwater	89,141	catchpits	2,015	catchpits	2.3%
	8,777km	kerb and channel	99km	kerb & channel	1.1%
	3,598	treatment devices	340	treatment devices	
Bridges and walls	1,261	road and footpath bridges and major culverts		new bridges estimated as proportion of new roads	1.1%
	338,902m ²	walls	4,000m ²	walls	
Footpaths and cycleways	7,460km	footpaths	104km	footpaths	1.4%
	350km	cycleways	10km	cycleways	2.9%
Street lights	122,347	street lights	2,300	street lights	2.2%
Traffic systems	675	signalised intersections	15	signalised intersections	2.3%

Expected growth in public transport assets over the coming ten years will be even faster. Public transport improvements funded in the Regional Land Transport Plan include:

- Three new City Rail Link stations at Aotea, Karangahape Rd and Mt Eden
- New Southern stations at Paerata, Drury North and Drury South as part of the electrification of the Southern Rail Line
- Additional electric trains
- New city centre bus interchanges
- New bus stations at Rosedale on the Northern Busway, Botany and Pakuranga on the Eastern Busway and at Westgate, Lincoln Rd and Te Atatu as part of the package NorthWest Bus improvements
- Improvements to Park and Ride.

3.5.3 Increased use of existing assets

Auckland's existing transport networks will need to move more people and goods as Auckland's population grows.

Effectively all deterioration of the road pavement asset is caused by heavy vehicles including heavy freight. On key freight routes, the design of road pavements needs to be especially strong in order to withstand the weight of heavy vehicles. AT is increasingly using stronger pavements, which have a higher unit cost but a longer asset life, and greater resilience to use by heavy vehicles.

The construction of new homes and commercial buildings itself requires the movement of many tonnes of material on existing roads, which are often not designed to withstand heavy use.

3.5.4 Increasing unit costs

Each year, around 10,000 new homes are built in Auckland, in addition to commercial development. Monthly building consent value shows a boom in construction from 2016, as shown in Figure 3-21.

Although construction dipped in 2020 due to Covid-19, recovery has been swift. In September 2020, the value of building consents issued in Auckland in a single month exceeded \$1 billion for the first time.

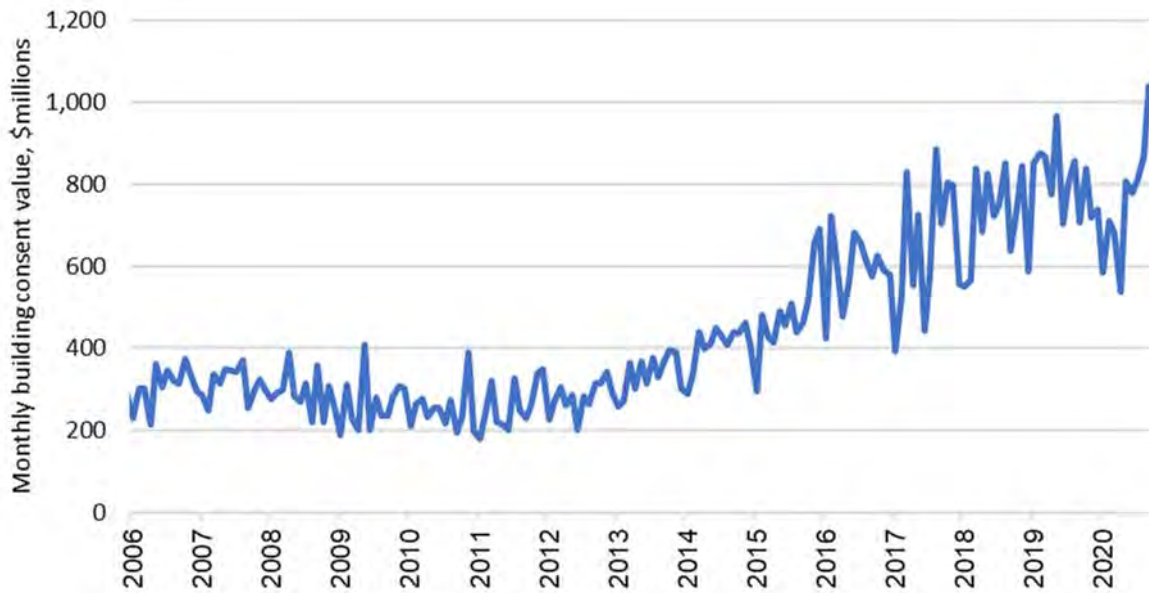



Figure 3-21: Auckland building consent value, 2006 to 2020

Source: Statistics NZ

AT’s current contracts for maintenance and renewals of road assets were negotiated in 2011. Even though the prices in these contracts are adjusted over time, the overall costs per unit of work covered by the contracts are still significantly lower than the rates being quoted for new contracts.

AT is currently procuring its South and Central maintenance contracts, with the new contracts expected to be in place on 1 July 2021. Procurement will start soon on contracts for the North and West areas.

3.5.5 Gap analysis – growth

RLTP outcome		How AT’s asset management is currently performing
Growth 	Delivering	AT is successfully managing and maintaining the assets created to support Auckland’s growth.
	Gap	Costs are increasing. As more transport assets are constructed, and as more people and freight is moving on the existing network, we have no choice but to provide for increased operations, maintenance and asset renewals expenditure.

3.6 Climate change and the environment



3.6.1 Reducing environmental impacts

The transport system generates a range of negative environmental effects, including:

- carbon emissions
- contamination of natural waterways through stormwater run-off from roads
- noise and vibration increasing with increased traffic use
- air quality in urban areas
- rural dust nuisance

Although there are a wide range of problems, the solutions to one problem often benefit another. For example, electric vehicles are quieter and have benefits for local air quality as well as having reduced carbon emissions over their lifecycle. Rural road treatments which reduce dust nuisance also have benefits for stormwater run-off.

3.6.2 Climate impact statement

On 11 June 2019, Auckland Council’s Environment and Community Committee formally recognised the urgency for action on climate change, by declaring a climate emergency (ENV/2019/72).

As part of this declaration, Auckland Council committed to visibly including climate change considerations in council work and decisions, a requirement which also binds AT as a council-controlled organisation.

Internationally, climate change action is defined as two separate challenges: mitigation and adaptation. This is reflected in the guidance provided by Auckland Council, as shown in Figure 3-22.

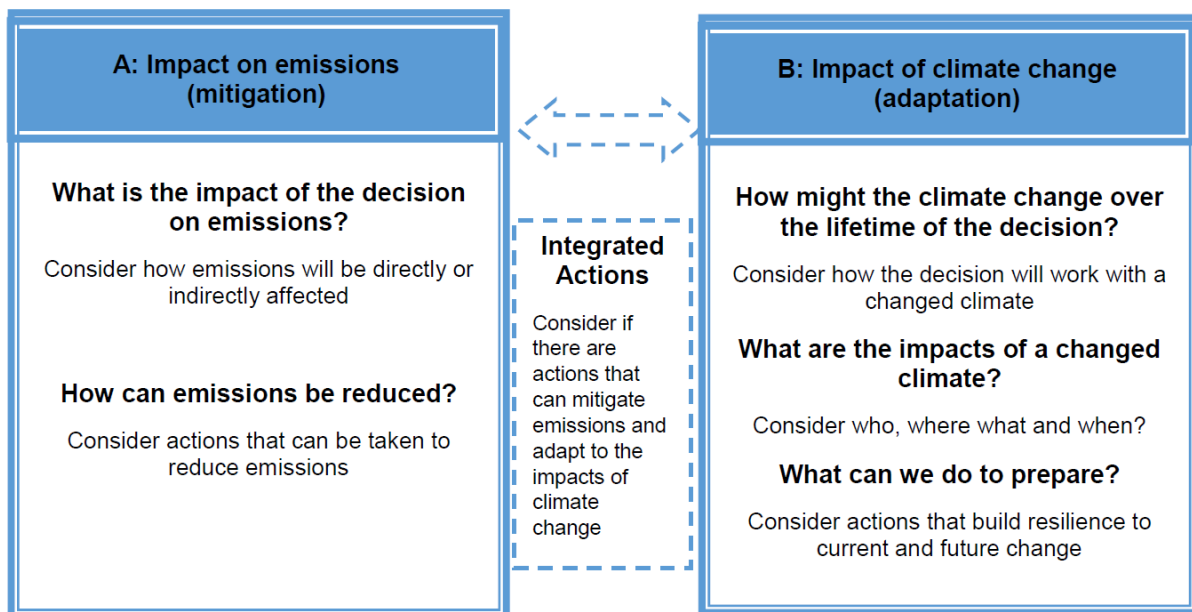


Figure 3-22: Key elements of a climate impact statement

Source: Auckland Council

3.6.3 Climate change mitigation

The gap analysis for the principle of movement over mode in section 3.6.1 concluded that the environmental impacts of the current transport system are not aligned with national or regional goals.

Transport is the source of 38 per cent of Auckland’s greenhouse gas emissions, and is also the sector with the fastest growth in emissions.


Auckland Council has committed, in its Climate Action Plan, to two significant mitigation goals:

- halving emissions by 2030
- reaching net zero emissions by 2050.

The Climate Action Plan notes that to achieve these goals, the transport system needs to support Aucklanders to make fundamental shifts in how they undertake personal travel, how this travel is powered, how freight is transported, and how much they travel.

AT is committed to these goals but [our own modelling](#) suggests that current plans, even if fully funded, would fall short of the required contribution from transport. Further decisions, including decisions on costs and funding, need to be made by central government and Auckland Council through the Auckland Transport Alignment Project.







One specific action required by the plan is to be innovative in how we maintain our infrastructure, to lower embodied emissions. This includes looking after the assets we already have, recognising that building new transport assets is a very energy-intensive activity.

RLTP outcome		How AT’s asset management is currently performing
Climate change and the environment 	Delivering	AT has improved our understanding of the risks to critical transport assets from extreme events, including events that are becoming more frequent due to climate change.
	Gap	We must develop detailed plans to reduce the vulnerability of our critical assets to damage from extreme events, and to mitigate the environmental impacts of our activities. AT will need to manage new assets required to support electric cars and buses.

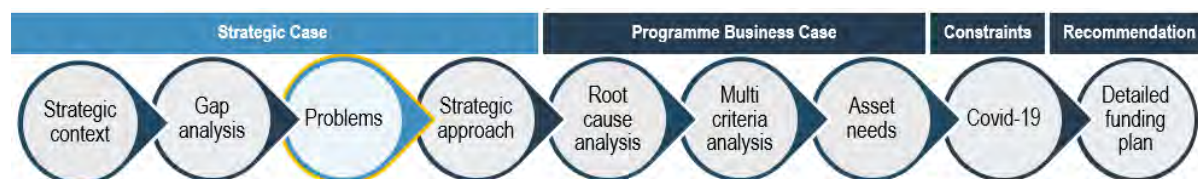
3.7 Overall gap analysis

The assessment in sections 3.1 to 3.6 looked at how AT is doing in terms of the objectives of the Regional Land Transport Plan. It identified areas where we are doing well, but also highlighted a number of gaps, where our current actions need to change in order to better contribute to the strategic outcomes. These gaps are summarised in Table 3.5.

Table 3-5: Overall gap analysis

RLTP outcome		How AT's asset management is currently performing
Asset management 	Delivering	AT is delivering the outcome of maintaining the condition and value of its asset portfolio.
	Gap	We must improve the timeliness of road pavement renewals, especially in new development areas, and on key quarry and landfill routes where heavy vehicles are causing cracks, rutting and other damage. We must improve our knowledge of stormwater assets, and how stormwater risks will increase with urban intensification and climate change.
Safety 	Delivering	AT is delivering the outcome of providing safe travel for our public transport customers. The latest road safety data shows a reduction in deaths and serious injuries, but there is no room for complacency as we work with our Vision Zero partners towards a transport network free of death and serious injury.
	Gap	We must improve the protection of pedestrians, cyclists and motorcyclists on urban roads, and we must manage rural roads in ways that better protect road users from death or serious injury.
Travel choices 	Delivering	AT is successfully managing a wider range of assets to support an increasingly multi-modal urban transport network.
	Gap	We must continue to improve how the existing network provides for public transport, walking and cycling for many reasons – to improve safety, to move more people and goods in limited road space, and to contribute to environmental goals.
Access and connectivity 	Delivering	AT is up to date with what its customers are experiencing, and has overall good relationships with stakeholders and investment partners.
	Gap	We need to increase provision , in a changing and growing Auckland, for assets to not only be renewed but improved to take account of the future needs of the network.
Growth 	Delivering	AT is successfully managing and maintaining the assets created to support Auckland's growth.
	Gap	Costs are increasing. As more transport assets are constructed, and as more people and freight is moving on the existing network, we have no choice but to provide for increased operations, maintenance and asset renewals expenditure.
Climate change and the environment 	Delivering	AT has improved our understanding of the risks to critical transport assets from extreme events, including events that are becoming more frequent due to climate change.
	Gap	We must develop detailed plans to reduce the vulnerability of our critical assets to damage from extreme events, and to mitigate the environmental impacts of our activities. AT will need to manage new assets required to support electric cars and buses.

4.0 Identifying the underlying problems

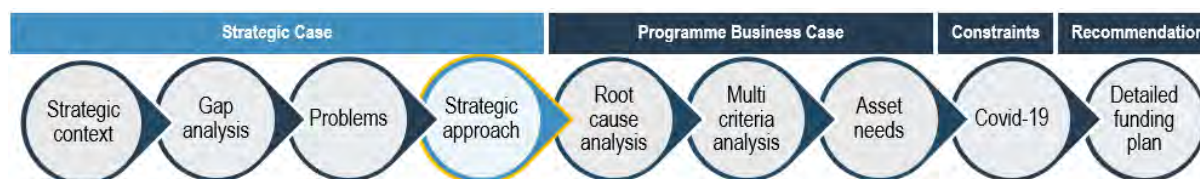


We have used the gaps identified during the gap analysis and shown in Table 3.5 to develop a series of problem statements, as set out in Table 4-1. These statements identify four main problems that underly our current service provision and are leading to the identified gaps.

Table 4-1: Relationship between the identified gaps and problem statements

<i>Safety of vulnerable road users on urban roads</i>	1. Asset deterioration: If AT does not address asset deterioration adequately, by maintaining and renewing public assets in a timely and efficient way, then safety will be compromised, customer journeys will be impacted, and significant problems will be created for the region and for future generations.
<i>Loss of control crashes on rural roads</i>	
<i>Increasing whole-of-life asset needs</i>	
<i>Road pavement and stormwater asset condition</i>	
<i>Resilience to extreme events</i>	2. Road safety: Deaths and serious injuries on Auckland's roads are high by national and international standards, especially for vulnerable road users.
<i>Roads that prioritise cars over other modes</i>	
<i>Need to reduce impacts on the environment</i>	3. Impacts of growth: Network requirements to address the impacts of growth and intensification will be significant, resulting in accelerated asset deterioration and escalating costs.
<i>Increasing costs for maintenance and renewals</i>	
	4. Lack of resilience: The transport network lacks resilience in the face of future challenges, including climate change, resulting in an increasing potential for significant disruption.

5.0 Strategic approach



The final step in the development of the strategic case is to recommend a response to each of the four problems identified from the gap analysis. This step includes a strategic multi-criteria analysis of the various options available to address the problems. This analysis ensures that a range of solutions are considered, even if some are ruled out early.

5.1 Strategic approach options

Each of the four problems represents an opportunity for AT to improve the contribution its asset management makes to strategic outcomes. This opportunity could be pursued using a number of broad strategic approaches, as explained below.

- **Programme adjustment:** this approach directs more resources to the assets that are most significant in the overall transport network. This means increasing tolerance for failures, defects, poor or very poor condition for less significant assets.
- **Policy:** this approach considers opportunities to change the level of service provided by assets, by either improving standards (and increasing costs) or lowering standards. A policy approach to a problem could also mean changing how an activity is funded or delivered.
- **Demand management:** this approach is an essential aspect of urban transport planning, because demand to travel at peak times on key routes consistently exceeds road capacity. AT can influence demand and may choose to prioritise this approach when responding to the problems.
- **Funding adjustment:** this approach involves increasing the overall funding available. The other aspect of funding adjustment, namely optimising the funding allocation (for example, between high and low volume roads), is already considered at the programme adjustment stage.
- **Risk-based:** this approach involves accepting an increased risk of unplanned asset failure, whether by lowering maintenance standards or postponing asset renewals, relative to AT's current programme.

Not all of these approaches were applicable for each of the problems.

Where a particular approach could apply, we assessed its potential to help solve a particular problem using the following criteria and the weightings in Figure 5-1.

- Meets national outcomes.
- Meets regional outcomes.
- Addresses the problems.
- Realises the benefits.
- Meets community outcomes.

- Meets customer outcomes.
- Delivers performance benefits.
- Delivers environmental benefits.
- Delivers social and cultural benefits.
- Compares based on relative costs.

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Figure 5-1: Weightings used to assess strategic approach options

This assessment process provided direction for the programme business case, by signalling the preferred strategic approaches for addressing particular problems across different asset classes and activities. We conducted the assessments using a template developed by the Road Efficiency Group. This results of the assessment are presented in Table 5-1 to Table 5-4.

Table 5-1: Problem one: Asset deterioration – multi-criteria analysis of the strategic approach options

Strategic approach options	Applicable?	Reason								Rank
1. Programme adjustment – rebalance existing programme	Yes	Re-balance the existing programme to focus on assets that have the most impact on customer experience, risk consequence and life-cycle cost								2 nd
2. Policy – change service delivery and/or level of service	Yes	Reduce the level of service on lower volume roads while maintaining levels of service on higher volume roads								3 rd
3. Demand management	No	N/A								
4. Funding adjustment – increase overall funding	Yes	Increase work programmes across the portfolio to maintain current levels of service and risk profile								1 st
5. Risk-based – accept a higher level of risk	Yes	Accept higher likelihood of asset failure and more failures on lower volume roads, where assets in a worse condition are more acceptable than on busier roads Ensure asset failure does not present a significant safety concern								4 th
		How good is this option?								
		Option 1 Rebalance existing programme		Option 2 Change levels of service		Option 4 Increase funding		Option 5 Accept increased risk		
Criteria to consider	Weighting (importance: total to 100%)	Raw	Score	Raw	Score	Raw	Score	Raw	Score	
Meets national outcomes	15%	1	0.15	1	0.15	2	0.3	0	0	
Meets regional outcomes	15%	1	0.15	1	0.15	2	0.3	0	0	
Addresses problems	15%	2	0.3	1	0.15	3	0.45	2	0.3	
Realises benefits	15%	1	0.15	1	0.15	2	0.3	1	0.15	
Meets community outcomes	10%	-1	-0.1	-1	-0.1	2	0.2	-1	-0.1	
Meets customer outcomes and delivers customer levels of service	15%	-1	-0.15	-2	-0.3	2	0.3	-1	-0.15	
Provides high performance impacts	0%	0	0	0	0	0	0	0	0	
Provides high environmental impacts	0%	0	0	0	0	0	0	0	0	
Provides social and cultural impacts	0%	0	0	0	0	0	0	0	0	
Compares on costs	15%	0	0	0	0	-2	-0.3	-1	-0.15	
Totals	100%		0.5		0.2		1.55		0.05	

Table 5-2: Problem two: Road safety – multi-criteria analysis of the strategic approach options

Strategic approach options	Applicable?	Reason								Rank	
1. Programme adjustment – rebalance existing programme	Yes	A range of activities can be emphasised within existing work programmes, including: • safety initiatives – maintain clear visibility, change intersection controls, improve lighting • improve road environment to make crashes more survivable, e.g. clear road shoulders • resurfacing programme – increase focus on skid resistance • increase focus of the low-cost low-risk programme towards safety investments								1 st	
2. Policy – change service delivery and/or level of service	Yes	A range of approaches are available, including: • safety investigations and audits • speed management and speed limit reviews								3 rd =	
3. Demand management	Yes	Implement a Vision Zero approach to mitigating overall risk through demand management by making it easier and safer to walk, cycle and catch public transport								3 rd =	
4. Funding adjustment – increase overall funding	Yes	Increase funding for the road safety low-cost low-risk programme								2 nd	
5. Risk-based – accept a higher level of risk	No	N/A									
		How good is this option?									
		Option 1 Stronger emphasis on safety in work programmes		Option 2 Investigations and speed management		Option 3 Vision Zero approach		Option 4 Increase low-cost low-risk capital improvements			
Criteria to consider	Weighting (importance: total to 100%)	Raw	Score	Raw	Score	Raw	Score	Raw	Score		
Meets national outcomes	10%	3	0.3	2	0.2	2	0.2	3	0.3		
Meets regional outcomes	10%	3	0.3	3	0.3	3	0.3	3	0.3		
Addresses problems	20%	3	0.6	2	0.4	2	0.4	3	0.6		
Realises benefits	20%	3	0.6	2	0.4	2	0.4	3	0.6		
Meets community outcomes	5%	3	0.15	2	0.1	1	0.05	3	0.15		
Meets customer outcomes and delivers customer levels of service	5%	2	0.1	0	0	0	0	2	0.1		
Provides high performance impacts	5%	2	0.1	1	0.05	1	0.05	2	0.1		
Provides high environmental impacts	0%	0	0	0	0	0	0	0	0		
Provides social and cultural impacts	10%	1	0.1	0	0	2	0.2	1	0.1		
Compares on costs	15%	-1	-0.15	0	0	-1	-0.15	-3	-0.45		
Totals	100%		2.1		1.45		1.45		1.8		

Table 5-3: Problem three: Impacts of growth – multi-criteria analysis of the strategic approach options

Strategic approach options	Applicable?	Reason						Rank
1. Programme adjustment – rebalance existing programme	No	N/A						
2. Policy – change service delivery and/or level of service	Yes	<ul style="list-style-type: none"> • Proactive approach to managing the impacts of developments • Identify key freight routes and work with freight industry 						2 nd
3. Demand management	Yes	Improve walking, cycling and public transport options to move more people and goods in constrained road space						1 st
4. Funding adjustment – increase overall funding	Yes	New capital projects – road corridor capacity upgrades, intersection improvements, mode separation programmes, public transport investment						3 rd
5. Risk-based – accept a higher level of risk	No	N/A						
		How good is this option?						
		Option 1 Policy approach to managing impacts		Option 2 Improve walking, cycling and public transport options		Option 3 New capital projects		
Criteria to consider	Weighting (importance: total to 100%)	Raw	Score	Raw	Score	Raw	Score	
Meets national outcomes	5%	3	0.15	3	0.15	2	0.1	
Meets regional outcomes	15%	3	0.45	3	0.45	3	0.45	
Addresses problems	15%	2	0.3	3	0.45	3	0.45	
Realises benefits	15%	1	0.15	2	0.3	2	0.3	
Meets community outcomes	5%	2	0.1	2	0.1	2	0.1	
Meets customer outcomes and delivers customer levels of service	5%	0	0	2	0.1	2	0.1	
Provides high performance impacts	5%	1	0.05	2	0.1	2	0.1	
Provides high environmental impacts	10%	1	0.1	2	0.2	-2	-0.2	
Provides social and cultural impacts	10%	3	0.3	3	0.3	1	0.1	
Compares on costs	15%	-1	-0.15	-1	-0.15	-3	-0.45	
Totals	100%		1.45		2		1.05	

Table 5-4: Problem four: Lack of resilience – multi-criteria analysis of the strategic approach options

Strategic approach options	Applicable?	Reason						Rank
1. Programme adjustment – rebalance existing programme	Yes	Prioritise renewals programmes based on criticality and vulnerability assessment.						1 st
2. Policy – change service delivery and/or level of service	Yes	Develop and prioritise mitigation options and strategies: • develop and update emergency response plans and protocols • rapid response arrangements for natural hazard events • alternative transport routes and modes for major road and rail disruption						3 rd
3. Demand management	No	N/A						
4. Funding adjustment – increase overall funding	Yes	Increase programme to accommodate bridges and structures seismic strengthening, scour protection, structural strengthening, slope stabilisation						2 nd
5. Risk-based – accept a higher level of risk	No	Not appropriate for critical assets, but is a potential option for low-volume roads with alternative accessibility						
		How good is this option?						
	Weighting (importance: total to 100%)	Option 1 Prioritise renewals programmes based on criticality and vulnerability		Option 2 Assess vulnerability and propose mitigations, coupled with response arrangements		Option 3 Increase work programme across multiple activities to improve resilience		
Criteria to consider		Raw	Score	Raw	Score			
Meets national outcomes		10%	2	0.2	2	0.2	3	0.3
Meets regional outcomes	10%	2	0.2	2	0.2	2	0.2	
Addresses problems	20%	3	0.6	3	0.6	3	0.6	
Realises benefits	20%	3	0.6	1	0.2	3	0.6	
Meets community outcomes	5%	2	0.1	1	0.05	2	0.1	
Meets customer outcomes and delivers customer levels of service	5%	1	0.05	1	0.05	1	0.05	
Provides high performance impacts	5%	1	0.05	0	0	1	0.05	
Provides high environmental impacts	5%	0	0	0	0	0	0	
Provides social and cultural impacts	5%	0	0	0	0	0	0	
Compares on costs	15%	0	0	0	0	-2	-0.3	
Totals	100%		1.8		1.3		1.6	

The preferred options from the multi-criteria analysis for the four identified problems are summarised in Table 5-5.

Table 5-5: Preferred for options for strategic approaches to address the problems

Problem	Possible strategic approaches				
	Adjust programme	Change policy	Use demand management	Increase funding	Accept higher risk profile
Asset deterioration	2nd	3rd	NA	1st	4th
Road safety	1st	3rd=	3rd=	2nd	NA
Impacts of growth	NA	2nd	1st	3rd	NA
Lack of resilience	1st	3rd	NA	2nd	NA

5.2 Recommended strategic approach

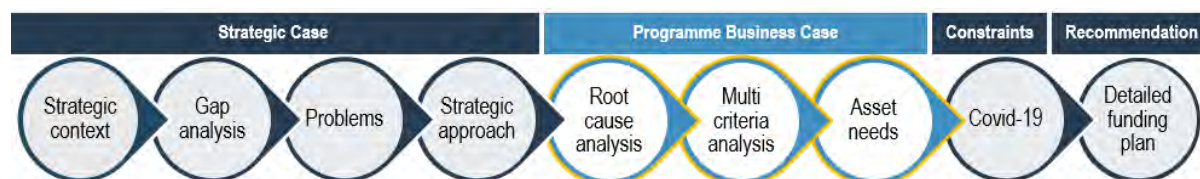
Table 5-6 outlines how AT will use the prioritised strategic approaches to develop an optimal strategic approach for addressing each of the four problems. This optimised approach may draw on a number of the available strategic approaches, with greater weight or preference given to some approaches, based in the multi-criteria analysis.

Table 5-6: Prioritised ranking of strategic approaches

Approach (ranked)	Asset deterioration
1	Increase funding: As Auckland's population grows and more assets are added to the transport network, increased funding will inevitably be needed to offset asset deterioration. The need for increased funding can be offset, but not eliminated, by considering the other strategic options.
2	Adjust the programme: This would put more emphasis on assets which have the most impact on customer experience, risk and life-cycle cost outcomes.
3	Change policy: There may be options to lower levels of service on lower volume roads and other less-used assets, while maintaining levels of service on the most used assets.
4	Accept a higher risk profile: This would mean accepting more failures on lower volume roads, with a poorer condition being acceptable compared to busier roads. It would be necessary, however, to ensure that poorer condition did not present a significant safety concern.
Road safety	
1	Adjust the programme: This option will consider road safety in prioritising maintenance and renewals programmes, and will seek to deliver safety benefits within existing budgets.
2	Increase funding: For specific safety programmes, including minor capital (low-cost low-risk) programmes.
3	Change policy: This approach, including safer speed limits and demand management initiatives, can complement physical works programmes, as set out in Auckland's Vision Zero strategy.

Impacts of growth	
1	Use demand management: The Auckland Transport Alignment Project has concluded that growth and increased travel cannot be accommodated by expanding Auckland's road network, and a significant shift is required to walking, cycling and public transport, in line with other successful cities.
2	Change policy and levels of service: The impact of the development process on Auckland's road assets, including road pavements and bridges, can to some extent be offset by actively participating in development consents, providing good design guidance and working with the freight industry to identify and improve key regional freight links, while discouraging use of roads that are not suitable for heavy trucks.
3	Increase funding: Even with demand management and policy initiatives, significant new capital investment is needed across all modes to manage the impacts of Auckland's growth.
Lack of resilience	
1	Adjust the programme: This requires AT to identify critical assets, which are most significant to the overall transport network in normal times, as well as those lifeline routes and assets that become essential in the face of a natural hazard or other disaster. These assets become a higher priority for inspection, renewals and potential upgrades.
2	Increase funding: While some improvements can be made within existing budgets, improving the resilience of the transport network will require increased funding.
3	Change policy and levels of service: The resilience of the transport network is influenced by a range of policy decisions and prioritisation mechanisms, which are being reviewed to better respond to resilience challenges, including climate change.

Programme business case



This part of the AMP details the business case that underpins AT’s asset management programme.

The business case sets out the actions that AT needs to start doing, or do differently, to address the four problems identified in the strategic assessment, namely:

- asset deterioration
- road safety
- impacts of growth
- lack of resilience.

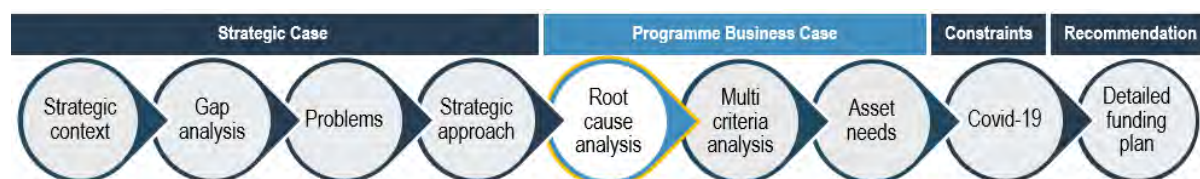
The business case begins with a root cause analysis of the issues affecting the transport asset portfolio for each of the four problem statements.

The root cause analysis generates a long list of potential options to address the problems. These options are then grouped by asset class and evaluated further in section 7.0, using a multi-criteria analysis. The multi-criteria analysis enables the options to be compared in a transparent way.

The final step in developing the programme business case is to consider the investment needed to deliver the recommended options, for each of the main asset classes. This process takes into account past investments and puts forward recommended investments needs for each class.

The total recommended asset needs for all AT assets are presented, before the impact of any funding constraints, including Covid-19, are taken into account. The outcome is two asset investment plans: a recommended asset needs investment plan and a constrained investment plan.

6.0 Root cause analysis



The root cause analysis looks at the reasons behind the four problems affecting AT’s transport asset portfolio. Having identified the causes of each problem, the root causes analysis then lists the potential responses that AT could use to address that problem for particular classes of assets. The analysis is vital, as actions that address the root cause of a problem are more likely to be effective than actions which only mitigate the symptoms.

The overall response that AT currently takes to address each problem is also discussed.

6.1 Root cause analysis – asset deterioration

The problem statement

If AT does not address asset deterioration adequately, by maintaining and renewing public assets in a timely and efficient way, then safety will be compromised, customer journeys will be impacted, and significant problems will be created for the region and for future generations.

The root cause analysis for asset deterioration examines the deterioration issues affecting all of the asset classes, and identifies some potential responses. An overview of the analysis is given in Figure 6-1.

The potential responses to address asset deterioration are then sorted according to the asset class they are most relevant to. They are then analysed further as part of our decision-making about which options to invest in as part of this AMP. This process is explained for each asset class in section 7.0.

If AT does not address asset deterioration adequately, by maintaining and renewing public assets in a timely and efficient way, then safety will be compromised, customer journeys will be impacted, and significant problems will be created for the region and for future generations.

SEALED ROADS										UNSEALED ROADS		STORMWATER	BRIDGES														
Sealed roads are showing signs of increased deterioration. Some roads are carrying very high levels of heavy traffic and are deteriorating rapidly.										Sealed pavement maintenance investment has fallen in real terms in recent years		Unsealed roads are mostly being maintained in good condition, but customer satisfaction is very low.	Dust from unsealed roads can be a problem in dry weather, this is worse in extended drought conditions.	There is a lack of knowledge about stormwater drainage assets, including their condition.			There are condition-based risks associated with existing bridges - premature failure would disrupt AT's customers and could damage other assets or pose a safety risk.										
↓										↓		↓	↓			↓											
Asphalt road pavement surfaces are significantly more expensive than chipseal, but chipseal is unpopular.										Defect trends for alligator cracking, rutting, flushing and scabbing on regional, arterial and primary collector roads have been increasing steadily from 2014 to 2019		Over the last 3 years, pavement rehabilitation budgets were temporarily reduced.	AT spend on road maintenance per km of vehicle travel is similar to other NZ road authorities, but costs per km of road are higher than peers.	Unsealed roads can deteriorate quickly - with the formation of potholes, corrugations and pavement failure, typically traffic use and weather related.	Dust affects residents' health and agricultural production on properties adjoining the road.	Stormwater asset deficiencies can be a safety concern and over time will adversely impact pavement performance and pose a potential asset failure risk.			There are 43 structures in the "red zone" (high criticality/poor condition) which pose a potentially significant failure risk.			9% of bridges are in poor or very poor condition, and there are risks around the 11% which do not have a condition rating.			Some bridges are vulnerable to earthquake damage or waterway scour		
↓										↓		↓	↓			↓			↓								
AT has a road reseal policy which sets out the criteria for selecting an asphalt surface. However some lower volume roads are still being resealed with asphalt, meaning fewer roads in total can be sealed within budgets.										A combination of heavy traffic exacerbating pavement deterioration coupled with reduced pavement budgets in recent years has led to a backlog of pavement renewal works.		These pavement bases will need to be replaced or rehabilitated in the near future to avoid rapid degradation and pavement failure.	Road maintenance needs are high in Auckland because of high traffic volumes, especially heavy traffic, and constrained pavement renewal budgets.	Unsealed roads in poor condition are uncomfortable to drive on, reduce traffic speeds, and can pose a safety hazard.	Dust suppressants can be used but must be sensitive to environmental concerns.	Stormwater renewals programme is based on incomplete information. Opportunity needs to be taken to carry out stormwater renewal and improvement works as part of pavement rehabilitation.			High risk structures include bridges, retaining walls and sea walls with a range of possible failure modes.			Possible failure modes include general deterioration of components and corrosion affecting post-tensioning cables in bridge structures			16 bridges require seismic retrofitting to better withstand earthquakes		
↓										↓		↓	↓			↓			↓								
POTENTIAL RESPONSES																											
Continue to maintain older AC surfaces on Access and Low Volume roads as long as economically effective to do so or until other factors such as safety concerns emerge. Review road reseal policy and monitor policy compliance. Seek lower cost alternatives for road resurfacing.										Continue regular condition monitoring and assessment. Increase pavement rehabilitation budget to address increased deterioration. Optimise resurfacing and rehabilitation programme through renewals modelling, independent review, and a collaborative approach to developing the forward works programme.		Increase maintenance budget to optimal. Target maintenance activities to busy roads.	Continue with current maintenance and renewal programmes. Investigate sites which are prone to deterioration.	Consider dust impact when prioritising seal extensions. Continue to investigate dust reduction options.	Improve data on stormwater asset inventory and condition. Allocate funds within the overall renewals programme for stormwater renewal in association with road pavement rehabilitation	High risk bridges and walls are a priority for further investigation and mitigation works - including replacement if necessary.			Condition rating for all bridges. Bridge inspection and monitoring in accordance with NZTA guidance. Programme bridge remedial works and replacements where identified, prioritise more important bridges first.			Carry out 14 minor bridge retrofits and 2 for bridge strengthening. Scour assessment and mitigation programme.					

If AT does not address asset deterioration adequately, by maintaining and renewing public assets in a timely and efficient way, then safety will be compromised, customer journeys will be impacted, and significant problems will be created for the region and for future generations.									
WALLS AND CORRIDOR STRUCTURES			PATHWAYS	STREET LIGHTING	TRAFFIC SYSTEMS		BUS	RAIL	FERRY
There are condition-based risks associated with retaining walls and sea walls - premature failure would disrupt AT's customers and could damage other assets or pose a safety risk.			Most corridor structure assets (such as guardrails and gantries) have no recent condition rating, posing a potential risk	While most footpaths are in a fit for purpose condition, there are deterioration issues. Cycleways are newer and generally in better condition.	Close to half of AT's streetlight luminaires are long life LED lamps, however there are condition issues with older, sub-standard poles.	Traffic Systems assets need to be maintained in good condition to ensure their ongoing reliability and clarity		Public transport networks are expanding rapidly to provide for increased public transport patronage across bus, rail and ferry - with significant new assets coming on stream in future years. Maintenance, operations and renewals costs for public transport assets need to remain affordable for AT customers while delivering reliable services.	
WHY?									
6% of sea walls are in poor or very poor condition, with 59% being moderate. Only 1% do not have a condition rating.	8% of retaining walls are in poor or very poor condition, and there are risks around another 8% which do not have a condition rating.	Responsibility for inspecting corridor structures forms part of AT's road maintenance contracts, but condition is not recorded in AT's core systems.	177km of footpaths are in poor or very poor condition and are expected to deteriorate rapidly.	These poles have an elevated risk of premature failure and due to the consequence of failure should be replaced	Electronic systems such as VMS and traffic signals help optimise road use	Traffic signs and markings provide direction and help keep road users safe	A clean, convenient and reliable bus system is important to customers - factors which contribute to patronage growth.	Failure of rail systems (fixed or rolling stock) can adversely affect rail network reliability and disrupt service levels.	Ferry services provide an efficient alternative to long journeys by car on congested roads. Assets need to be well maintained due to the marine environment.
WHY?									
Sea walls are vulnerable to deterioration being in a marine environment, as well as damage due to coastal hazards. Corrosion of structural steel is a particular concern.	Timber retaining walls are susceptible to decay and are a potential risk - particularly following storm events when the ground is saturated	If guardrails are not well maintained or not installed to specifications, they have the potential to injure road users that strike them. Other corridor structures eg. Gantries also carry significant risk.	Older footpaths are mostly concrete and breaking up, often exacerbated by vehicles - this results in increasing trip hazards for pedestrians, a safety concern	AT is halfway through a pole replacement programme to address the risk of failure	When traffic systems fail unexpectedly traffic disruption can be significant	If visibility or clarity are poor or the assets are missing, road users may make poor decisions resulting in crash or loss of direction	Busway and bus stations are mostly in very good condition. Some bus shelters are in very poor condition.	Track, signaling and traction systems are the responsibility of KiwiRail - failure of these assets affect's AT's services. Stations are mostly in good or very good condition. Rolling stock is mostly managed by the supplier until 2026.	There is a backlog of wharves in poor or very poor condition. Ferry terminals and buildings are generally in good condition.
POTENTIAL RESPONSES									
Carry out close monitoring for signs of accelerated deterioration. Plan early intervention to avoid the combination of poor condition walls collapsing or being damaged during significant marine events (storm surge, wave action, etc.)	Condition rating. Regular inspection and monitoring, especially storm related. Programme maintenance, replacement or upgrade based on road importance and failure risk.	Condition rating and risk assessments for structures - prioritise in terms of road function and level of risk to road users. Regular inspection and monitoring. Programme remedial and replacement work before deterioration becomes significant. Replace installations not meeting standards.	Continue to monitor condition using automatic sensing and visual inspections. Increase budgets for footpath maintenance targeting localised repair needs. Renewal programmes to target larger-scale problems.	Continue with the streetlight LED conversion programme. Continue with the streetlight pole replacement programme.	Intensive condition and performance monitoring regime. Maintain and replace components to achieve high levels of reliability.	Regular inspections, audits and deficiency reviews including visibility and reflectivity testing. Remarking frequency matched to ONRC. Monitor materials technology to improve products used. Signs cleaning, maintenance and replacement programmes.	Cleaning and maintenance of bus facilities. Replace busway station assets in poor or very poor condition. Replace bus shelters in very poor condition. Enhance bus shelter provision through partnerships that generate advertising revenue.	Britomart plant and control rooms replacement upgrade programme - address poor or very poor condition assets. CAF Ltd, the supplier of electric trains, to maintain train components in good or very good condition. Prepare for hand-over of rolling stock maintenance to AT.	Regular inspection and investigation of marine assets. Maintain customer-facing assets to high level of service. Replace wharves and ferry buildings in very poor condition or for public safety reasons.

Figure 6-1: Root cause analysis – asset deterioration

6.2 Our overall approach to managing asset deterioration

The multi-criteria assessment of the approaches for addressing asset deterioration concluded that priority should be given to more important road assets, using the One Network road classification framework.

Unless safety is an issue, this means there will be more failures, defects, and poor or very poor condition assets on access and low-volume roads, with less tolerance for these issues on regional, arterial and collector roads.

This approach to asset deterioration was introduced in the 2018 AMP and has been part of AT's asset management programme for 3 years. We use it for renewals planning across the full transport asset portfolio, to ensure that significant assets are renewed before they fail.

This renewals optimisation process is illustrated in Figure 6-2. The process runs through several iterations before setting AT's final 10-year renewals programme.

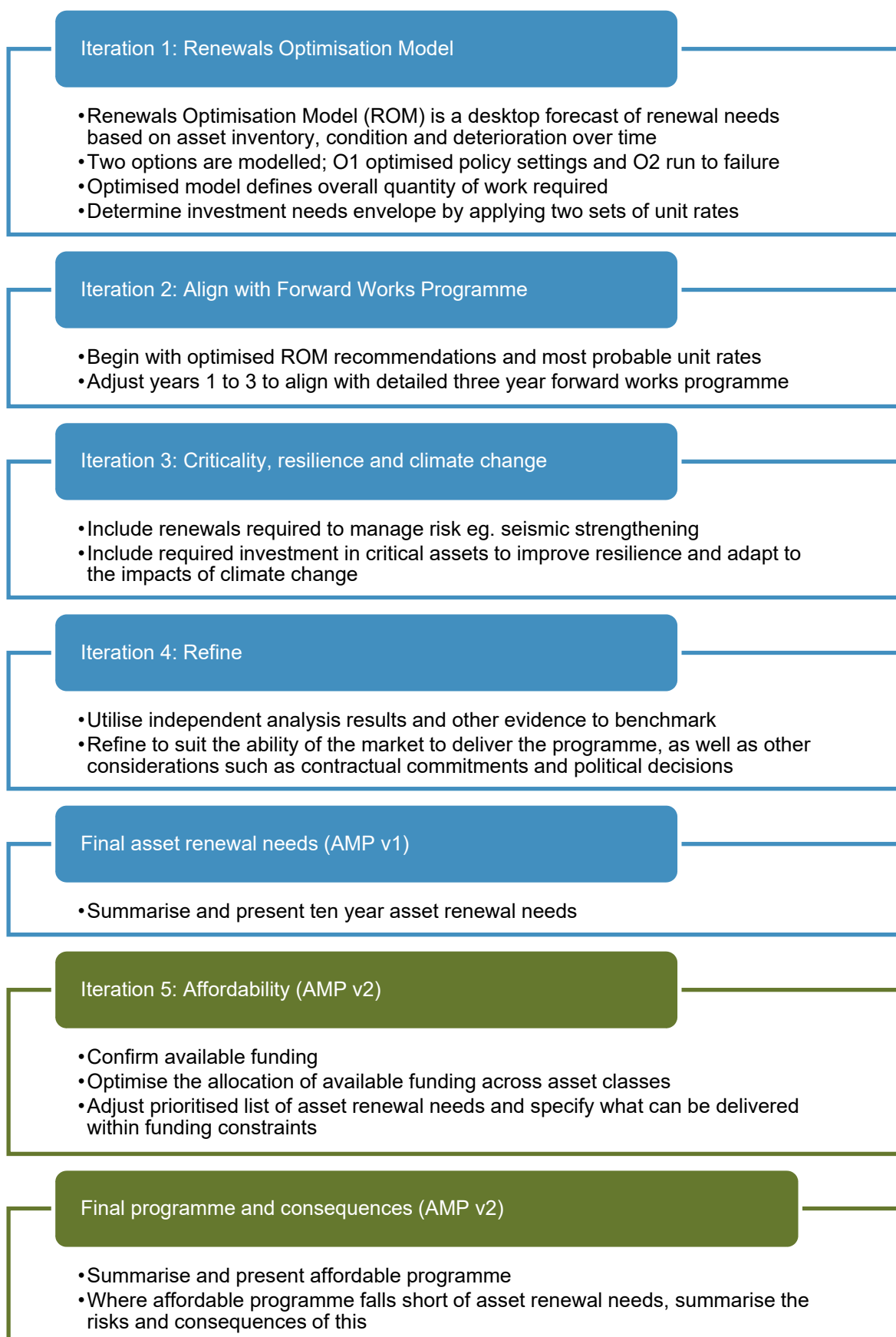


Figure 6-2: Renewals optimisation process

6.2.1 Iteration 1: Renewals optimisation model

The first iteration in developing AT's 10 year renewals programme involves developing an optimised renewals scenario for all road assets: this is option 1.

The optimised scenario sets fit-for-purpose levels of service for the assets, leading to earlier renewals on regional and arterial roads, and a greater risk tolerance for access and low-volume roads.

The costs and impacts of the optimised scenario are then compared with a run-to-failure scenario: this is option 2. The results of this comparison are shown in Table 6-1, and demonstrate why the run-to-failure scenario (where assets are replaced at the end of their useful life) is not recommended.

Compared with the optimised renewal scenario (where assets are replaced when they are no longer fit for purpose), the run-to-failure approach would save \$0.8 billion in renewals over the 10 years. However, the impact of this short-term saving would be a \$1.65 billion additional backlog of assets in poor and very poor condition at the end of the 10-year period.

Table 6-1: Comparison between optimised renewal and run to failure scenarios

	10- year renewal needs	Percentage of network in poor or very poor condition	Value of asset network in poor or very poor condition
Option 1: Optimised renewal scenario (recommended)	\$ 4.4 billion	12%	\$ 1.75 billion
Option 2: Run-to-failure scenario (not recommended)	\$ 3.6 billion	20%	\$ 3.4 billion
Difference in cost over 10 years	-\$0.8 billion	Difference in value of assets in poor or very poor condition at end of 10 years	-\$1.65 billion

The run-to-failure approach has many other disadvantages in addition to the negative long-term impact on asset value, including worsening levels of service, more frequent disruptions, higher replacement costs and much higher risks. Overall, the run-to-failure approach is inconsistent with the prudent management of Auckland's transport assets, because a financial saving for the current generation would pass an unacceptable burden on to future generations.

6.2.2 Iteration 2: Align with forward works programme

The second iteration in developing our renewals programme involves aligning the optimised renewals scenario with renewals forward works programme.

In the first 3 years of this AMP, the renewals forward works programme provides a more detailed picture of renewals needs, informed by asset inspections and detailed programming and project planning considerations. This includes programming renewals for any road, bridge and other assets that are experiencing early failure due to very heavy traffic loads.

6.2.3 Iteration 3: Criticality, resilience and climate change

The third iteration brings in any renewals programmes that are needed to mitigate natural hazard risks including seismic, slip and flood damage, and future climate change impacts.

6.2.4 Iteration 4: Refine

The fourth iteration in developing our renewals programme seeks independent assessment of the programme's size and scope. This can include comparison with peer organisations, expert modelling techniques such as dTIMS® and independent advice.

This stage also includes early engagement with contractors to discuss programme delivery, and with local boards to identify opportunities to achieve co-benefits.

6.3 Root cause analysis – road safety

The problem statement

Deaths and serious injuries on Auckland's roads are high by national and international standards, especially for vulnerable road users.

The root cause analysis for road safety examines the safety issues affecting all of the asset classes, and identifies some potential responses. An overview of the analysis is given in Figure 6-3.

The potential responses to address road safety are then sorted according to the asset class they are most relevant to. They are then analysed further as part of our decision-making about which options to invest in as part of this AMP. This process is explained for each asset class in section 7.0.

Auckland is facing a road safety crisis, especially for vulnerable road users, which is resulting in unacceptable increasing trends in road crashes, deaths and serious injuries - Auckland has the highest rate of deaths and serious injuries per km of road in NZ.

WHY?											
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Road trauma has been increasing since 2012. More deaths and serious injuries occur on urban Regional and Arterial roads than any other type of road.	Road trauma associated with loss of control is significant	Almost half of deaths and serious injuries are people riding motorbikes, cycling or walking	The rail corridor is a safety concern	Poor driver behaviour is contributing to road trauma					Walking, cycling and public transport do not create risk to other road users.		
WHY?											
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Infrastructure for safety has not kept up with growth and changing use of the transport network	Red-light running, vulnerable users not sighted, failure to give way	Increasing trend in DSI crashes due to wet roads	Loss of control DSI's on urban roads at night are increasing	Loss of control on rural roads was a contributing factor in 19% of road trauma in the last 5 years, mostly during the day	Vulnerable road users (cyclists, pedestrians and motorcyclists) represent 46% of deaths and serious injuries 2014-2018	8% of 5-year transport system deaths are related to train strikes	Alcohol and/or drugs are contributing factors in 19% of road deaths and serious injuries.	Excessive speed for the conditions was a contributing factor in 24% of road deaths and serious injuries	28% of deaths and serious injuries involve young drivers (16-24 year olds)	Less car travel means less safety risk, but personal safety concerns can limit peoples travel choices.	
WHY?											
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Some assets do not meet current safety standards. More safety infrastructure is needed.	Visibility restricted at intersections, signs and markings not clear or inadequate, traffic signals not seen	Poor skid resistance at intersections increases stopping distance and can cause loss of control	Likely to be a combination of lighting inconsistency, road road environment, poor driver behaviour	Poor road geometry, narrow pavement widths, drop-offs, lack of delineation and/or guard-rails, roads not "self-explaining", excessive speed.	There are increasing areas of conflict between vulnerable users and other road users (including heavy vehicles) combined with risk taking and poor driver behaviour	15 people on foot were killed while on the railway corridor from 2014 to 2018.	Alcohol and drugs can severely impair driver ability and response times, increase risk appetite, and result in crash	Inappropriate speed limits (urban and rural) for the road environment - too high, and implying a higher level of perceived safety than is warranted	Drivers not recognising the limitations of the road environment or their own skills	Young drivers tend to take greater risks and perceive their skills to be better than they are - this often results in the loss of innocent lives	Poor lighting of footpaths and cycleways. Older CCTV systems and lack of help points on the public transport network.
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
POTENTIAL RESPONSES											
Deliver low cost safety improvements as part of overall maintenance and renewal activities. Increase maintenance and renewal allocations to cover whole of life costs of safety infrastructure improvements. Complete the replacement of older streetlight poles with safer modern designs	Improve visibility at intersections - vegetation / other obstacles. Safety initiatives such as providing islands, refuges, barriers, lighting, pedestrian priority, etc. Review appropriateness of existing intersection controls at poorly performing sites - e.g. Give Way, Stop, roundabout, traffic signals.	Skid resistance measurements at intersections with remedial works to improve surface friction, both at intersections and bends	Investigate the underlying causes of crashes, identify common themes, and develop improvement programmes to address these issues. Consider skid resistance deficiencies and ensure reseals programme is addressing these.	Improve the road environment, targeting problem issues and improving visual cues for drivers. Address alignment and geometry inconsistencies using a crash-risk based approach. Measures to make the road "more forgiving" should loss of control occur - e.g. safe run-off, protected drop-offs, protected bridge ends, etc.	Improved facilities for vulnerable users that provide a better level of protection in conflict zones - including separate space within the road corridor or alternative non-vehicular corridors. Encourage more use of public transport as the "safest mode". Cycle skills training and behaviour change initiatives.	AT's long term strategy is to close or grade separate all rail level crossings. Meanwhile, AT will continue to work with KiwiRail and other stakeholders to identify safety improvements, including security, visibility, warning devices. Provide safe routes along and across the rail corridor to reduce trespassing.	Implement campaigns with our Vision Zero partners to encourage responsible driving. Partner with police to enhance enforcement of drink driving and drugged driving laws.	Set safe and appropriate speed limits. Increase Police enforcement of speed limits with targeted campaigns	Build community support for safer speeds. Measures to make the road "more forgiving" should crashes at speed occur - e.g. safe run-off, protected drop-offs, protected bridge ends, etc.	Support / promote / reward safe driver training programmes	More streetlights to light a greater proportion of the AT pathways network. Improve CCTV coverage and help points at public transport and parking facilities to improve personal safety

Figure 6-3: Root cause analysis – road safety

6.4 Our overall approach to managing road safety

The regionally agreed approach for reducing deaths and serious injuries on Auckland's roads is set out in [Vision Zero for Tāmaki Makaurau](#). This strategy has a long-term goal of no deaths or serious injuries on Auckland's transport network by 2050.

AT will contribute towards this goal through three main areas: safer infrastructure, safer speeds and safer transport user behaviour.

6.4.1 Safer infrastructure

As both urban and rural roads become busier, there is a greater need for specialised assets to keep road users safe, and to keep people and goods moving. This will impact on costs through all phases of the asset lifecycle, from capital investments, through operations and maintenance, to renewals.

As asset managers, the Vision Zero approach requires us to be proactive about all opportunities to prevent crashes and to mitigate their impacts, even when other factors including speed and driver behaviour are also contributing factors. This leads to different actions being required for urban and rural roads.



Safer rural roads have:

- clear sightlines
- road shoulders that are clear of trees and objects
- pavements that drain well and provide good skid resistance
- clearly marked edges
- a safe and appropriate speed limit
- well signposted hazards (where they cannot be eliminated)
- median and side barriers on high-speed rural roads.



Safer urban roads have:

- slower vehicle speeds
- protected space for pedestrians and cyclists (or very slow shared spaces)
- shade and visual interest, to create a welcoming space
- design features that slow traffic even further at intersections and conflict points
- good lighting for footpaths and crossings as well as the road.

These asset management initiatives will complement other safer infrastructure improvements funded as capital projects, or smaller projects implemented through the low-cost low-risk capital programme.

6.4.2 Safer speeds

Establishing and managing speed limits that are appropriate to the road environment is an important part of AT's strategy for improving road safety outcomes. Table 6-2 lists AT's planned speed management actions.

Table 6-2: Speed management actions to improve safety

Activity area	Action
Speed management	<ul style="list-style-type: none"> Follow recommended national practices in analysing and prioritising routes based on safety-related characteristics and establishing appropriate speed limits. Conduct regular speed limit reviews on both urban and rural roads (e.g. 100km/hr to 80km/hr rural, 30km/hr or 40km/hr urban).
Speed enforcement	<ul style="list-style-type: none"> Work with road safety partners including NZTA and Auckland Council to build public understanding and support for speed limit changes. Work with NZ Police to increase the level of speed enforcement with targeted campaigns.

These activities are funded as part of AT's overall network management budget.

6.4.3 Safer transport user behaviour

The Vision Zero for Tāmaki Makaurau strategy includes a plan to support safe transport user behaviour through education, promotion, enforcement and travel demand management. This plan is set out in Table 6-3 and will be delivered by AT in partnership with the NZTA, the NZ Police and health sector representatives.

Table 6-3: Actions to support safe transport user behaviour

Activity area	Action
Education	<ul style="list-style-type: none"> Offer road user education campaigns focused on driver behaviour and crash factors such as loss of control, crossing the rail corridor, alcohol and drugs, speed, and intersection behaviour.
Enforcement	<ul style="list-style-type: none"> Work with the NZ Police to prevent harm through integrated campaigns to improve compliance with key road rules, including speed restraints, impairment by alcohol and drugs, compliance with road rules at intersections, and avoiding distractions.
Cyclist training	<ul style="list-style-type: none"> Support the delivery of cyclist training programmes in schools.
Driver training	<ul style="list-style-type: none"> Support and promote safe driver training programmes.
Modal choice	<ul style="list-style-type: none"> Encourage more use of public transport as the safest mode of transport.
Legislation	<ul style="list-style-type: none"> Lobby for more stringent legislation and increased penalties especially for recidivist unsafe drivers.

6.5 Root cause analysis – impacts of growth

The problem statement

Network requirements to address the impacts of growth and intensification will be significant, resulting in accelerated asset deterioration and escalating costs

The root cause analysis for growth examines the growth-related issues affecting the transport system, and identifies some potential responses. An overview of the analysis is given in Figure 6-4.

The potential responses to address the impacts of growth are then sorted according to the asset class they are most relevant to. They are then analysed further as part of our decision-making about which options to invest in as part of this AMP. This process is explained for each asset class in section 7.0.

Network requirements to address the impacts of growth and intensification will be significant, resulting in increased asset deterioration and escalating costs												
WHY?												
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
The long term impacts of COVID-19 are not yet clear	Costs involved in maintaining and renewing assets have increased	Population growth rates are significant. This is leading to increased transport demand.	The road network does not have sufficient capacity to cope with the growth in peak-hour commuter demands	Heavy construction vehicles need access to development areas	Economic growth is forecast to lead to more demand for freight movement on the road network - to the Port, industrial and commercial areas, and other freight hubs							
WHY?												
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
The rate of growth could slow down	Construction costs may move up or down	There has been a high level of competition for construction resources in the Auckland market - in part due to urban development	Around 10,000 new homes are being built in Auckland each year	Intensification is occurring, which means more people living in the existing urban area.	Active transport and public transport modes are not as attractive to use as they could be	Arterial roads are experiencing significant traffic delays at peak-hours	Access roads to greenfields developments, landfills and quarries are inadequate for loadings related to the movement of construction materials	Very high volumes of heavy vehicles on the network is resulting in physical damage to the road network as well as congestion and safety risks				
WHY?												
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Recessionary conditions in the economy could stifle land development.	Changing market competitiveness in the construction sector, due to variable workloads (could be increase or decrease)	High demand has increased the unit rates used for planning maintenance and renewal work programmes	New subdivisions means more roads are being added to the network every year - increasing the demand for more funding to maintain them	Intensification means more people are trying to use the same transport assets, making the road network more complex	Walking, cycling and public transport all use less space per person than private vehicles, but are neither safe nor attractive on roads congested with private vehicles	Local roads that connect to/from the motorway network are highly congested at peak times	Many controlled intersections (roundabouts, traffic signals) cannot cope with peak-hour volumes	Bridge load / capacity restrictions on access roads to new developments	Pavement strength and width are often inadequate and premature deterioration has occurred or will occur	Heavy vehicles are using roads which are not suitable, both in terms of design and because freight uses conflict with the needs of residents and other road users.	Faster pavement deterioration rate, thus increasing demand for maintenance and renewal funding	More exposure of vulnerable road users to conflict with larger vehicles
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
POTENTIAL RESPONSES												
Monitor development trends (e.g. planning consents)	Monitor market cost trends	Work with the construction sector to identify pinch-points and opportunities to reduce supply costs over time	Allocate funding to operate and maintain a growing transport network. Provide design guidance and controls to ensure inappropriate assets are not being created, or to avoid acquiring assets with excessive life-cycle costs.	Move more people and goods within the footprint of existing roads, by improving the attractiveness of public transport, walking and cycling. Develop safe, attractive and well-connected footpath and cycleway networks within the transport corridor	Transform the existing road network, from one where typically 80% of road space is devoted to cars, to a multi modal network	Expand on the "One-network" approach demonstrated by the Auckland Traffic Operations Centre. Provide public transport and cycling options on key links to offset demand for single occupant vehicle travel.	Targeted intersection improvements for priority road users as identified in the Network Operating Plan. Expand capacity at Traffic Operations Centre to enable further optimisation of traffic signals for enhanced network performance.	Use land use consents to specify suitable access routes including bridges, and/or to seek financial contributions for necessary strengthening and upgrade works to meet future needs.	Forward assessment of routes to be used for future land development, landfills and quarries. Work with industry partners to mitigate the impacts of heavy traffic.	Work with freight industry to identify key freight routes. Improve the suitability of these routes eg. by ensuring pavements are designed for longer life, and intersections and bridges are suitable for heavy vehicles.	Separation of modes on identified freight routes, direct freight away from roads with high place values.	

Figure 6-4: Root cause analysis – impacts of growth

6.6 Our overall approach to managing the impacts of growth

AT's overall response to growth is developed in partnership with Auckland Council and Central Government through the Auckland Transport Alignment Project. A key output of the project is an agreed programme of new capital investments, including state highways, local roads, rail freight and public transport, to meet the needs of Auckland's growth.

Within AT, the impacts of growth are managed as part of the Network Operating Plan and through the Road Safety Programme. Many of these initiatives are smaller projects implemented through the low-cost low-risk capital programme.

This AMP includes a consequential opex model. The model sets out the additional costs of operating and maintaining new assets created or purchased during the 10 years of this AMP, which then need to be included in operations and maintenance budgets.

6.7 Root cause analysis – lack of resilience

The problem statement

The transport network lacks resilience in the face of future challenges including climate change, resulting in an increasing potential for significant disruption

The root cause analysis for lack of resilience examines the resilience, natural hazard and climate change-related issues affecting the transport system, and identifies some potential responses. An overview of the analysis is given in Figure 6-5.

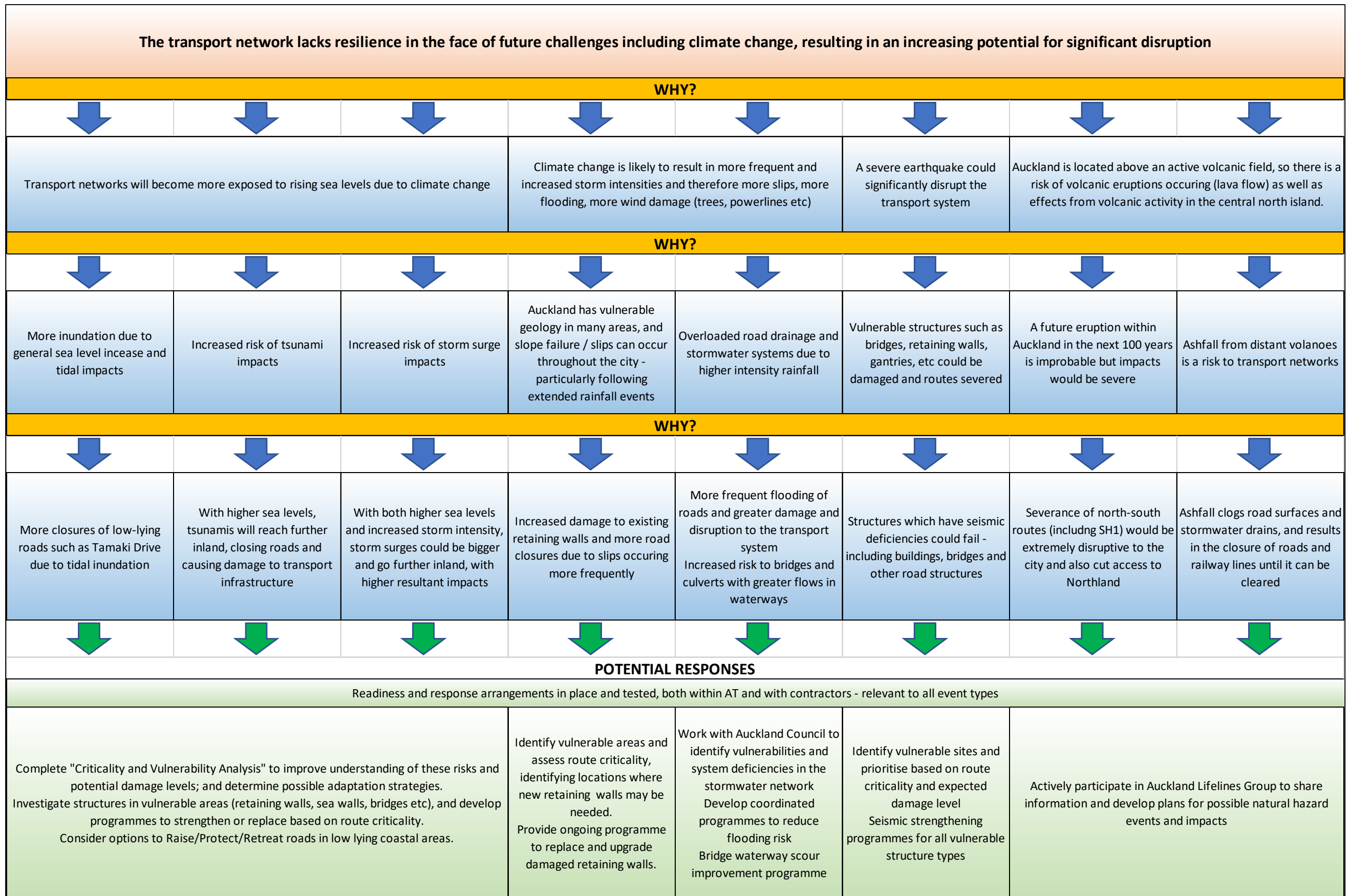


Figure 6-5: Root cause analysis – resilience and climate change

6.8 Our overall approach to managing lack of resilience

Auckland's transport network is not especially resilient. At some critical locations, a relatively small incident can cause significant disruption to customer journeys, because the road network is close to capacity and there are few alternative routes. We use our [criticality framework for transport infrastructure](#) to identify critical assets in critical locations, and we have a low tolerance for risks which could impact on these assets, because of the consequences if these assets fail.



Figure 6-6: Asset risk management framework

To manage the risk of asset failure, AT assesses what assets are at risk of damage, and how vulnerable these assets are to being damaged in a hazard event.

6.8.1 Adaptation, resilience and natural hazards

As asset managers, we are most concerned about hazards that physically damage assets. Hazards include vandalism and road crashes, but the most serious and irreversible physical damage to assets is usually due to natural hazards, most frequently heavy rainfall, high winds and coastal erosion.

AT incorporates its climate change mitigation plans into its overall framework for managing risk from natural hazards. This framework is shown in Figure 6-6 and considers the three separate parameters that make up overall risk: likelihood, vulnerability and consequence.

AT's approach to planning for climate change is to look first at the current likelihood of natural hazards, and then to adjust that likelihood over time based on the latest climate change science.

For some natural hazards, for example volcanic activity and tsunamis, the likelihood of hazard events is unchanging over time, so past data can be used to inform future probabilities. For other natural hazards including high winds, flooding and storm surges, climate change [projections for Auckland](#) forecast that extreme events will become more common and more severe due to climate change.

Natural hazards relevant to Auckland and their general consequences are summarised in Table 6-4.

Table 6-4: Natural hazards

Hazard	Description	Effects / Impacts
Storm, flood and wind	Weather-based events; expected to become more severe and frequent with climate change	Increasing risk of road closures and damage to roading assets, including washouts, slips, erosion, scour, bridge failures, wind impacts, etc.
Tsunami and storm surge	Hazard events relating to the sea (which could become more intense with climate change), and tsunami events.	Increasing risk of road closures and potentially extensive damage to roading assets. Potential inundation of roads in low-lying coastal areas.
Earthquakes and liquefaction	Fault movement, ground shaking, induced liquefaction and other effects arising from major seismic activity.	Road closures and potential damage to assets.
Volcanic eruption	Eruptions from the Auckland volcanic field or eruptions from the Taupo volcanoes.	Potential destruction of roads and property due to lava flows. Disruption due to ash fall on roads and railway lines.
Wildfire	Fires which occur in forests and on rural land; expected to become more frequent and severe with climate change.	Increasing risk of road closures, disruption and damage.

To understand the consequences of each natural hazard, AT uses the best available data to assess specific threats and forecast which assets will be affected, and to what extent.

The outcome of this work is summarised in Table 6-5.

Table 6-5: Proportion of road network exposed to natural and climate change hazards

Hazard types	Road network likely to be exposed	
Liquefaction susceptibility (low elevation)	17.79%	1,360km
Liquefaction susceptibility (high elevation)	21.55%	1,647km
Floodplain	13.24%	1,012km
Tsunami	3.44%	263km
Auckland volcanic field	22.88%	1,749km
Auckland volcanic field (buffer)	15.55%	1,189km
Coastal inundation (present day 5 year)	0.10%	10km
Coastal inundation (present day 20 year)	0.20%	14km
Coastal inundation (present day 50 year)	0.20%	18km
Coastal inundation (present day 100 year)	0.60%	47km
Coastal inundation (0.5m sea-level rise 50 year)	0.70%	50km
Coastal inundation (1m sea-level rise 50 year)	1.30%	102km
Coastal inundation (2m sea-level rise 50 year)	2.90%	220km
Coastal inundation (0.5m sea-level rise 100 year)	1.10%	86km
Coastal inundation (1m sea-level rise 100 year)	1.80%	140km
Coastal inundation (2m sea-level rise 100 year)	3.20%	242km

6.8.2 Assessing the criticality of assets

AT's [Criticality Framework for Transport Infrastructure](#) identifies the criticality of each of AT's major assets, based on the severity of the consequences of any disruption to those assets.

For assets in the road corridor, the network-level criticality assessment is primarily based on:

- One Network road classification
- lifeline routes – whether the route provides access to lifeline utilities (such as water, wastewater, power and telecoms) or a lifeline evacuation route in order for Auckland to respond and recover from hazard events
- essential services – whether the route provides access to facilities and services that are essential to the social wellbeing of the community.

The results of this assessment are summarised in Table 6-6.

Table 6-6: Network criticality assessment for major assets in the road corridor

Asset network		Unit	Network criticality level					TBD
			Level 1 (vital)	Level 2	Level 3	Level 4	Level 5 (minor)	
#Road corridor network by One Network road classification	Regional	km	218.1	130.8	21.2			8
	Arterial	km	136.5	278.7	509.8	139.5	11	17.7
	Primary collector	km	3.7	37.8	177.5	415.7	332.3	15.4
	Secondary collector	km		14.5	102.3	532.5	1,416	44.5
	Access	km		0.1	17.9	281.3	1,417.3	43
	Low volume	km		0.3	1.9	90.9	1,009	166.8
Total road pavement		km	366.2	468.8	853.5	1490.1	4251.2	161.2
Catchpits		count	7,101	6,534	12,315	11,984	45,593	4,660
Bridges		count	80	80	114	144	216	230
Retaining walls and sea walls		count	473	440	653	775	1650	370
Cycleways		km	6.9	11.1	34.4	46.5	181.7	58
Footpaths		km	195	278.1	756.1	785.9	3592.8	1767.7
Street light luminaires		count	11,736	10,881	18,227	16,138	56,035	6,391
Controlled intersections		count	398	238	125	8	15	2

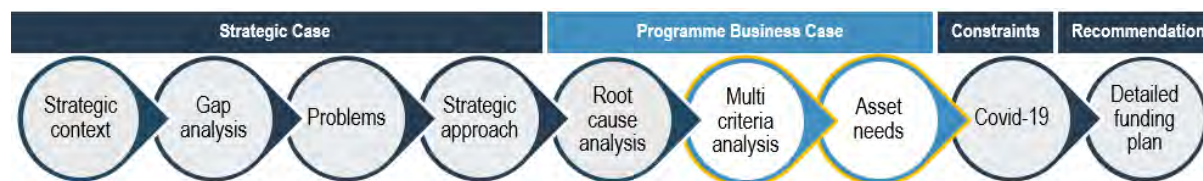
For AT Metro and parking facilities, criticality is ranked based on the number of users, and details of the criticality assessment are provided in the asset class management plans.

In this AMP, the criticality ratings of assets have been used to:

- inform asset inspection protocols
- prioritise maintenance and renewal works
- inform decisions on budgets and resources, by identifying the likely impacts, if asset repairs and renewals are not undertaken in a timely manner.

Asset criticality is also used alongside asset condition to rank assets from those most in need of intervention to those where no action is needed, and is used to prioritise maintenance and renewals. Figure 7-21 shows an example of how this method has been applied to prioritise bridge renewals.

7.0 Multi-criteria analysis and asset needs



The root cause analysis identified a longlist of options to address the problems identified in the strategic assessment, and improve the contribution of asset management to strategic outcomes.

Not all of the options identified can be funded or delivered, so it is important to make trade-offs. AT uses multi-criteria analysis to compare the options, support conversations about trade-offs and document decisions in a transparent way.

Our approach follows the guidelines developed by the NZ Road Efficiency Group and ensures all options are considered as we develop our investment recommendations. This includes asking ourselves, in relation to each option, whether we can:

- change the timing of intervention responses
- adjust the level of service
- use existing assets differently
- change the level of risk – for example, by postponing renewals
- manage demand
- manage routes
- use alternative approaches – for example, different technology
- change the balance of activities – for example, maintenance and renewal adjustments
- varying levels of service according to the One Network road classification
- extend temporary management
- make supply chain improvements
- improve systems and capability.

This analysis is completed for each asset class in the following sections.

For each asset class we also look at the past operations, maintenance and renewals investment required. This information, together with our analysis of the options, forms the basis for our recommended investment needs for each asset class. These needs are also detailed in this section, then combined into our total recommended asset investment needs in section 8.0.

7.1 Sealed roads

Sealed road pavements are AT's most significant asset and form the basis of the transport network. Auckland's 6,774km of sealed roads have a replacement cost of \$8.85 billion, excluding the value of the land under roads, as shown in Table 7-1.

The current, depreciated value of the pavement base is 59 per cent of its replacement cost, and for the pavement surface it is 45 per cent of replacement cost, indicating that around half of the economic value of the portfolio has already been consumed. Annual depreciation is \$132.3 million.

Table 7-1: Sealed roads valuation

Asset	Replacement cost \$m	Depreciated value \$m	Annual depreciation \$m
Sealed road formation	\$3,148.8	\$3,148.8	\$0.0
Sealed road pavement base	\$4,567.9	\$2,711.7	\$57.7
Sealed road pavement surface	\$1,169.1	\$528.9	\$74.6
Sealed roads total	\$8,885.8	\$6,389.4	\$132.3

7.1.1 Sealed roads – issues and potential responses

The root cause analysis in section 6 highlighted a range of issues and concerns about our sealed road assets. It also identified a range of potential responses to address these issues, as set out in Table 7-2.

Table 7-2: Root cause analysis – potential responses for sealed roads

Problem area	Potential responses
Asset deterioration	Continue to maintain older asphaltic concrete surfaces on access and low-volume roads as long as it is economically effective to do so or until other factors such as safety concerns emerge.
Asset deterioration	Review road reseal policy and monitor policy compliance. Seek lower cost alternatives for road resurfacing.
Asset deterioration	Increase pavement rehabilitation budget to address increased deterioration.
Asset deterioration	Optimise resurfacing and rehabilitation programme through renewals modelling, independent review, and a collaborative approach to developing the forward works programme.
Asset deterioration	Increase maintenance budget to optimal. Target maintenance activities to busy roads.
Safety	Deliver low-cost safety improvements as part of overall maintenance and renewal activities.
Safety	Increase maintenance and renewal allocations to cover the whole-of-life costs of safety infrastructure improvements.
Safety	Improve visibility at intersections, e.g. by removing vegetation and other obstacles.
Safety	Install skid-resistance measures and undertake remedial works to improve surface friction, at both at intersections and bends.
Safety	Investigate the underlying causes of crashes, identify common themes, and develop improvement programmes to address these issues.
Safety	Prioritise locations with poor skid resistance in the road pavement renewals programme.
Safety	Improve the rural road environment, targeting issues and improving visual cues for drivers.
Safety	Address alignment and geometry inconsistencies using a crash-risk based approach.
Safety	Undertake measures to make the road more forgiving should a crash occur, e.g. safe run-off, protected drop-offs, protected bridge ends.
Growth and demand	Allocate funding to operate and maintain a growing transport network.
Growth and demand	Provide design guidance and controls to ensure inappropriate assets are not being created, and to avoid acquiring assets with excessive life-cycle costs.

Problem area	Potential responses
Growth and demand	Move more people and goods within the footprint of existing roads, by improving the attractiveness of public transport, walking and cycling.
Growth and demand	Transform the existing road network, from one where typically 80 per cent of road space is devoted to cars, to a multi-modal network
Growth and demand	Provide public transport and cycling options on key links to offset demand for single occupant vehicle travel.
Growth and demand	Use land use consents to specify suitable access routes, including bridges, and seek financial contributions for necessary strengthening and upgrade works to meet future needs.
Growth and demand	Work with the freight industry to identify key freight routes. Improve the suitability of these routes, e.g. by ensuring pavements are designed for a longer life, and intersections and bridges are suitable for heavy vehicles.
Growth and demand	Separate modes on identified freight routes, and direct freight away from roads with high place values.
Resilience	Consider options to raise, protect or retreat roads in low-lying coastal areas.

7.1.2 Sealed roads – evidence of issues and trends

Asset deterioration

The rate at which the pavements of sealed roads deteriorate already has a significant impact on AT's overall financial position. Annual depreciation for these assets is \$105 million.

Across the Auckland transport network, 3.0 per cent of road pavement surfaces and 3.8 per cent of road pavement bases are in very poor condition.

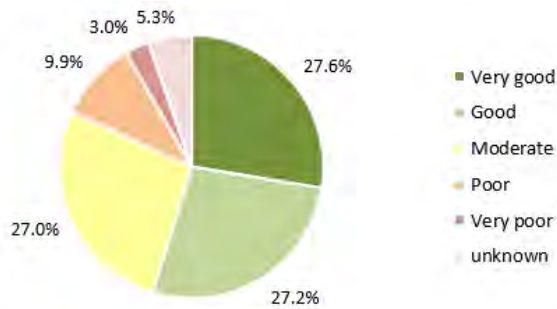
The various problems affecting sealed road pavements are summarised in Figure 7-1. The main factors contributing to the deterioration of these assets are:

- urban growth and intensification causing more rapid deterioration in some areas, including access roads to quarries and landfills
- a backlog of road pavement bases in very poor condition that require renewal.

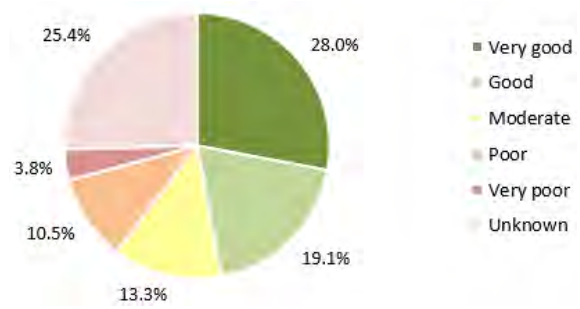
AT must balance the deterioration of Auckland's sealed road network with an appropriate investment in road pavement maintenance and renewals. Failure to do this could result in unsustainable future liabilities, poor levels of service and an unsafe network for users. Over time, asset deterioration devalues the very significant investment made by past generations to create Auckland's local road network.

Asset deterioration

Road pavement surface condition 2020



Road pavement base condition 2020



Note: Most roads of unknown pavement base condition are access and low volume roads. AT monitors its critical roads every 1 to 2 years.

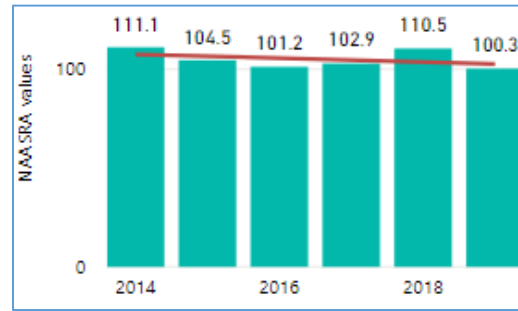
Surface flushing trends



(Data represents regional, arterial and primary collector roads only)

A rise in flushing defects indicates an increasing safety risk on the network, specifically for skid resistance. Maintenance options such as water cutting need to be employed to prevent further bleeding and tracking of the binder layer.

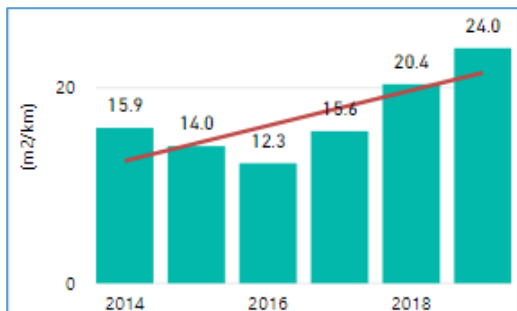
Road roughness trends



(Data represents regional, arterial and primary collector roads only)

Road roughness (NAASRA) is a measure of the condition of the pavement base and reflects user perceptions of how smooth (low NAASRA) or bumpy (high NAASRA) their ride was. The trend over time appears stable.

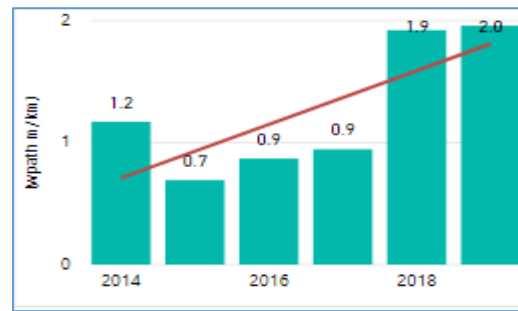
Surface scabbing trends



(Data represents regional, arterial and primary collector roads only)

Scabbing is a type of chip loss and can cause loss of surface friction, increasing safety risk on the network. Causes for this failure can include increased heavy traffic loading, construction material issues or poor repairs.

Road rutting trends



(Data represents regional, arterial and primary collector roads only)

Rutting is caused by deformation or consolidation of any of the pavement layers or subgrade, and is a measure of the condition of the pavement base. Ruts filled with water can cause vehicle hydroplaning, and can be hazardous.



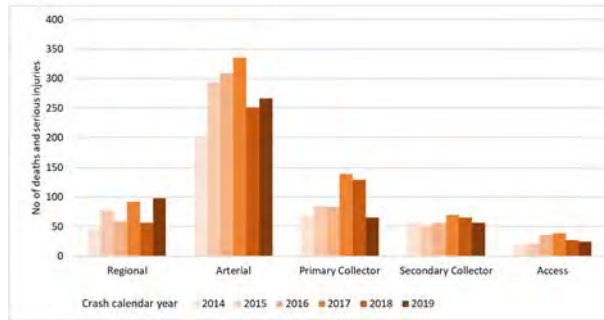
Figure 7-1: Sealed roads – evidence of asset deterioration

Road safety

Regional and arterial roads are the most problematic for road safety, as shown in Figure 7-2. These roads carry almost 80 per cent of Auckland’s vehicle traffic, and also have the greatest mix of road users, including vulnerable pedestrians, cyclists and motorcyclists.

Well maintained road pavements can help reduce crashes, especially where driver loss of control is a factor, and mitigate the impacts of any crashes that do occur. Other road assets, including pathways and traffic systems, also help keep all road users safe.

Deaths and serious injuries on AT roads



Deaths and serious injuries where loss of driver control in the wet was a contributing factor

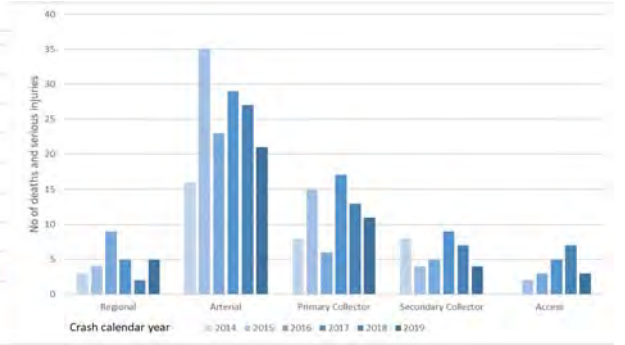


Figure 7-2: Sealed roads – evidence of safety issues

Growth

Auckland’s road network is growing, and becoming busier and more complex to manage.

Around 1 per cent more roads (70km) are added to the network each year, as shown in Figure 7-3. This directly increases costs for maintenance and in the longer term also impacts on renewals needs.

As Auckland’s population grows and as more people choose to live in high density suburbs, existing roads need to meet the needs of cyclists, motorcyclists, bus passengers and freight vehicles, as well as general traffic. This creates a more dangerous road environment where small pavement faults can lead to serious crashes. The task of repairing roads is also made more difficult and expensive because of traffic management requirements.

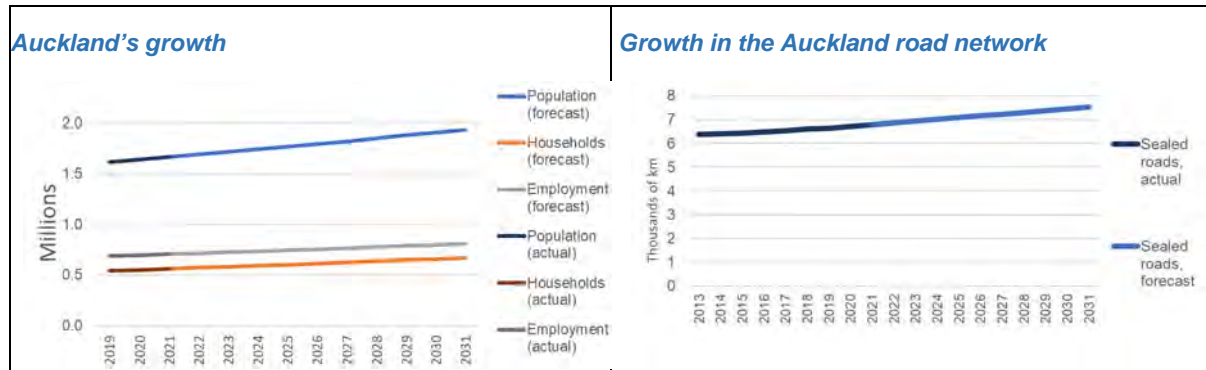


Figure 7-3: Sealed roads – evidence of growth and demand

Resilience

AT has a good understanding of which parts of the road network are most critical, and where sealed road pavements are at risk from natural hazards, as shown in Figure 7-4. The next step is to invest in resilience improvements, so the impacts of these hazards can be managed and mitigated.

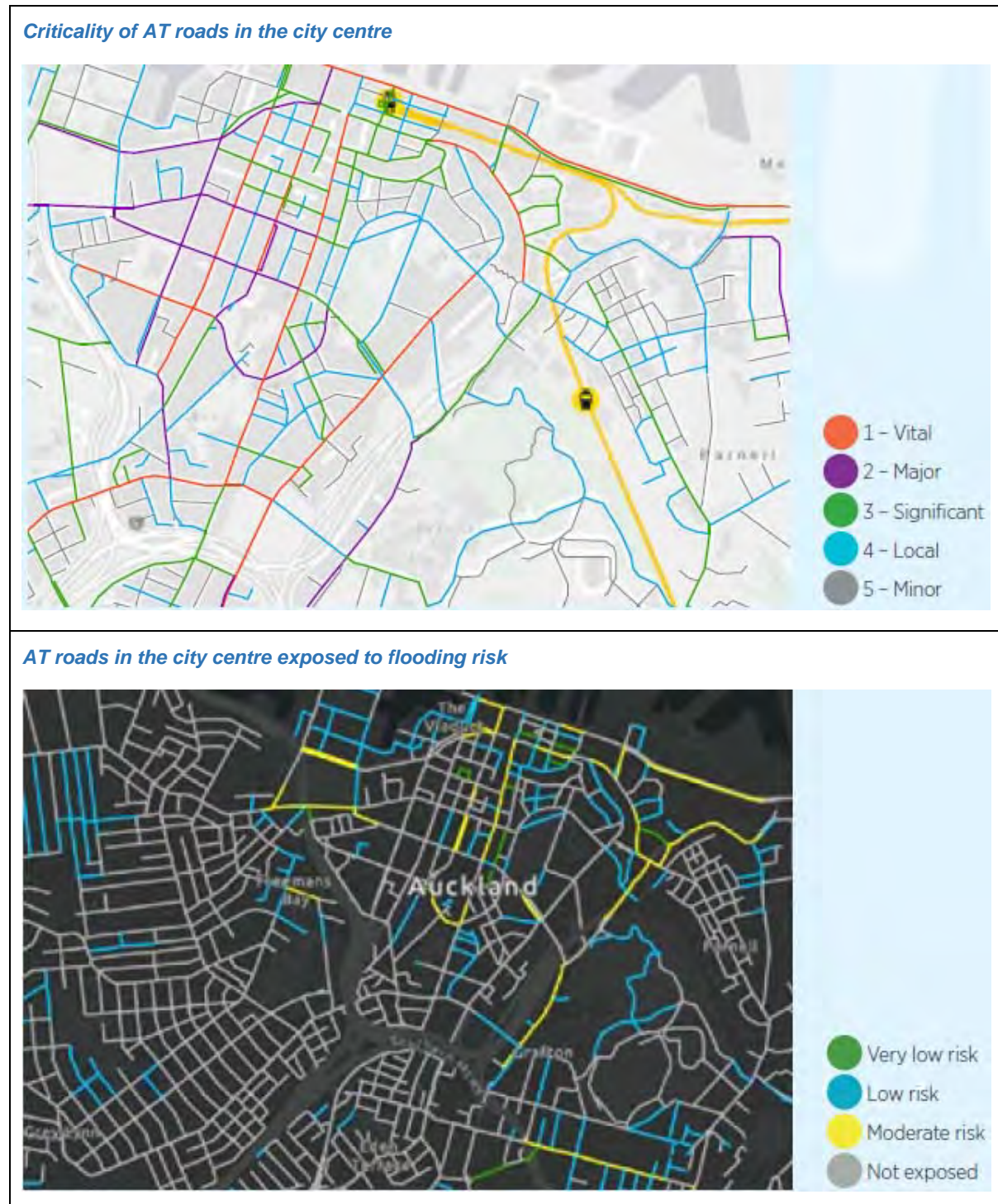


Figure 7-4: Sealed roads – evidence of criticality and resilience

7.1.3 Sealed roads options analysis

AT used a multi-criteria analysis to rank six of the options identified in the root cause analysis in order of preference or importance. The results are shown in Table 7-3.

Table 7-3: Multi-criteria analysis of options for managing sealed roads

Option - Can we make	Yes/No	Rank	Reason													
<input type="checkbox"/> Intervention response timing change	Yes	3	Proactively identify roads expected to be loaded by heavy traffic and work with the freight industry, the NZ Transport Agency and other stakeholders to manage the impacts of this.													
<input type="checkbox"/> Level of service adjustments	Yes	5	Tighter implementation of resurfacing guidelines - only resurface busy roads and commercial areas with asphalt, all other roads chip seal or other low cost alternative													
<input type="checkbox"/> Use existing assets differently																
<input type="checkbox"/> Blending Work Categories differently	Yes	1	Less resurfacing, more rehabilitation - last 3 years had reduced rehab budget. Optimise using dTIMS / tech input													
<input type="checkbox"/> Risk - Hold Assets longer	Yes	7	Allow more failures on less busy pavements while managing skid resistance													
<input type="checkbox"/> Managing demand																
<input type="checkbox"/> Route Management																
<input type="checkbox"/> Alternative approaches – different technology	Yes	2	Investigate and implement alternative resurfacing / rehabilitation technologies													
<input type="checkbox"/> Maintenance vs Renewal adjustments																
<input type="checkbox"/> ONRC Classification variance	Yes	6	Restore maintenance budgets to optimal and direct a higher proportion of budget to busy roads, accept more failures on lower volume roads													
<input type="checkbox"/> Extended temporary management																
<input type="checkbox"/> Supply chain improvements	Yes	4	Review incentives and risk sharing within maintenance contracts, improve decision tools for resurfacing													
<input type="checkbox"/> Improve systems and capability																
Criteria	Weight	How good is this option														
		Option 1 - early intervention "growth" related		Option 2 - reduce "amenity" AC		Option 4 - increase rehabilitation		Option 5 - accept higher risk profile except for skid resistance		Option 8 - investigate alternative treatment types		Option 10 - stronger alignment of failure risk profile with ONRC		Option 12 - review incentives and risk sharing with suppliers, decision trees		
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	
Community Outcomes Achieved	20%	1	0.2	-3	-0.6	2	0.4	-1	-0.2	1	0.2	0	0	0	0	
Problem solving effectiveness	5%	2	0.1	1	0.05	2	0.1	-1	-0.05	1	0.05	2	0.1	2	0.1	
Benefits realised			0		0		0		0		0		0		0	
Good Environmental impacts			0		0		0		0		0		0		0	
Value for Money	20%	2	0.4	3	0.6	1	0.2	3	0.6	3	0.6	3	0.6	3	0.6	
Closing Customer and Technical LoS gaps and impacts			0		0		0		0		0		0		0	
Closing ONRC Performance gaps	10%	0	0	-1	-0.1	2	0.2	-1	-0.1	1	0.1	1	0.1	1	0.1	
Asset preservation and sustainability	10%	3	0.3	3	0.3	3	0.3	-1	-0.1	2	0.2	1	0.1	2	0.2	
Total Cost of Ownership (whole of life Costs)	20%	2	0.4	3	0.6	2	0.4	2	0.4	2	0.4	1	0.2	2	0.4	
Life Cycle Management	10%	3	0.3	3	0.3	3	0.3	-1	-0.1	2	0.2	0	0	2	0.2	
COVID-19 Recovery	5%	1	0.05	0	0	1	0.05	0	0	1	0.05	0	0	1	0.05	
			0		0		0		0		0		0		0	
Totals	100%		1.75		1.15		1.95		0.45		1.8		1.1		1.65	

7.1.4 Sealed roads – past investment

Past maintenance investment

Past investment in sealed road maintenance is shown in Figure 7-5. There has been a sustained reduction in expenditure over the past 8 years, which is even more apparent once expenditure is adjusted for inflation and growth in the sealed road network.

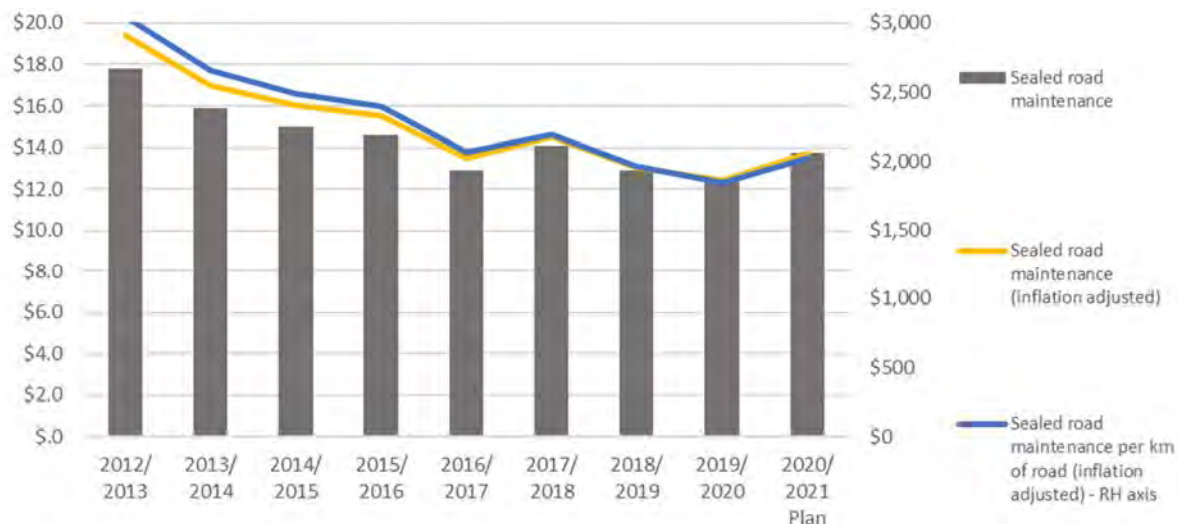


Figure 7-5: Sealed roads – past maintenance investment

This reduction in sealed road maintenance budgets is likely to mean that small problems such as potholes are less likely to be addressed in a timely manner, which in turn will lead to a greater pressure on renewals budgets and a higher whole-of-life cost.

An increase in expenditure on sealed road maintenance is included in the Annual Plan for the current year 2020/2021.

Past operations investment

Past investment in sealed road operations is shown in Figure 7-6.

However, past operations expenditure is a poor guide to future needs for sealed roads, because responsibilities including footpath cleaning and berm maintenance have been reallocated over time between Auckland Council and AT.

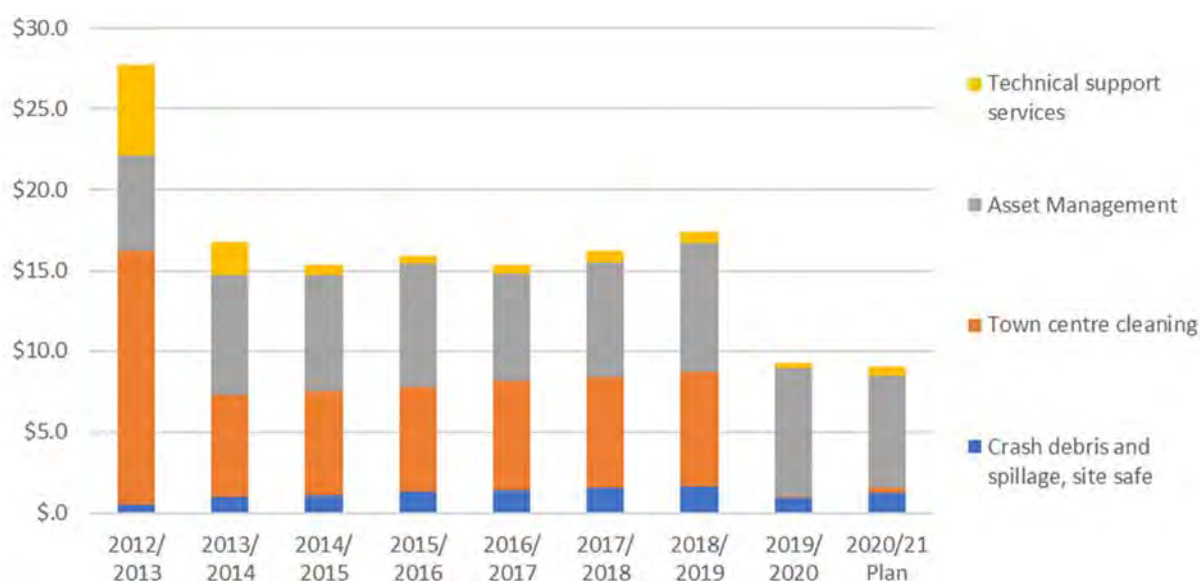


Figure 7-6: Sealed roads – past operations investment

Past renewals investment

Past investment in sealed road renewals is shown in Figure 7-7. Sealed road renewals is the largest single item in AT’s renewals programme, and peaked in 2016/2017 at \$156 million.

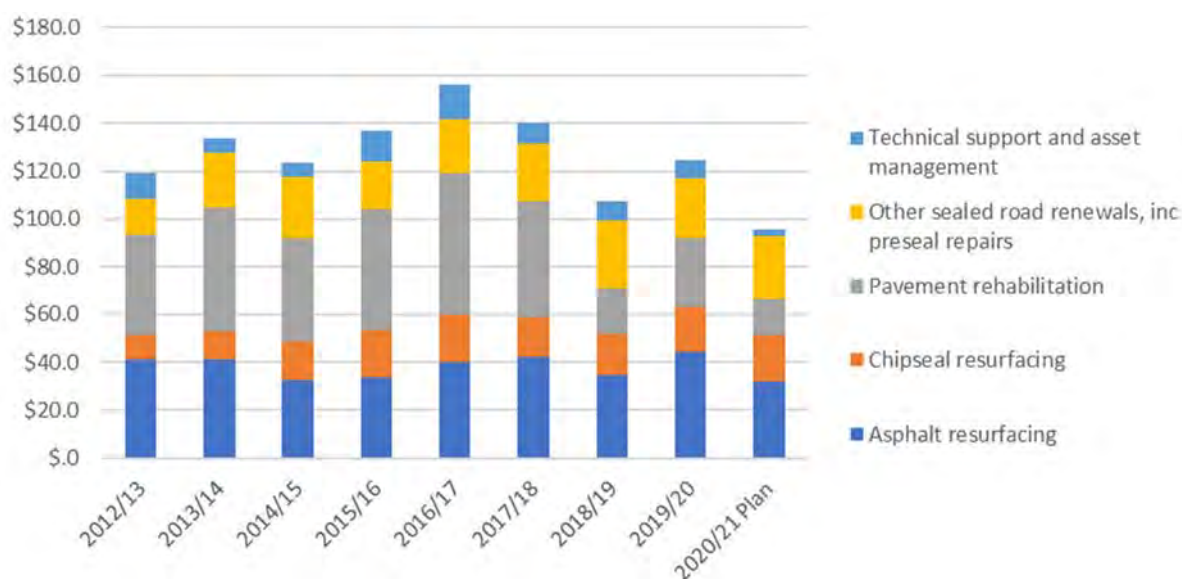


Figure 7-7: Sealed roads – past renewals investment

In its 2018 AMP, AT was able to reduce costs for sealed road renewals using the One Network road classification. The renewals programme was reprioritised and renewals of less busy roads were postponed unless there were safety or asset integrity reasons to proceed. This generated short-term savings, especially in pavement rehabilitation. However, the plan made it clear that this strategy can only defer renewals and associated costs by a few years, before the volume of renewals work needs to increase again to meet the asset need.

7.1.5 Sealed roads – recommended investment needs

AT has developed its recommended future investment needs for sealed roads based on the multi-criteria analysis and One Network road classification priorities.

Maintenance – recommended investment needs

High-ranked options for sealed road maintenance from the multi-criteria analysis were:

- restore maintenance budgets to optimal and direct a higher proportion of budget to busy roads, accepting more failures on lower volume roads
- continue to maintain older asphalt surfaces on access and low-volume roads for as long as it is economically effective to do so or until other factors such as safety concerns emerge.

The recommended investment in sealed road routine maintenance is \$16.2 million per year for existing road assets. This will reverse previous declines in maintenance budgets and restore the level of funding to \$2,362 per kilometre of sealed road per year.

This level of investment will support a prompt response to maintenance issues, especially on regional and arterial roads, contributing to asset preservation and safety.

To address the problems related to growth, it is recommended that road maintenance investment needs increase in line with growth in the road network, as shown in Figure 7-8 and Table 7-4.

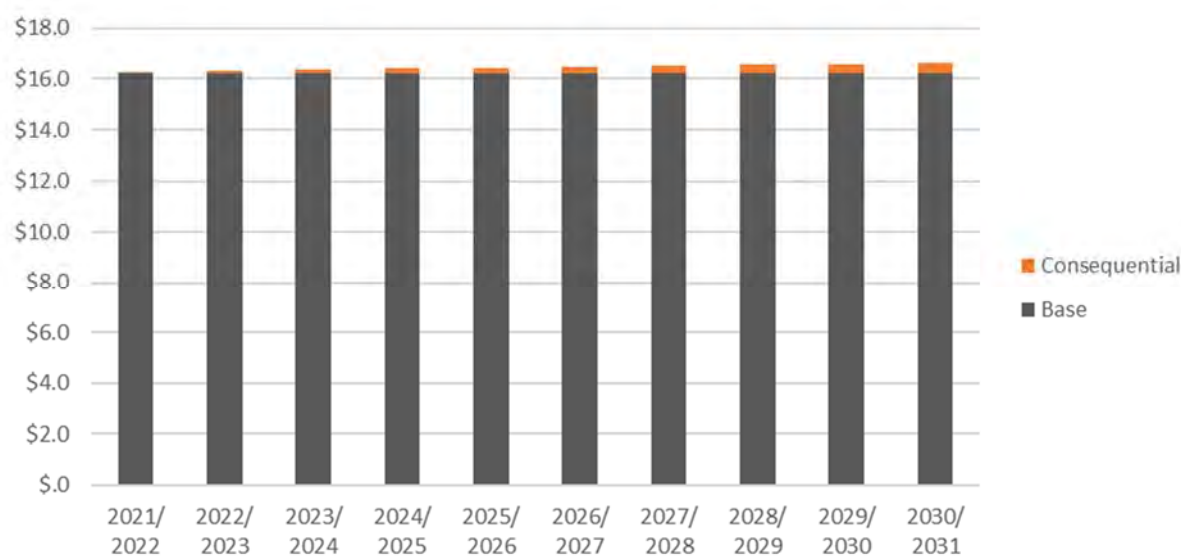


Figure 7-8: Sealed road maintenance – recommended investment needs (uninflated)

Table 7-4: Sealed road maintenance – recommended investment needs (uninflated)

	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
\$m										
Sealed road maintenance	\$16.3	\$16.3	\$16.4	\$16.4	\$16.4	\$16.5	\$16.5	\$16.6	\$16.6	\$16.6

Operations – recommended investment needs

High-ranked options for sealed road operations from the multi-criteria analysis were:

- optimise the mix of rehabilitation and resurfacing using AT’s renewals optimisation model, dTIMS®, independent review and the forward works programme.

AT’s activities to monitor the condition of roads and optimise the renewals programme are funded through the ‘asset management and technical support services’ activities in ‘sealed road operations’.

The benefits of this expenditure include a more cost-effective renewals programme and a better information base from which to make asset management decisions.

Sealed road operations budgets also include provision for clearing crash debris and for cleaning high-priority roads in town centres.

Recommended investment needs for sealed road operations are shown in Figure 7-9 and Table 7-5. Like sealed road maintenance, costs are expected to increase in proportion to forecast growth in the sealed road network.

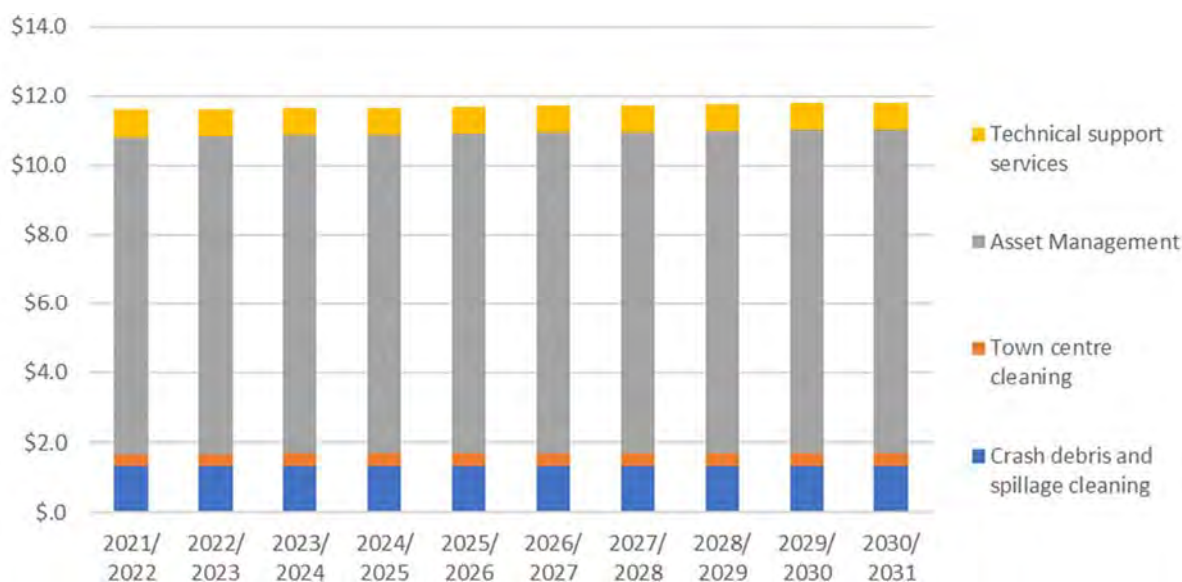


Figure 7-9: Sealed road operations – recommended investment needs (uninflated)

Table 7-5: Sealed road operations – recommended investment needs (uninflated)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Crash debris and spillage, site safe	\$1.3	\$1.3	\$1.3	\$1.3	\$1.3	\$1.3	\$1.3	\$1.3	\$1.3	\$1.3
Town centre cleaning	\$0.3	\$0.4	\$0.4	\$0.4	\$0.4	\$0.4	\$0.4	\$0.4	\$0.4	\$0.4
Asset management	\$9.1	\$9.2	\$9.2	\$9.2	\$9.2	\$9.2	\$9.3	\$9.3	\$9.3	\$9.3
Technical support services	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8
Total sealed road operations	\$11.6	\$11.6	\$11.7	\$11.7	\$11.7	\$11.7	\$11.7	\$11.8	\$11.8	\$11.8

Renewals – recommended investment needs

High-ranked options for sealed road renewals from the multi-criteria analysis were:

- optimise the mix of rehabilitation and resurfacing using AT’s renewals optimisation model, dTIMS®, independent review, and the forward works programme
- carry out more rehabilitation to address increased deterioration (the past 3 years have seen a reduced rehabilitation budget)
- ensure tighter implementation of the resurfacing guidelines – only resurface busy roads and commercial areas with asphalt, as set out in the reseals strategy; on all other roads use chip seal or other lower cost alternative.

The asset needs (before consideration of funding) for sealed road renewals are shown in Figure 7-10 and Table 7-6.

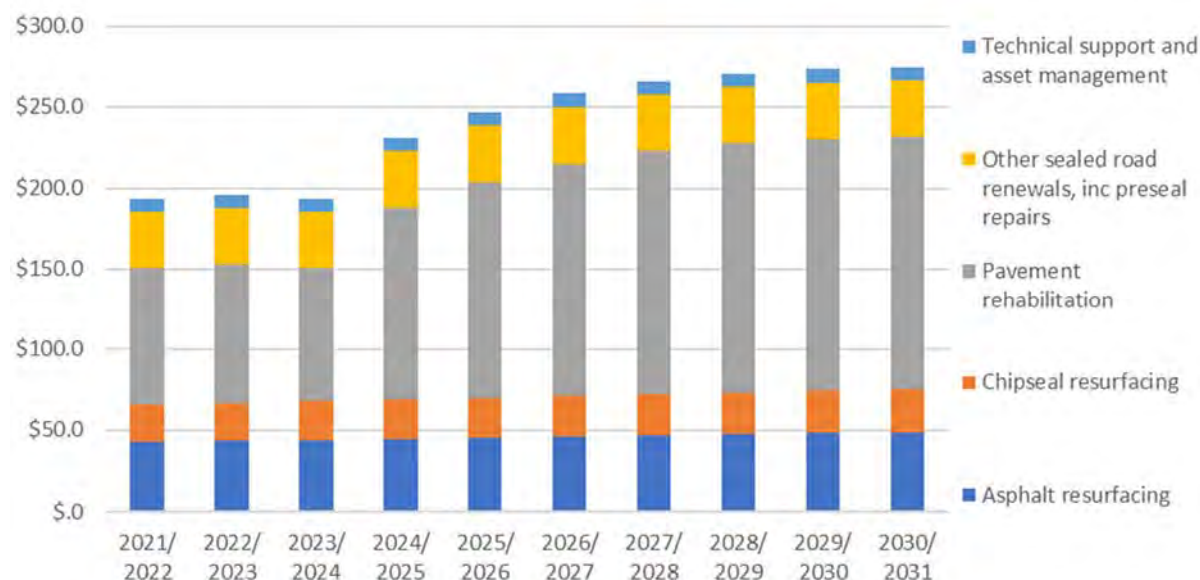


Figure 7-10: Sealed road renewals investment – asset needs (uninflated)

Table 7-6: Sealed road renewals investment – asset needs (uninflated)

Asset type \$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Technical support and asset management	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2
Other, including pre seal repairs	\$34.9	\$34.9	\$34.9	\$34.9	\$34.9	\$34.9	\$34.9	\$34.9	\$34.9	\$34.9
Pavement rehabilitation	\$84.6	\$86.1	\$82.6	\$118.8	\$133.7	\$144.2	\$150.8	\$154.5	\$156.0	\$155.9
Chipseal resurfacing	\$23.3	\$23.6	\$24.0	\$24.3	\$24.7	\$25.1	\$25.4	\$25.8	\$26.2	\$26.6
Asphalt resurfacing	\$42.6	\$43.3	\$43.9	\$44.6	\$45.2	\$45.9	\$46.6	\$47.3	\$48.0	\$48.7
Total	\$193.6	\$196.1	\$193.5	\$230.8	\$246.7	\$258.3	\$265.9	\$270.7	\$273.3	\$274.3

The recommended investment needs for sealed road renewals will address the issues highlighted in the multi-criteria analysis by:

- restoring pavement rehabilitation budgets, in order to fund an optimal pavement rehabilitation programme, following 3 years of deliberately postponed renewals. High priorities for rehabilitation include growth areas and key rural freight routes, including access roads to quarries and landfills. Further increases in the pavement rehabilitation budget will be required in future years in order to sustain the value of AT's most significant asset.
- maintaining the resurfacing budget for asphalt. This expenditure will be directed to high-volume roads, freight routes and locations of high pavement stress, as set out in the reseals strategy
- increasing the chipseal resurfacing budget to anticipate more use of chipseal, as set out in the reseals strategy. The prioritisation of chipseal resurfacing projects will also include the option of maintaining older asphalt surfaces for longer, and consideration of other resurfacing options.

Other recommendations from the multi-criteria analysis for sealed roads are considered further in the Asset Management Improvements section of this plan.

7.1.6 Sealed roads – investment benefits

Table 7-7 sets out the performance indicators that AT will use to measure the success of its investment in sealed roads, at a governance level. These are supported by customer and technical performance measures, as set out in the asset class management plan.

Table 7-7: Sealed roads – governance performance indicators

Government investment benefits	Key performance indicators	Performance or service measure description	2019/2020	Target
Impact on social cost and incidents of crashes	Deaths and serious injuries are reduced	Deaths and serious injuries on Auckland local roads	533	Reduce
		Collective risk – deaths and serious injuries per kilometre of road	0.17	Reduce
		Personal risk – deaths and serious injuries per 100 million vehicle kilometres travelled	6.96	Reduce
Impact on system safety	Assets meet Vision Zero safety standards	Percentage of rural vehicle kilometres travelled on roads that provide safe system primary and supporting treatments (e.g. three-star equivalent or better)	10	Improve on base-line
	AT staff and suppliers work safely	Number of health and safety incidents involving injuries to AT employees	4	(blank)
		Number of health and safety incidents involving injuries to other persons	12	(blank)
Impact on system reliability	The transport system is reliable	The proportion of the arterial road network operating at levels of service A to C in the morning peak	(blank)	(blank)
	Road assets are in acceptable condition	Percentage of carriageway surface in acceptable condition	97%	97%
		Road roughness (ride quality) as measured by smooth travel exposure for rural roads	94%	92%
		Road roughness (ride quality) as measured by smooth travel exposure for urban roads	87%	81%

Government investment benefits	Key performance indicators	Performance or service measure description	2019/2020	Target
Impact on network productivity and utilisation	The movement of freight is facilitated	Proportion of the freight network operating at level of service C or better during the inter-peak		85%
Auckland Council group requirements	AT is responsive to customers	Percentage of customer service requests relating to roads and footpaths that receive a response within specified timeframes	0.823	0.85

7.2 Unsealed roads

There are 823km of unsealed road in the Auckland Region, of which most (652km) are in the Rodney ward. Unsealed roads have a replacement value of \$506 million as shown in Table 7-8. Most of the value of an unsealed road is in the earthworks and formation, which does not depreciate. The unsealed road pavement base has a current, depreciated value of \$151.1 million, compared with \$216.4 million replacement cost, indicating that 70 per cent of the economic value of the asset has been consumed. Annual depreciation is \$2.2 million.[]

Table 7-8: Unsealed roads valuation

Asset	Replacement cost \$m	Depreciated value \$m	Annual depreciation \$m
Unsealed road formation	\$289.6	\$289.6	n/a
Unsealed road pavement base	\$216.4	\$151.1	\$2.2
Total unsealed roads	\$506.1	\$440.7	\$2.2

7.2.1 Unsealed roads – issues and potential responses

The root cause analysis in section 6.0 highlighted that very low customer satisfaction and dust are the main issues affecting unsealed roads:

The analysis also identified the potential responses to these issues shown in Table 7-9.

Table 7-9: Root cause analysis – potential responses for unsealed roads

Root cause analysis	Potential responses
Asset deterioration	<ul style="list-style-type: none"> Continue with current maintenance and renewal programmes.
Asset deterioration	<ul style="list-style-type: none"> Investigate sites which are prone to deterioration.
Asset deterioration	<ul style="list-style-type: none"> Consider dust impact when prioritising seal extensions. Continue to investigate dust reduction options.

7.2.2 Unsealed roads – evidence of issues

The evidence of the issues affecting unsealed roads is summarised in Figure 7-11.

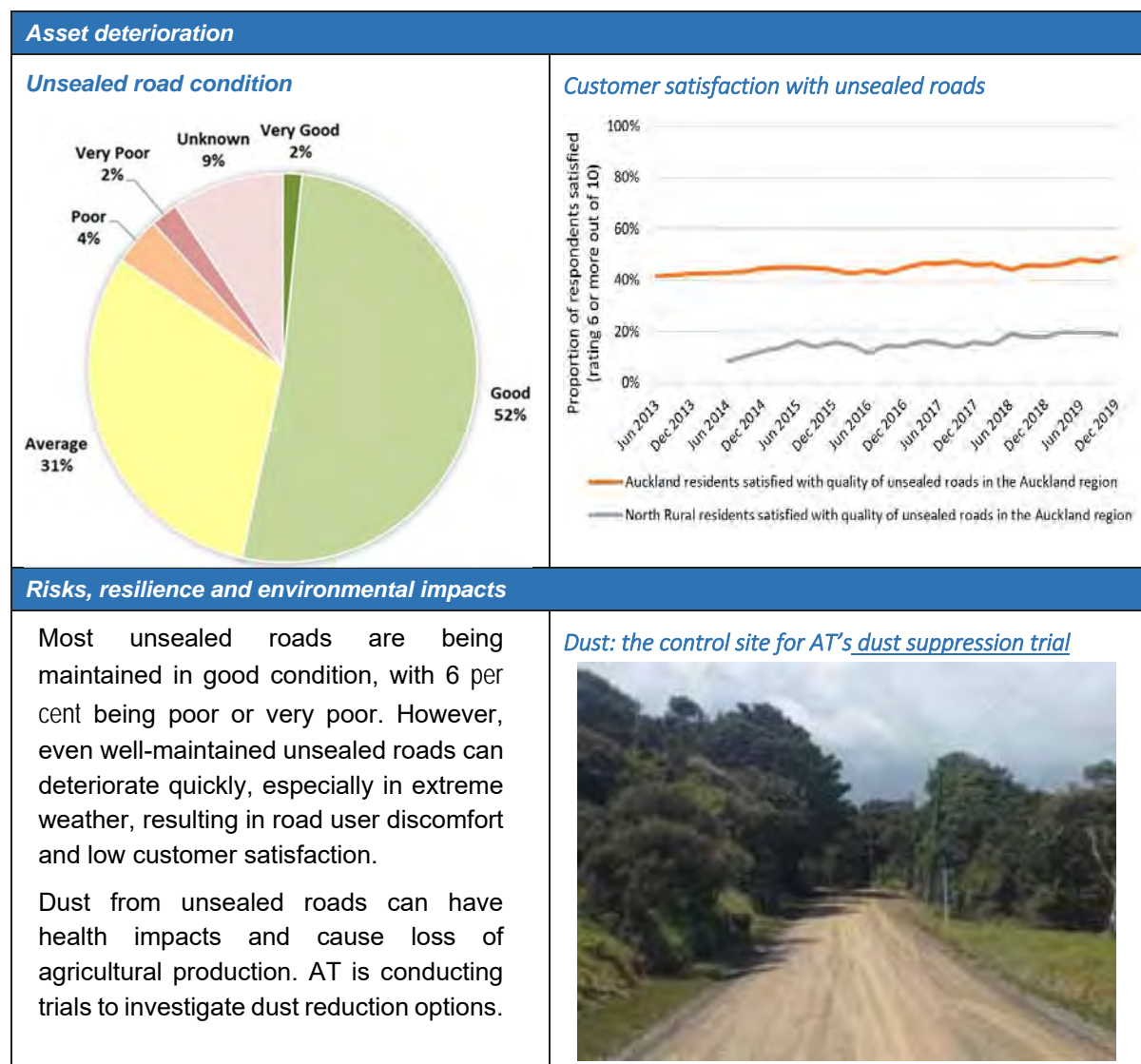


Figure 7-11: Unsealed roads – evidence of issues

7.2.3 Unsealed roads options analysis

AT used a multi-criteria analysis to rank three of the options identified in the root cause analysis in order of preference or importance. The results are shown in Table 7-10.

The fourth option ranked through this process (improve levels of service through a prioritised programme of seal extensions) is funded as a capital improvement, with the level of funding being set by Auckland Council. AT prioritises and delivers this programme in line with its seal extension criteria.

Table 7-10: Multi-criteria analysis of options for managing unsealed roads

Option - Can we make	Yes/No	Rank	Reason							
<input type="checkbox"/> Intervention response timing change										
<input type="checkbox"/> Level of service adjustments	Yes	4	Seal extensions to improve levels of service based on criteria in the Seal Extension Guidelines							
<input type="checkbox"/> Use existing assets differently										
<input type="checkbox"/> Blending Work Categories differently										
<input type="checkbox"/> Risk - Hold Assets longer										
<input type="checkbox"/> Managing demand										
<input type="checkbox"/> Route Management										
<input type="checkbox"/> Alternative approaches – different solutions/technology	Yes	3	Continue with dust reduction and low cost sealing trials, and identify the most appropriate solutions for different sets of conditions							
<input type="checkbox"/> Maintenance vs Renewal adjustments	Yes	1	Align grading and remetalling schedules with function of road, recognising heavy vehicle traffic, deterioration patterns, and safety							
<input type="checkbox"/> ONRC Classification variance										
<input type="checkbox"/> Extended temporary management										
<input type="checkbox"/> Supply chain improvements										
<input type="checkbox"/> Improve systems and capability	Yes	2	Improve data relating to heavy vehicle use of unsealed roads and impacts on asset deterioration							
Criteria	Weight	How good is this option								
		Option 2 - seal extensions		Option 8 - dust reduction / low cost seal investigations		Option 9 - align grading and remetalling with traffic etc		Option 13 - improve traffic data for unsealed roads		
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	
Community Outcomes Achieved	20%	2	0.4	2	0.4	2	0.4	0	0	
Problem solving effectiveness	5%	2	0.1	3	0.15	3	0.15	3	0.15	
Benefits realised			0		0		0		0	
Good Environmental impacts	10%	2	0.2	2	0.2	1	0.1	0	0	
Value for Money	15%	1	0.15	1	0.15	2	0.3	3	0.45	
Closing Customer and Technical LoS gaps and impacts			0		0		0		0	
Closing ONRC Performance gaps	10%	0	0	0	0	2	0.2	2	0.2	
Asset preservation and sustainability	10%	1	0.1	2	0.2	2	0.2	2	0.2	
Total Cost of Ownership (whole of life Costs)	20%	-1	-0.2	-1	-0.2	2	0.4	1	0.2	
Life Cycle Management	10%	2	0.2	2	0.2	2	0.2	3	0.3	
COVID-19 Recovery	n/a		0		0		0		0	
Totals	100%		0.95		1.1		1.95		1.5	

7.2.4 Unsealed roads – past investment

Past investment in unsealed road maintenance and renewals is shown in Figure 7-12.

There has been a sustained increase in expenditure over the past 8 years, which is even more apparent once expenditure is adjusted for the reduction in length of the unsealed road network, due to the seal extension programme. In 2018/2019, AT spent over \$9,000 per kilometre of unsealed road or roughly double the rate of 2013/2014.

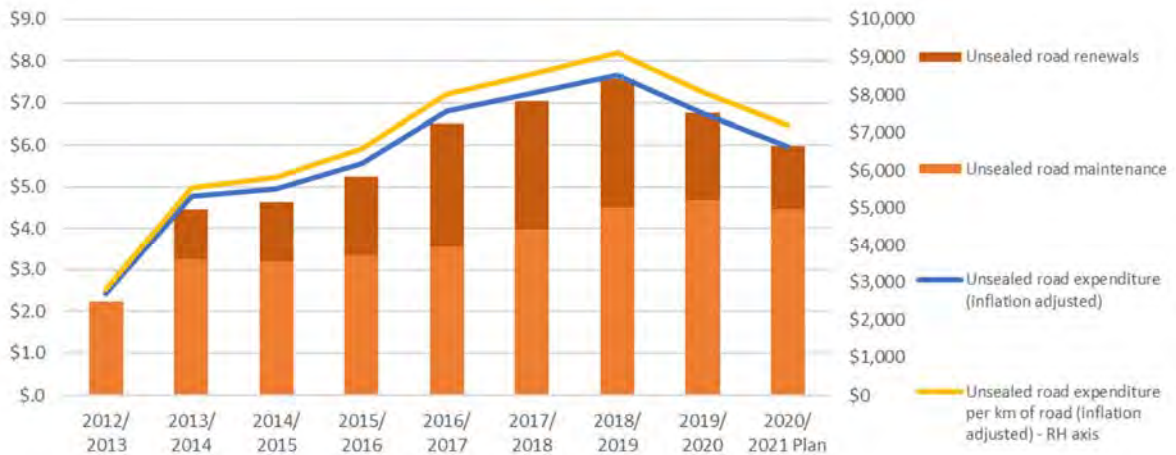


Figure 7-12: Unsealed roads – past investment

The increased investment in unsealed roads contrasts with low and unchanging customer satisfaction as shown in Figure 7-11.

7.2.5 Unsealed roads – recommended investment needs

AT has developed its recommended future investment needs for unsealed roads based on the multi-criteria analysis in Table 7-10.

The high-ranked options from the analysis were to:

- align grading and re-metalling schedules with the function of the road, recognising heavy vehicle traffic, deterioration patterns and safety
- improve asset data relating to heavy vehicle traffic on unsealed roads and the impacts on deterioration; and proactively manage these roads in the same manner as for sealed roads
- continue with dust mitigation trials and trials of low-cost sealing options.

Recommended investment needs for unsealed roads (both maintenance and renewals) are shown in Figure 7-13 and Table 7-11.

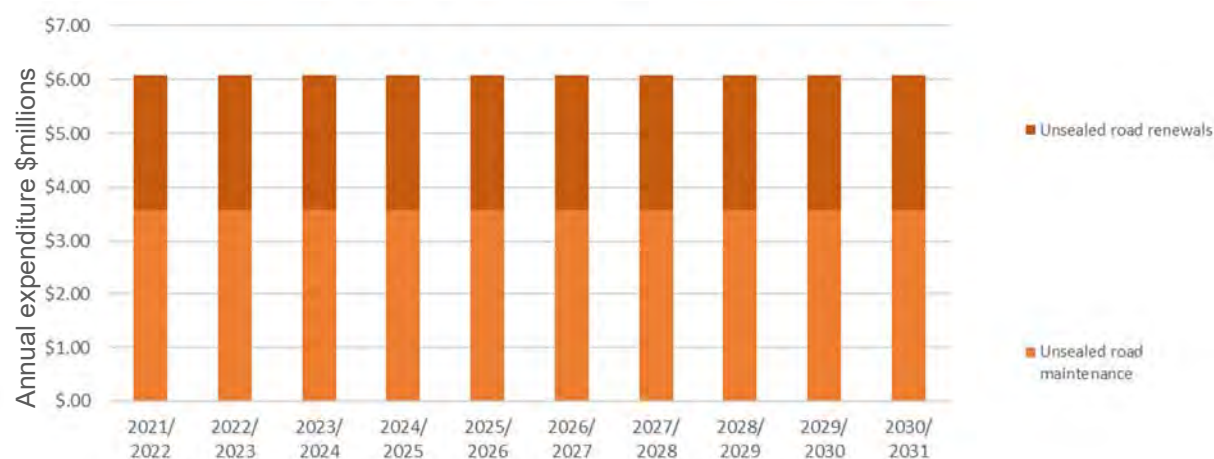


Figure 7-13: Unsealed road maintenance and renewals – asset needs (uninflated)

Table 7-11: Unsealed road maintenance and renewals – asset needs (uninflated)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Unsealed road maintenance	\$3.59	\$3.59	\$3.59	\$3.59	\$3.59	\$3.59	\$3.59	\$3.59	\$3.59	\$3.59
Unsealed road renewals	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50

This level of recommended investment will address the issues affecting unsealed roads by:

- setting the level of renewals at \$2.5 million per year, slightly higher than the annual depreciation of unsealed roads (\$2.2 million): this will enable AT to keep up with re-metalling schedules
- allocating \$3.59 million per year to maintaining unsealed roads, an activity that has cost over \$5 million per year for the past 3 years. Grading for unsealed roads and other maintenance activities will need to be prioritised in line with the function of the road, in order to remain within this allocation. This level of maintenance funding will still enable AT to continue its dust-mitigation and low-cost sealing trials.

No provision is needed for growth, as the unsealed road network is not growing.

Other recommendations from the multi-criteria analysis for unsealed roads are included in the improvements section of this plan.

7.3 Stormwater

Stormwater assets are the second most valuable set of assets in AT’s portfolio, after sealed roads, with a combined replacement cost of \$2.862 billion as shown in Table 7-12.

Responsibility for the overall stormwater network in Auckland is shared between AT and Auckland Council Healthy Waters. The stormwater system that drains road runoff is an AT asset, while the drainage system for private properties and the bulk network that combines both road and property runoff is managed by Healthy Waters.

Table 7-12: Stormwater assets valuation

Asset group	Replacement cost \$m	Depreciated value \$m	Annual depreciation
Stormwater channel	\$1,373.7	\$832.5	\$20.3
Catchpit leads	\$301.1	\$143.9	\$4.3
Subsoil drain	\$551.1	\$337.1	\$8.0
Minor culverts (<2100mm)	\$137.1	\$78.2	\$2.1
Others	\$63.6	\$58.9	\$0.8
Catchpits	\$258.3	\$128.5	\$3.6
Soakholes	\$158.0	\$75.1	\$1.4
Treatment devices	\$6.3	\$4.1	\$0.1
Manholes	\$12.9	\$11.8	\$0.2
Total stormwater	\$2,862.1	\$1,670.2	\$40.8

Source: AT asset valuation 2020

Stormwater assets in poor condition or with inadequate capacity can have an adverse impact on pavement performance through saturation, risk of asset failure risk (e.g. culvert collapse), and local flooding where drainage facilities are not able to deal with stormwater runoff from roads. These problems are likely to be exacerbated by climate change, which is forecast to increase the frequency of extreme rainfall events.

7.3.1 Stormwater – issues and potential responses

The root cause analysis in section 7 highlighted specific issues for stormwater assets, and a range of potential responses, as set out in Table 7-13.

Table 7-13: Root cause analysis – potential responses for stormwater

Root cause analysis	Potential responses
Asset deterioration	<ul style="list-style-type: none"> Improve data on stormwater inventory and condition
Asset deterioration	<ul style="list-style-type: none"> Allocate funds within the overall renewals programme for stormwater renewals in association with road pavement rehabilitation projects
Resilience	<ul style="list-style-type: none"> Work with Auckland Council to identify vulnerabilities and system deficiencies in the stormwater network
Resilience	<ul style="list-style-type: none"> Develop coordinated programmes to reduce flooding risk

Common themes in these issues is AT's lack of knowledge about stormwater assets and the need to share data more effectively with Auckland Council Healthy Waters. We are already addressing these issues, and expect to have better information available before this AMP is finalised.

A particular issue affecting this asset class relates to stormwater quality treatment devices. These devices mitigate the impact on water quality of hydrocarbons, heavy metals and other pollutants that accumulate in road runoff. In the 2020 valuation, stormwater treatment devices had a total value of \$6.3 million. This value is increasing rapidly as stormwater treatment conditions are required by the Unitary Plan wherever new roads are being created in new subdivisions.

At present, there is no explicit provision for these devices in current budgets. Instead, renewal of these assets has been managed by the Asset Management team. However, a longer term solution is required,

with investigation to determine the proportion of expenditure that needs to be dedicated to treatment devices specifically for road runoff, and separate budgets set up for this activity.

7.3.2 Stormwater – evidence of issues

AT holds limited data about its stormwater assets and their condition, and as a result, cannot currently present information about deterioration trends. The work that is underway with Healthy Waters will consolidate and improve asset data. The proportion of asset data shown as ‘unknown’ in Figure 7-14 will reduce significantly as a result of this work.

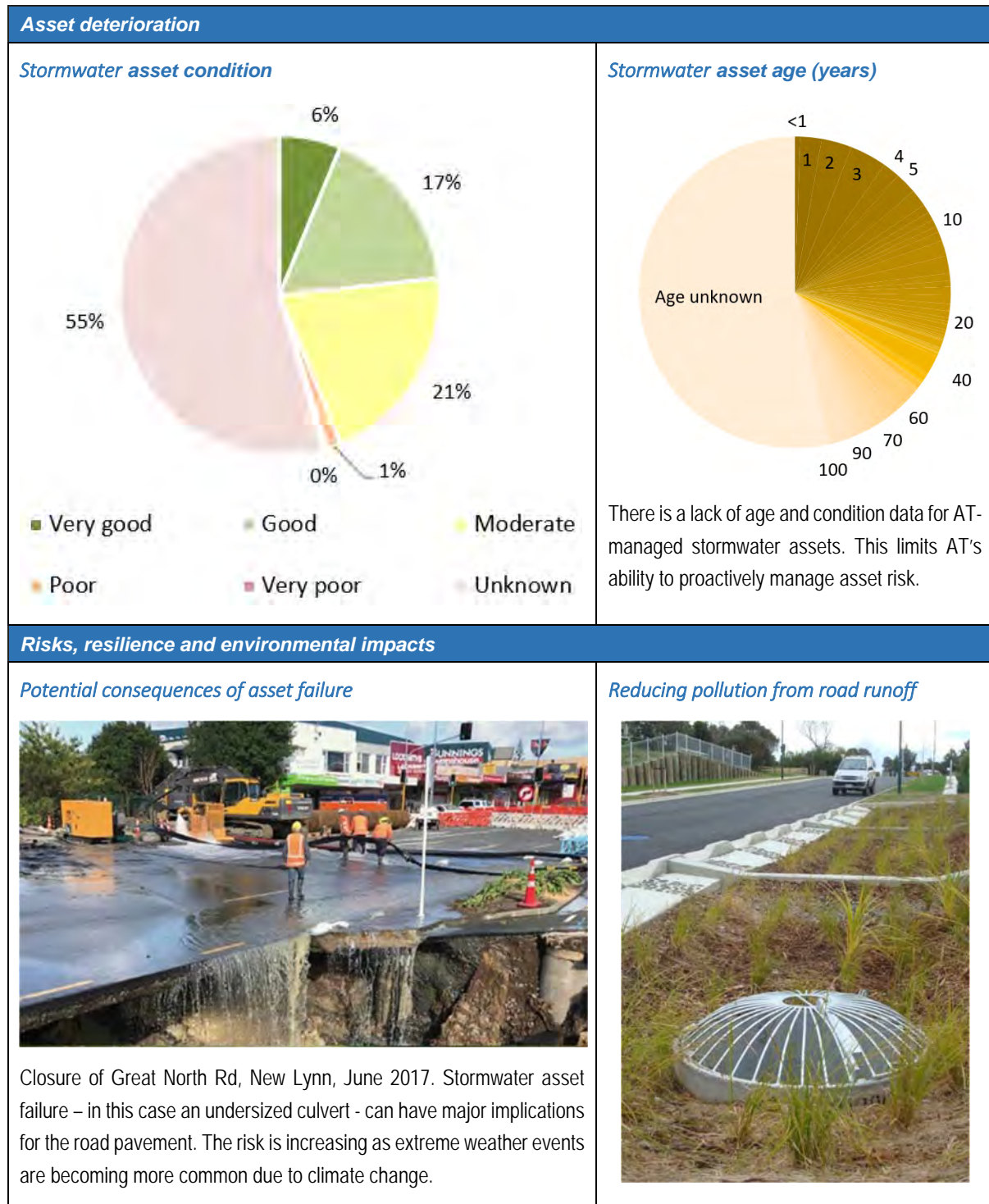


Figure 7-14: Stormwater – evidence of issues

7.3.3 Stormwater options analysis

AT used a multi-criteria analysis to rank six of the options identified in the root cause analysis in order of preference or importance. The results are shown in Table 7-14.

All of the options were considered appropriate: options 1 and 2 have been incorporated in the recommended budgets, while options 3, 4 and 5 need further investigation and planning. Option 6 is an asset management improvement task, requiring stormwater renewals be considered and prioritised as part of pavement renewals.

Table 7-14: Multi-criteria analysis of options for managing stormwater

Option - Can we make	Yes/No	Rank	Reason										
<input type="checkbox"/> Intervention response timing change	Yes	1	Intervene earlier on important roads - identify older, at-risk culvert replacements with upgrade where appropriate. Programme increase.										
<input type="checkbox"/> Level of service adjustments	Yes	4	Improve protection for important roads - better or more of culverts, catchpits, subsoil drains etc. Ensure the system has the capacity required for rainfall return periods by ONRC type. Requires programme increase.										
<input type="checkbox"/> Use existing assets differently													
<input type="checkbox"/> Blending Work Categories differently	Yes	6	Drainage renewals and upgrades in association with pavement renewals										
<input type="checkbox"/> Risk - Hold Assets longer	Yes	5	Improve management of rural at-risk areas - such as slip-prone areas, poor water tables, wash-outs, poor culvert inlets/outlets etc in order to keep existing assets intact for longer.										
<input type="checkbox"/> Managing demand	Yes												
<input type="checkbox"/> Route Management													
<input type="checkbox"/> Alternative approaches – different solutions/technology	Yes	3	Ensure whole of life management of stormwater treatment devices to achieve water quality outcomes										
<input type="checkbox"/> Maintenance vs Renewal adjustments													
<input type="checkbox"/> ONRC Classification variance													
<input type="checkbox"/> Extended temporary management													
<input type="checkbox"/> Supply chain improvements													
<input type="checkbox"/> Improve systems and capability	Yes	2	Improve knowledge about condition and performance to better inform renewal planning. More inspections and condition monitoring to help determine risk areas.										
Criteria	Weight	How good is this option											
		Option 1 - early replacement of culverts on important routes		Option 2 - LoS based on route importance		Option 4 - renew with pavement rehabs		Option 5 - improve management of at-risk sites		Option 6 - stormwater quality		Option 13 - improve knowledge for better renewal planning	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	20%	2	0.4	3	0.6	0	0	1	0.2	3	0.6	0	0
Problem solving effectiveness	5%	2	0.1	2	0.1	3	0.15	2	0.1	2	0.1	3	0.15
Benefits realised			0		0		0		0		0		0
Good Environmental impacts	10%	1	0.1	1	0.1	1	0.1	3	0.3	3	0.3	0	0
Value for Money	15%	3	0.45	3	0.45	3	0.45	3	0.45	1	0.15	3	0.45
Closing Customer and Technical LoS gaps and impacts			0		0		0		0		0		0
Closing ONRC Performance gaps	10%	3	0.3	2	0.2	0	0	1	0.1	0	0	2	0.2
Asset preservation and sustainability	10%	3	0.3	1	0.1	2	0.2	3	0.3	2	0.2	2	0.2
Total Cost of Ownership (whole of life Costs)	20%	1	0.2	1	0.2	2	0.4	1	0.2	2	0.4	3	0.6
Life Cycle Management	10%	2	0.2	0	0	3	0.3	0	0	1	0.1	3	0.3
COVID-19 Recovery			0		0		0		0		0	0	0
Totals	100%		2.05		1.75		1.6		1.65		1.85		1.9

7.3.4 Stormwater – past investment

Past maintenance investment

Typical maintenance activities for stormwater assets include repairing faults and defects.

Stormwater maintenance cost trends are shown in Figure 7-15. Budgets were reduced substantially in 2014/2015, especially for kerb and channel repairs, and have since increased.

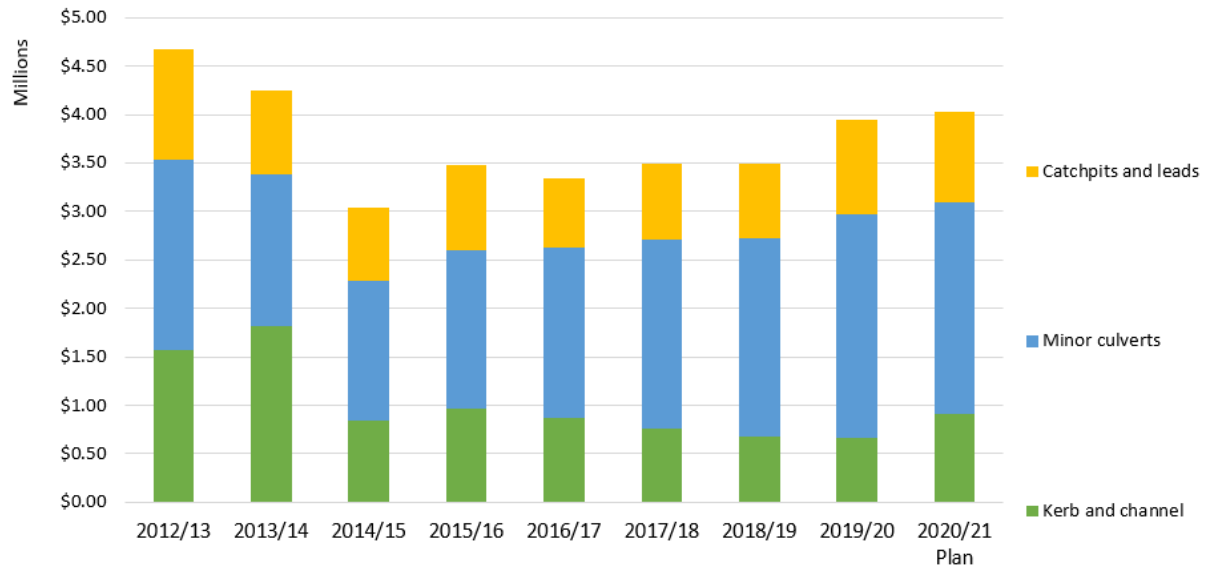


Figure 7-15: Stormwater – past maintenance investment

Past operations investment

Operational activities for stormwater assets avoid costly blockages and overflows elsewhere in the network. Key operational activities include asset inspections and monitoring, cleaning and clearing away debris, sweeping kerb and channel, and customer service and emergency response activities.

Past investment in stormwater operations is shown in Figure 7-16.

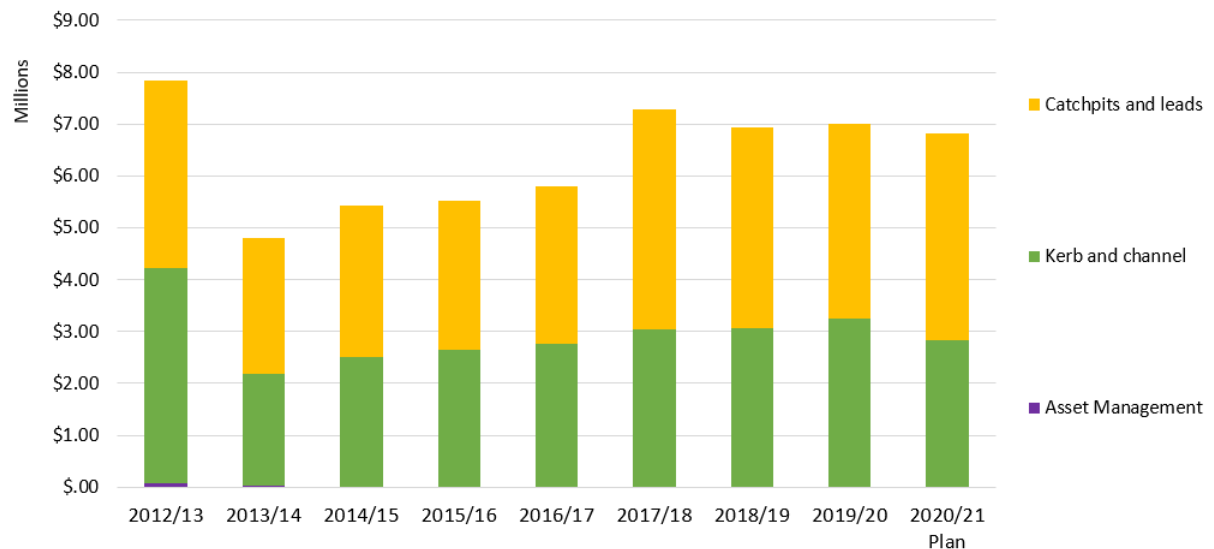


Figure 7-16: Stormwater – past operations investment

Past renewals investment

Past investment in stormwater renewals is shown in Figure 7-17. Total renewals reached a maximum of \$16.1 million in 2017/2018.

The current level of investment in stormwater asset renewals is significantly less than their annual depreciation (\$40.8 million per year), indicating the value of the assets may not be being sustained over time.

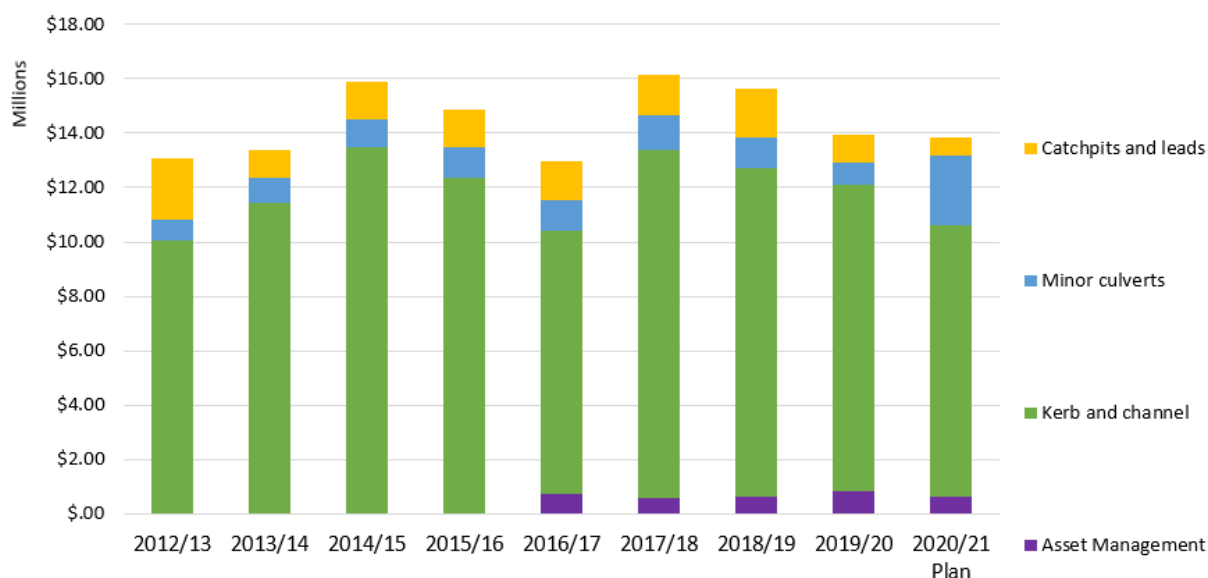


Figure 7-17: Stormwater – past renewals investment

The majority of stormwater renewals expenditure is on renewing kerb and channel, although these assets makes up only around half of the total value and annual depreciation for stormwater assets. Replacement kerb and channel is often required as part of pavement resurfacing projects. While this is important expenditure, the activity is driven by road pavement priorities, not stormwater priorities.

7.3.5 Stormwater – asset needs

AT has developed its recommended future investment needs for stormwater based on past investment trends and the recommendations from the multi-criteria analysis.

Maintenance – recommended investment needs

The recommended investment in maintenance for stormwater assets is \$4.1 million per year, as shown in Figure 7-18 and Table 7-15.

This level of investment will support a prompt response to maintenance issues, especially on regional and arterial roads, and ongoing minor repairs to catchpits, leads, minor culverts, and kerb and channel.

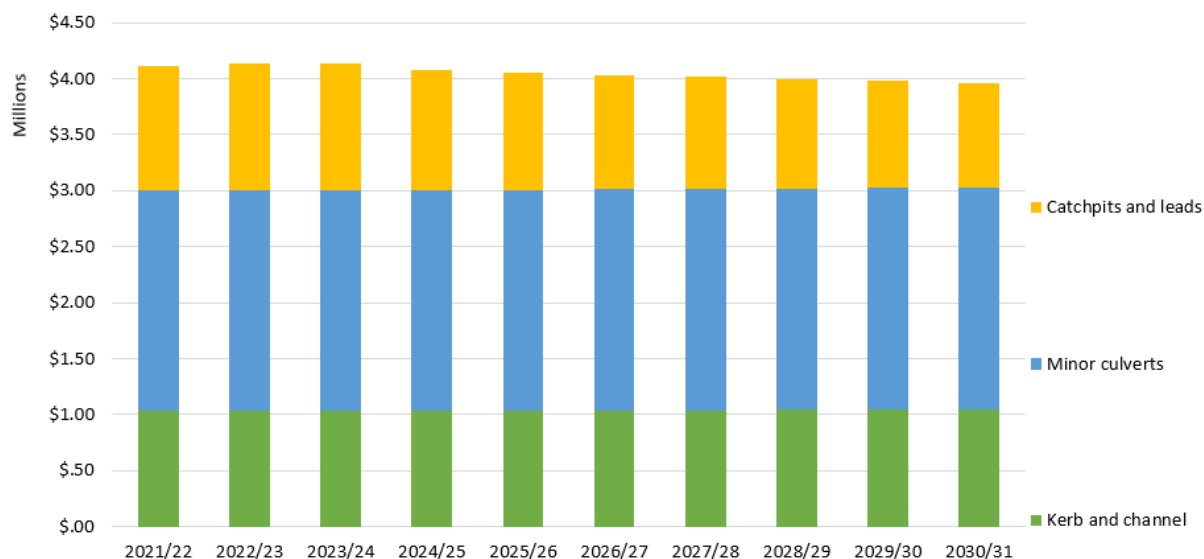


Figure 7-18: Stormwater maintenance – recommended investment needs (uninflated)

Table 7-15: Stormwater maintenance – recommended investment needs (uninflated)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Catchpits and leads	\$1.1	\$1.1	\$1.1	\$1.1	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$0.9
Minor culverts	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0
Kerb and channel	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0
Total stormwater maintenance	\$4.1	\$4.1	\$4.1	\$4.1	\$4.1	\$4.0	\$4.0	\$4.0	\$4.0	\$4.0

Some maintenance issues on the stormwater network, including damaged catchpits and leads and blocked culverts, are better addressed by increasing operations budgets.

Operations – recommended investment needs

High-ranked options in the multi-criteria analysis for stormwater operations, are

- improve knowledge about the condition and performance of assets to better inform renewal planning – this will require more inspections and condition monitoring to help determine risk areas.
- ensure whole-of-life management of stormwater treatment devices to achieve water quality outcomes – this option requires further investigation to establish costs.

A key recommendation in this AMP is to increase investment in the operational costs of catchpits and leads, from \$4 million in the current (2020/2021) budget, to \$7.5 million in 2021/2022, as shown in Figure 7-19 and Table 7-16.

This increase will address issues affecting these assets by:

- emptying catchpits across the network to a level that:
 - prevents flooding of the road surface

- avoids expensive blockages of underground catchpit leads, subsoil drains and minor culverts
- covers the increasing cost of safely disposing of polluted catchpit dredging materials.
- enabling condition and performance information to be collected proactively, and used for renewal planning and to determine risk areas
- covering the future costs of operations for stormwater treatment devices (recognising that separate budgets need to be established for this activity).

Over time, these changes to operational budgets will improve water quality and create a fairer allocation of costs between ratepayers and road users.

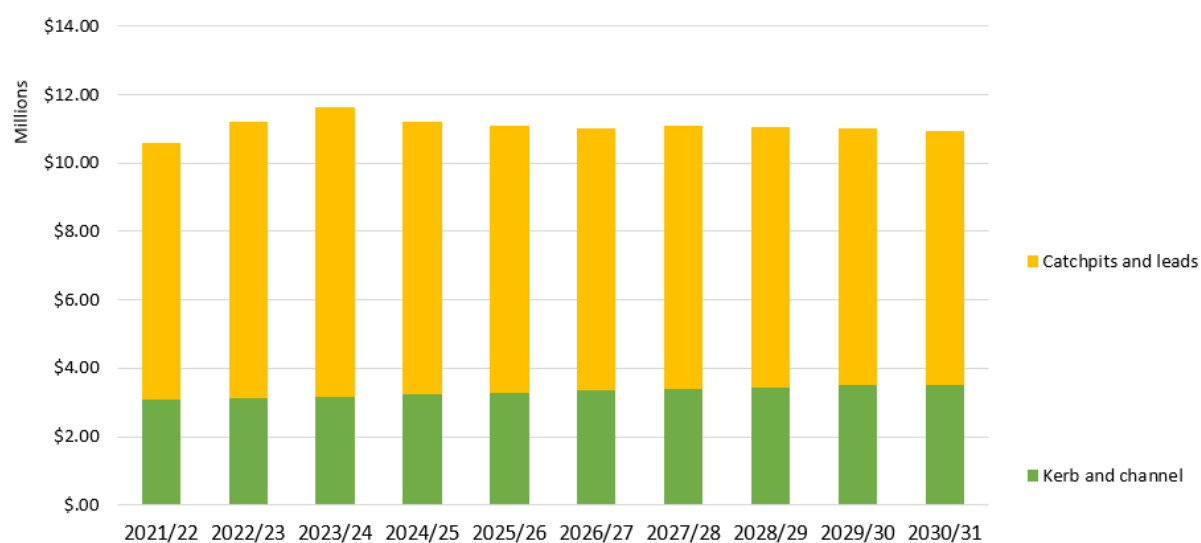


Figure 7-19: Stormwater operations – recommended investment needs (uninflated)

Table 7-16: Stormwater operations – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Catchpits and leads	\$7.5	\$8.1	\$8.5	\$8.0	\$7.8	\$7.7	\$7.7	\$7.6	\$7.5	\$7.4
Kerb and channel	\$3.1	\$3.1	\$3.2	\$3.2	\$3.3	\$3.3	\$3.4	\$3.4	\$3.5	\$3.5
Total stormwater operations	\$10.6	\$11.2	\$11.6	\$11.2	\$11.1	\$11.0	\$11.1	\$11.1	\$11.0	\$10.9

Renewals – recommended investment needs

High-ranked options in the multi-criteria analysis for stormwater renewals are:

- intervene earlier on important roads, and replace older, at-risk catchpits and culverts with assets with great capacity, where appropriate – this will require increased funding
- improve knowledge about the condition and performance of assets to better inform renewal planning – this will require more inspections and condition monitoring to help determine risk areas.

- improve management of rural at-risk areas (such as slip-prone areas, poor water tables, wash-outs, poor culvert inlets and outlets) in order to keep existing assets intact for longer – this option requires further investigation to establish costs
- carry out drainage renewals and upgrades in association with pavement renewals – this option is already included in renewals budgets.

A common theme in the options for stormwater renewals is the need to manage AT’s level of risk by renewing assets that are damaged or do not have sufficient capacity. The renewals programme set out in Figure 7-20 and Table 7-17 is a significant increase on past renewals investment, in order to reduce this risk.

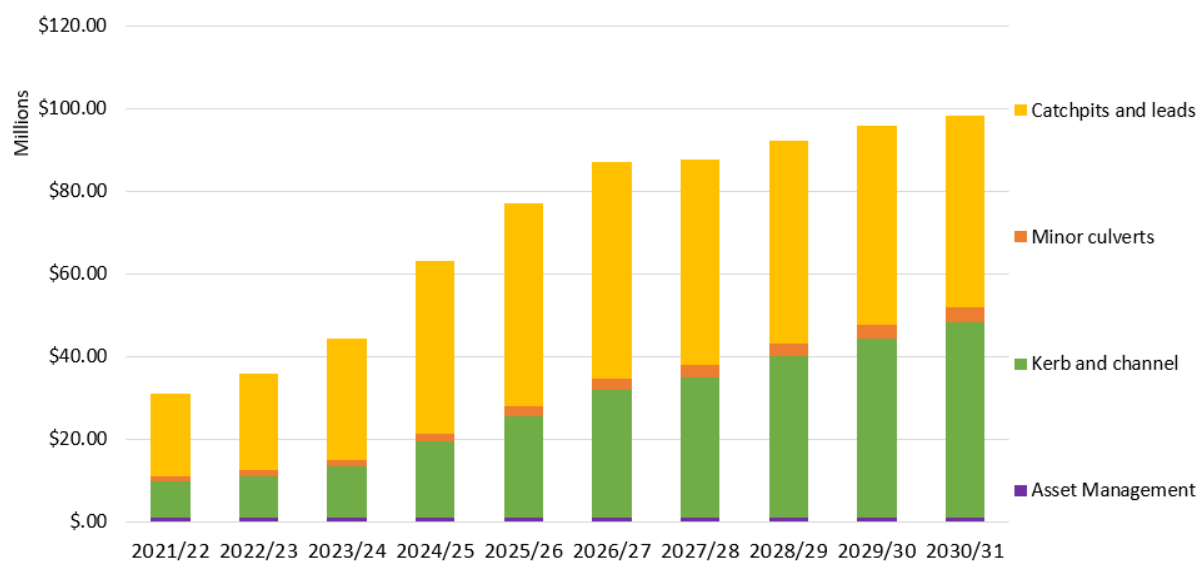


Figure 7-20: Stormwater renewals – asset needs (uninflated)

Table 7-17: Stormwater renewals – asset needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Catchpits and leads – baseline	\$12.9	\$16.5	\$22.2	\$34.4	\$41.7	\$44.8	\$41.9	\$41.3	\$40.0	\$38.4
Catchpits and leads – climate change response	\$7.0	\$7.1	\$7.2	\$7.3	\$7.5	\$7.6	\$7.7	\$7.8	\$7.9	\$8.1
Minor culverts – baseline	\$1.2	\$1.3	\$1.4	\$2.0	\$2.4	\$2.7	\$2.9	\$3.2	\$3.5	\$3.7
Kerb and channel – baseline	\$4.8	\$6.1	\$8.4	\$14.3	\$20.4	\$26.8	\$29.8	\$34.7	\$39.0	\$42.8
Kerb and channel – renewals complementing other works	\$4.0	\$4.0	\$4.1	\$4.1	\$4.2	\$4.2	\$4.3	\$4.3	\$4.4	\$4.4
Asset management	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0
Total stormwater renewals	\$30.9	\$36.0	\$44.3	\$63.2	\$77.1	\$87.2	\$87.7	\$92.3	\$95.8	\$98.4

This recommended investment programme for stormwater renewals will address the issues affecting this asset group in a staged way.

Initially, there will be a short-term increase over the 3 years of this AMP, with proposed investment averaging \$37 million. This is close to double the 2019/2020 renewals programme, but is still lower than

the depreciation of stormwater assets (\$40 million per year). With this level of investment, we can put in place a prioritised programme of asset renewals, which:

- promptly addresses damaged catchpits and leads on regional and arterial roads
- begins to implement a climate change response programme, which will proactively identify catchpits and culverts that do not have sufficient capacity to work well in extreme weather (this may need to include capital improvements as well as renewals)
- improves management of rural at-risk areas
- includes separate provision for kerb and channel renewals carried out to complement other works, so these assets can be renewed when needed as part of the pavement rehabilitation programme.

Renewals investment will then increase further from 2024/2025, in order to:

- continue and expand the climate change response programme
- expand the kerb and channel renewal programme beyond the level needed to keep up with pavement renewals.
- expand the rural at-risk programme
- renew stormwater treatment devices as required.

7.3.6 Stormwater – investment benefits

AT will measure the success of its investment in stormwater using the key performance indicators shown in Table 7-18.

Table 7-18: Stormwater – investment benefits

Investment benefits	Key performance indicators	Performance/ service measure	2019/ 2020	Target 1
Impact on system reliability	Road assets are in a fit for purpose condition	Percentage of kerb and channel in acceptable condition	99.8%	
		Percentage of stormwater catchpits and manholes in acceptable condition	99.1%	
Impact on water	Stormwater is well managed	Percentage of properties flooded due to road runoff reported during storm events	New measure	

7.4 Bridges, walls and structures

AT is responsible for bridges (including major culverts), retaining walls and other structures on the local road network.

Bridges, walls and structures have a replacement cost of \$1.8 billion as shown in Table 7-19. The current, depreciated value of these assets is \$1 billion or 55 per cent of its replacement cost, indicating that 45 per cent of the economic value of the portfolio has been consumed. Annual depreciation is \$26.2 million.

Table 7-19: Bridges, walls and structures valuation

Asset	Replacement cost \$m	Depreciated value \$m	Annual depreciation \$m
Bridges	\$975.9	\$543.8	\$10.3
Retaining walls	\$362.6	\$190.6	\$5.5
Seawalls	\$143.6	\$54.7	\$1.6
Corridor structures	\$333.9	\$218.2	\$8.8
Total	\$1,815.9	\$1,007.3	\$26.2

7.4.1 Bridges, walls and structures – issues and potential responses

The root cause analysis in section 7 highlighted a range of issues and concerns relating to bridges, walls and structures, as well as potential responses to address these issues, as set out in Table 7-20.

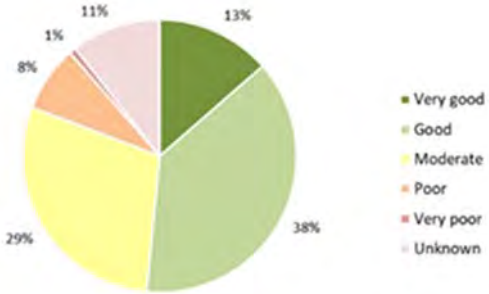
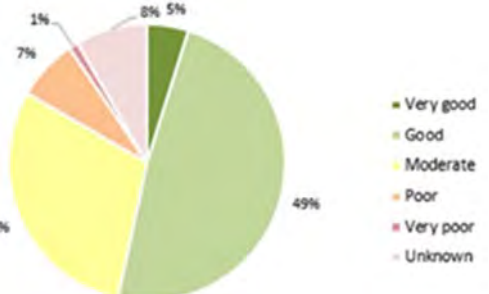
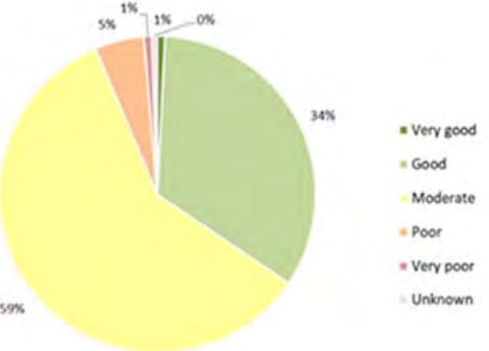
Table 7-20: Root cause analysis – potential responses for bridges, walls and structures

Root cause analysis	Potential responses
Asset deterioration	Make high-risk bridges, walls and structures (with high criticality or poor condition) a priority for further investigation and mitigation works, including replacement if necessary.
Asset deterioration	Provide condition ratings for all bridges, walls and structures in the road corridor, based on inspections and monitoring in accordance with NZTA guidance.
Asset deterioration	Intervene early to address poor condition bridges, walls and structures before they are at risk of collapsing or being damaged
Asset deterioration	Provide additional inspection and monitoring after severe storms.
Asset deterioration	Replace corridor structures that are not meeting standards
Resilience	Investigate bridges, walls and structures in vulnerable areas, and develop programmes to strengthen or replace them, based on route criticality.
Resilience	Identify vulnerable areas and assess route criticality, identifying locations where new retaining walls may be needed.
Resilience	Provide an ongoing programme to replace and upgrade damaged retaining walls and seawalls.
Resilience	Introduce seismic strengthening programmes for all vulnerable structures identified in seismic screening.
Resilience	Address seismic risk through 14 minor bridge retrofits and seismic strengthening for 2 bridges.

7.4.2 Bridges, walls and structures – evidence of issues

AT is currently implementing a significant change in how we manage bridges, walls and structures to address the problems identified in the 2018 Asset Management Plan. Major projects are underway including to replace the Quay Street seawall and upgrade the Tāmaki/Ngapipi bridge and seawall. These projects are needed to address a backlog of deferred or poorly executed renewals that date to before 2018, and in many cases to before AT was established in 2010.

Figure 7-21 summarises the issues that AT's bridge, wall and structure assets face, and the impact this is having on their risk levels and resilience.

Asset deterioration	
<p style="color: #0056b3; margin: 0;">Bridges and major culverts condition</p>  <p>9 per cent of bridges are in poor or very poor condition. Around 11 per cent of mostly walking and cycling bridges do not yet have a condition rating.</p>	<p style="color: #0056b3; margin: 0;">Retaining walls condition</p>  <p>Timber structures in particular need to be monitored for decay. The safety of road users is a particular concern following high-intensity storms or floods.</p>
<p style="color: #0056b3; margin: 0;">Sea walls condition</p>  <p>There is a significant proportion of sea walls in 'moderate' condition, which is an emerging concern for the future. Sea walls are particularly vulnerable to deterioration being in a marine environment, and are potentially impacted by sea-level rise.</p>	<p style="color: #0056b3; margin: 0;">Corridor structures condition</p> <p>There is limited condition data for this group. Better information is being collected, especially for assets such as guardrails and gantries that are important for safety.</p>
<p style="color: #0056b3; margin: 0;">Heavy vehicle loading trends</p> <p>Increased heavy vehicle volumes on roads that access new subdivisions or development areas, as well as landfills and clean fill sites, is increasing loading on existing structures.</p> <p>A trend toward using larger vehicles and heavier loads is resulting in more applications for overweight and over-dimension vehicles, which place additional stress on bridges and walls.</p>	

Risks and resilience											
Asset criticality and condition for bridges and walls											
Asset count		Asset condition									
		Very good		Good		Moderate		Poor		Very poor	
		Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Criticality level	Vital	55	8.5%	298	45.9%	171	3.0%	27	0.5%	4	0.1%
	Major	32	5.5%	254	43.9%	201	3.5%	46.0	0.8%	16	0.3%
	Significant	75	1.3%	372	6.6%	261	4.6%	77.0	1.4%	10.0	0.2%
	Local	47	0.8%	416	7.3%	370	6.5%	103	1.8%	24.0	0.4%
	Minor	139	2.5%	915	16.1%	632	11.1%	167	2.9%	26	0.5%
	TBD	35	0.6%	166	2.9%	62	1.1%	11	0.2%	3	0.1%
Total		383	6.8%	2,421	42.7%	1,697	29.9%	431	7.6%	83	1.5%

The criticality of bridges and walls to the transport network is as important as their condition in assessing priorities. Criticality is assessed using the methodology described in section 6.8.2.

Figure 7-21: Bridges, walls and structures – evidence of issues

7.4.3 Bridges, walls and structures options analysis

AT used a multi-criteria analysis to rank five of the options derived from the root cause analysis in order of preference or importance. The results of this analysis are summarised in Table 7-21.

Table 7-21: Multi-criteria analysis of options for managing bridges, walls and corridor structures

Option - Can we make	Yes/No	Rank	Reason									
<input type="checkbox"/> Intervention response timing change	Yes	2	Bring forward interventions relating to natural hazards and impacts on important roads (eg bridge strengthening, sea wall replacements, etc) based on vulnerability impact investigations									
<input type="checkbox"/> Level of service adjustments												
<input type="checkbox"/> Use existing assets differently												
<input type="checkbox"/> Blending Work Categories differently												
<input type="checkbox"/> Risk - Hold Assets longer												
<input type="checkbox"/> Managing demand	Yes	4	Develop programme to reduce the risk to bridges and walls from use by heavy commercial vehicles, especially in growth areas.									
<input type="checkbox"/> Route Management	Yes	5	Address seismic risks and ensure that all structures comply with seismic requirements									
<input type="checkbox"/> Alternative approaches – different solutions/technology												
<input type="checkbox"/> Maintenance vs Renewal adjustments												
<input type="checkbox"/> ONRC Classification variance	Yes	3	Develop programme for "below-standard" retaining wall upgrades on important roads that are exposed to natural hazards. Similar to 1 above.									
<input type="checkbox"/> Extended temporary management												
<input type="checkbox"/> Supply chain improvements												
<input type="checkbox"/> Improve systems and capability	Yes	1	Improve data on condition and criticality of bridges, walls and structures to better inform maintenance / renewal / upgrade planning									
Criteria	Weight	How good is this option										
		Option 1 - early intervention based on natural hazard impacts and ONRC		Option 6 - Reduce the risk to bridges and walls from use by heavy commercial vehicles		Option 7 - address seismic risks		Option 10 - address poor retaining walls, align with ONRC		Option 13 - improve data and planning for bridges, walls and structures		
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	
Community Outcomes Achieved	20%	3	0.6	1	0.2	1	0.2	2	0.4	0	0	
Problem solving effectiveness	10%	3	0.3	3	0.3	2	0.2	2	0.2	3	0.3	
Benefits realised			0		0		0		0		0	
Good Environmental impacts			0		0		0		0		0	
Value for Money	20%	3	0.6	2	0.4	-1	-0.2	2	0.4	3	0.6	
Closing Customer and Technical LoS gaps and impacts			0		0		0		0		0	
Closing ONRC Performance gaps	10%	2	0.2	0	0	2	0.2	2	0.2	2	0.2	
Asset preservation and sustainability	10%	3	0.3	3	0.3	1	0.1	2	0.2	2	0.2	
Total Cost of Ownership (whole of life Costs)	20%	-1	-0.2	-1	-0.2	-1	-0.2	1	0.2	3	0.6	
Life Cycle Management	10%	3	0.3	3	0.3	1	0.1	3	0.3	3	0.3	
COVID-19 Recovery	n/a		0		0		0		0		0	
Totals	100%		2.1		1.3		0.4		1.9		2.2	

7.4.4 Bridges, walls and structures – past investment

Past maintenance investment

Investment in maintenance activities for bridges, walls and structures in past years is shown in Figure 7-22.

The significant variability from year to year reflects the weather. Extreme weather events in 2016/2017 and again in 2017/2018 resulted in slips and damage to retaining walls. The initial response to these events is recorded as a maintenance item. For serious damage, renewal of the asset is also needed.

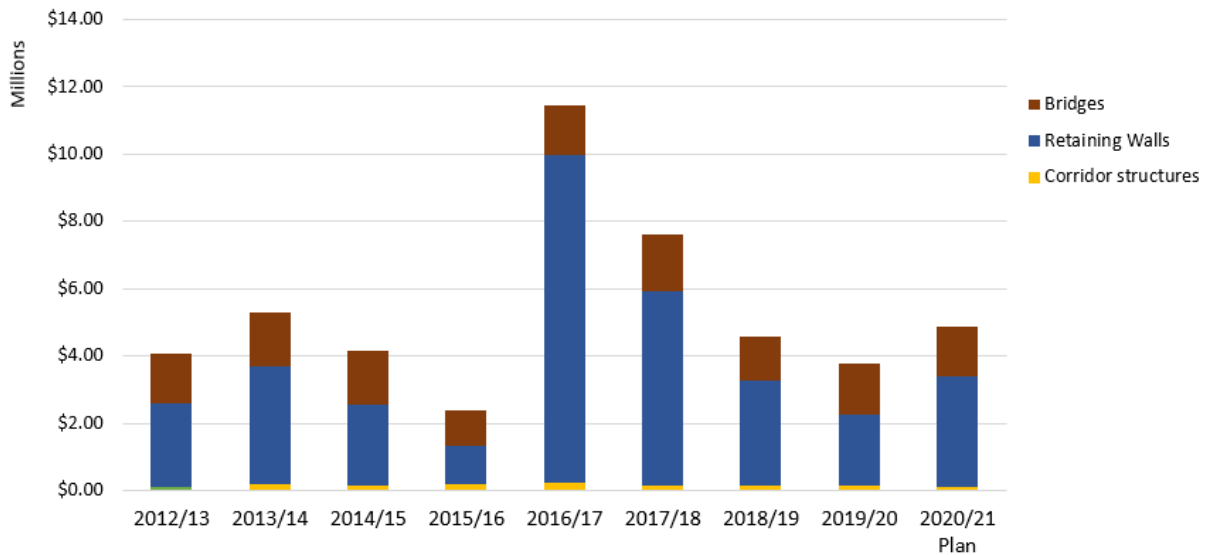


Figure 7-22: Bridges, walls and structures – past maintenance investment

Past operations investment

The main operational activity for bridges, walls and structures is asset inspections and forward planning. Past investment in these activities is shown in Figure 7-23.

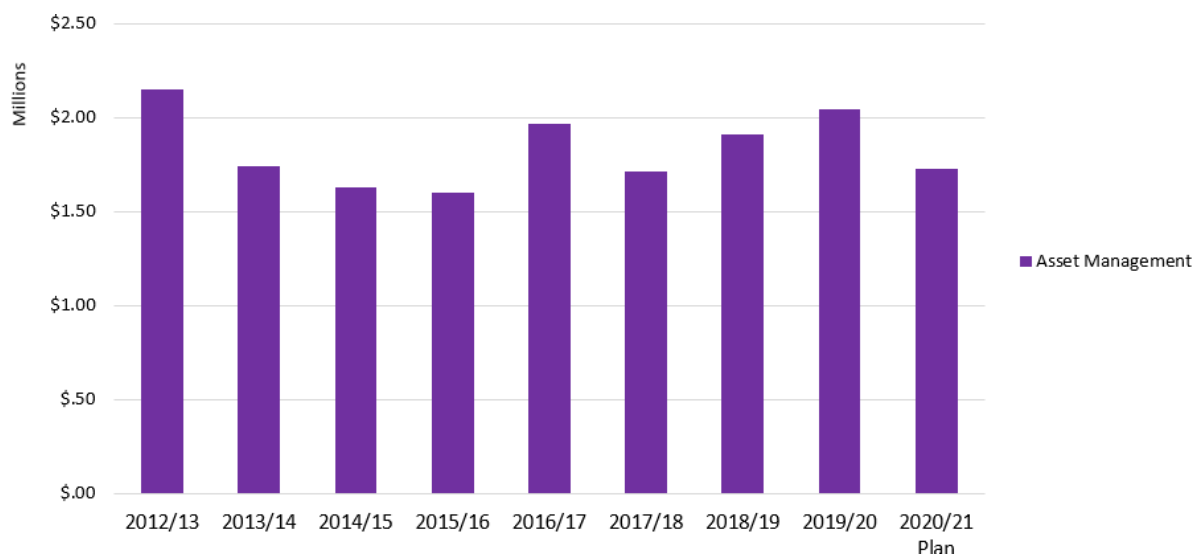


Figure 7-23: Bridges, walls and structures – past operations investment

Past renewals investment

Past investment in renewals for bridges, walls and structures is shown in Figure 7-24. The influence of weather, which can be seen in past maintenance expenditure, can also be seen in the renewals of retaining walls and sea walls, which peaked in 2017/2018.

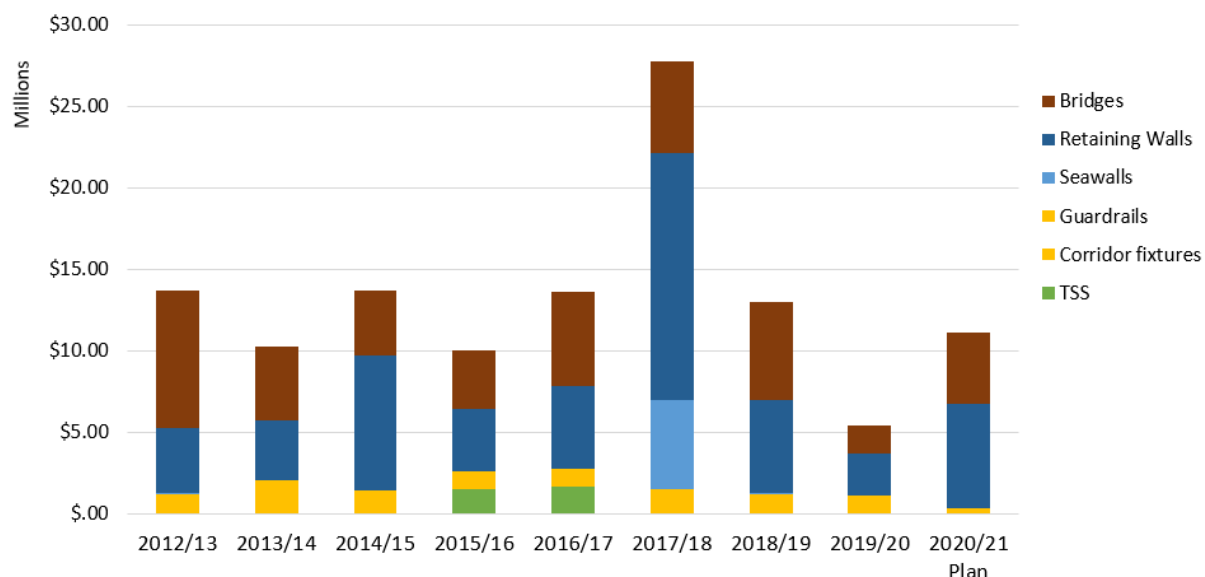


Figure 7-24: Bridges, walls and structures – past renewals investment

7.4.5 Bridges, walls and structures – recommended investment needs

AT has developed its recommended future investment needs for bridges, walls and structures based on past investment trends and the recommendations of the multi-criteria analysis.

The following recommendation will be addressed through AT’s Freight Strategy.

- Develop programme to reduce the risk to bridges and walls from use by heavy commercial vehicles. Involve freight representatives in decisions about where to restrict access by heavy vehicles, and where to upgrade assets to cope with heavier loads.

Maintenance – recommended investment needs

The recommended investment in bridges, walls and structures maintenance is \$5.5 million per year, as shown in Figure 7-25 and Table 7-22.

This level of investment will support a prompt response to maintenance issues, especially for critical assets. Additional funding may be needed in years where extreme weather events cause significant damage, but over time AT hopes to proactively improve the resilience of its assets. This will be demonstrated by doing more routine and programmed maintenance, which should reduce the need for unplanned and emergency maintenance.

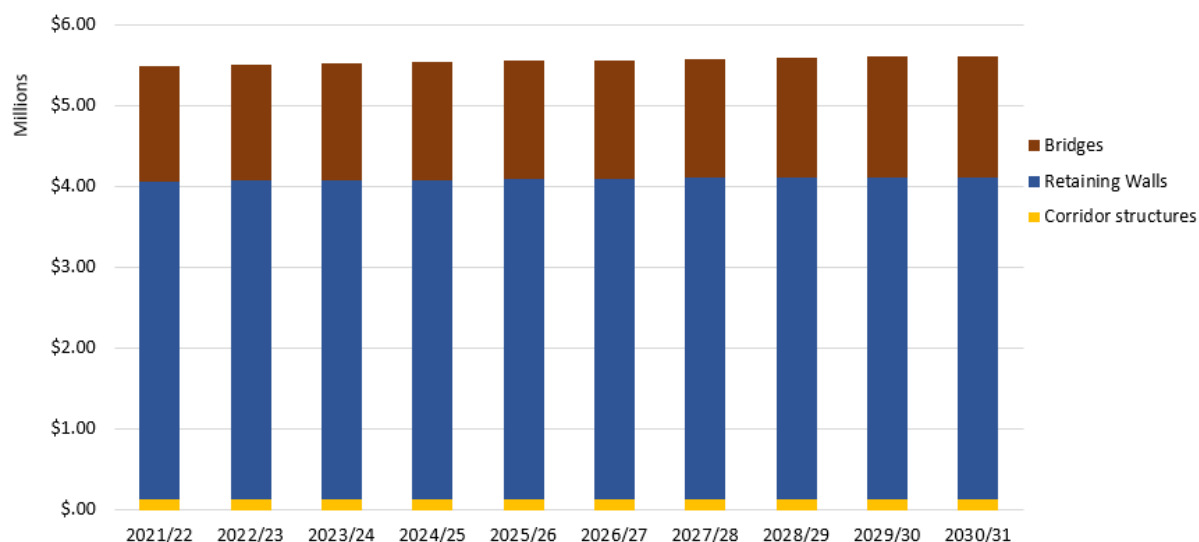


Figure 7-25: Bridges, walls and structures maintenance – recommended investment needs (uninflated)

Table 7-22: Bridges, walls and structures maintenance – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Bridges	\$1.4	\$1.4	\$1.4	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5
Retaining walls	\$3.9	\$3.9	\$3.9	\$3.9	\$4.0	\$4.0	\$4.0	\$4.0	\$4.0	\$4.0
Corridor structures	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1
Total	\$5.5	\$5.5	\$5.5	\$5.5	\$5.6	\$5.6	\$5.6	\$5.6	\$5.6	\$5.6

Operations – recommended investment needs

The condition of an asset, from ‘very good’ to ‘very poor’, and its criticality to the transport network, from ‘vital’ to ‘minor’, are both taken into account when AT sets its expenditure priorities. This process requires accurate, complete and comprehensive data, which is costly to collect and maintain, and is the main driver for operational budgets.

The highest ranked recommendation from the multi-criteria analysis relates to this work.

- Improve data about the condition and criticality of bridges, walls and corridor structures to better inform maintenance, renewal and upgrade planning. This includes inspecting assets following storms or other hazard events.

Figure 7-26 and Table 7-23 show the expected costs of this data collection and planning effort.

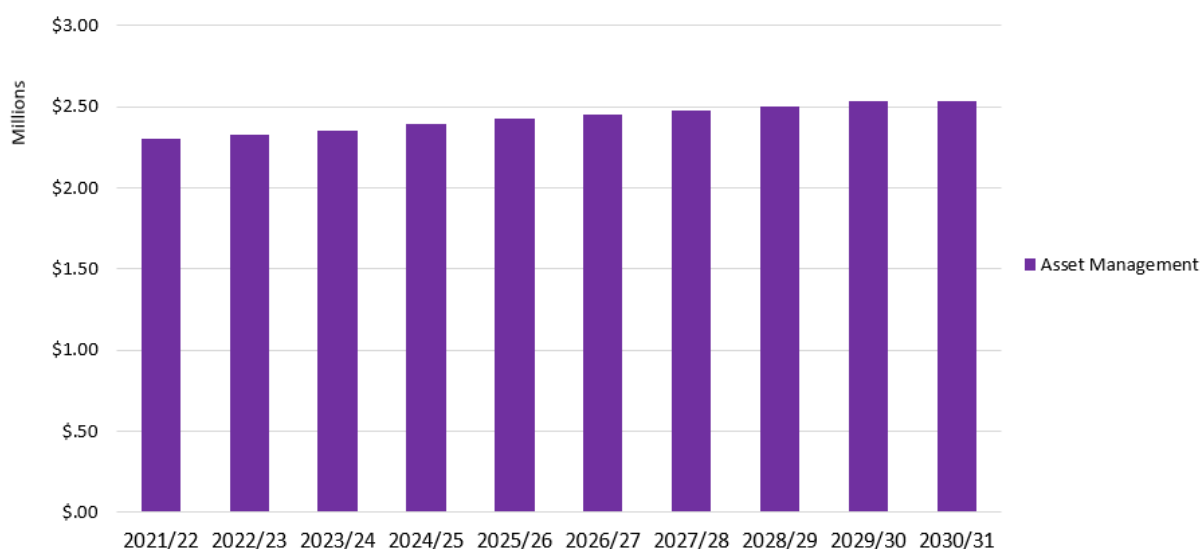


Figure 7-26: Bridges, walls and structures operations – recommended investment needs (uninflated)

Table 7-23: Bridges, walls and structures operations – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Asset management	\$2.3	\$2.3	\$2.4	\$2.4	\$2.4	\$2.4	\$2.5	\$2.5	\$2.5	\$2.5

Renewals – recommended investment needs

High-ranked options in the multi-criteria analysis for renewals of bridges, walls and structures are to:

- bring forward interventions relating to natural hazards (including coastal hazards associated with climate change) and their impacts on important roads (e.g. bridge strengthening, bridge retrofits, waterway scour mitigation, sea wall replacements, etc.) based on vulnerability impact investigations
- develop a programme to upgrade retaining walls on important roads that are exposed to natural hazards.
- address seismic risks and ensure that all structures comply with seismic requirements.

These options are reflected in the recommended renewals investment shown in Figure 7-27 and Table 7-24.

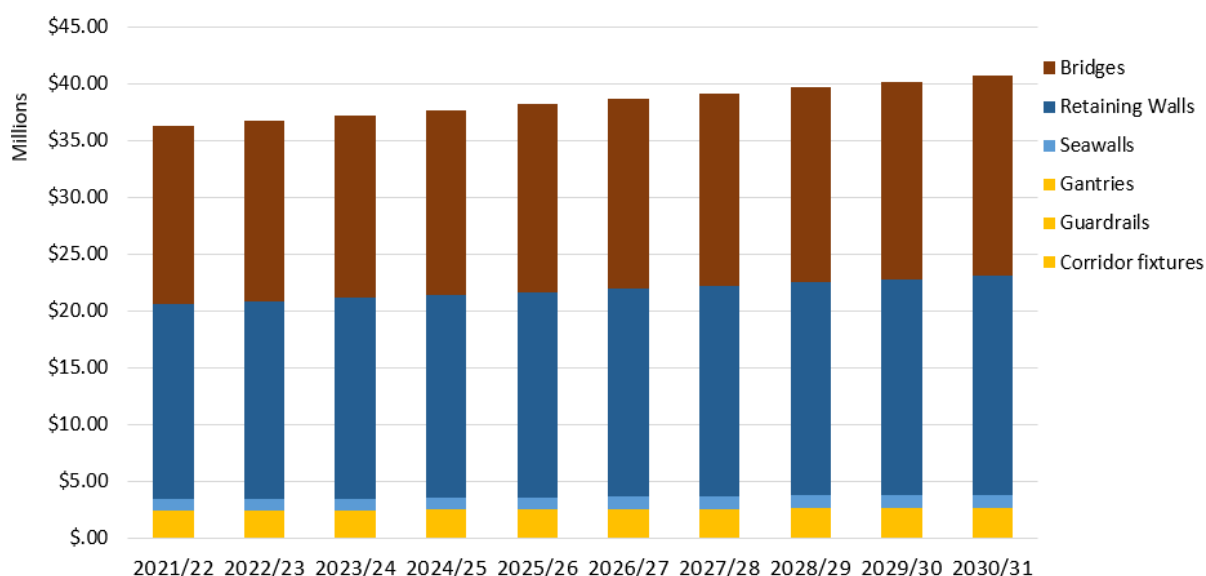


Figure 7-27: Bridges, walls and structures renewals – asset needs (uninflated)

Table 7-24: Bridges, walls and structures renewals – asset needs (uninflated)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Bridges – baseline	\$7.7	\$7.8	\$7.9	\$8.0	\$8.1	\$8.2	\$8.4	\$8.5	\$8.6	\$8.7
Bridges – seismic retrofitting	\$8.0	\$8.1	\$8.2	\$8.3	\$8.4	\$8.5	\$8.6	\$8.7	\$8.8	\$8.9
Retaining walls and seawalls – baseline	\$6.2	\$6.3	\$6.4	\$6.5	\$6.6	\$6.7	\$6.8	\$6.9	\$7.0	\$7.1
Retaining walls – climate change response	\$5.0	\$5.1	\$5.1	\$5.2	\$5.2	\$5.3	\$5.4	\$5.4	\$5.5	\$5.6
Retaining walls – slip repairs	\$6.0	\$6.1	\$6.1	\$6.2	\$6.3	\$6.4	\$6.4	\$6.5	\$6.6	\$6.7
Corridor structures – baseline	\$2.4	\$2.4	\$2.5	\$2.5	\$2.6	\$2.6	\$2.6	\$2.7	\$2.7	\$2.7
Gantries – seismic retrofitting	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1
Total bridges, walls and structures	\$36.3	\$36.7	\$37.2	\$37.7	\$38.2	\$38.7	\$39.2	\$39.7	\$40.2	\$40.8

The asset needs investment programme for bridges, walls and structures renewals addresses the issues highlighted in the multi-criteria analysis by:

- prioritising renewals for bridges and retaining walls based on risk.
- making additional provision for seismic retrofitting of bridges, gantries and other at-risk corridor structures – this is a 10-year programme
- strengthening and in some cases raising retaining and sea walls, as part of AT’s adaptation response to climate change
- providing for slip repairs for retaining walls, and constructing new retaining walls on slip-prone roads. This proactive programme focusses on stabilising slopes and strengthening existing walls. It is expected to result in a corresponding reduction in emergency renewals required to rebuild walls damaged by extreme weather.

7.4.6 Bridges, walls and structures – investment benefits

The performance indicators that AT will use to measure the success of its investment in bridges, walls and structures are shown in Table 7-25.

Table 7-25: Bridges, walls and structures – performance indicators

Investment benefits	Key performance indicators	Performance/ service measure	2019/ 2020
Impact on system reliability	Road assets are in a fit-for-purpose condition	Percentage of bridges and major culverts in acceptable condition	99.6%
		Percentage of walls in acceptable condition	99.5%
		Percentage of corridor structures in acceptable condition	99.4%
Impact on network productivity and utilisation	The movement of freight is facilitated	Percentage of network not accessible to 50-max vehicles	1%
		Percentage of network not accessible to high-productivity motor vehicles	1%
		Number of posted bridges (weight and/or speed limited)	19

7.5 Footpaths and cycleways

Auckland is experiencing a walking and cycling revival, with investment in safe infrastructure leading to more people choosing to walk, wheel and cycle, which in turn leads to public support for further infrastructure improvements. More walking and cycling has important benefits for health, the environment, and the transport network.

Auckland's off-road cycle network is expanding by around 10km of additional off-road cycleways each year. Around 104km of new footpath is constructed each year. In the city centre and town centres, wider footpaths are contributing to a safer and more welcoming street environment.

Footpaths and cycleways have a replacement cost of \$1.5 billion as shown in Table 7-26. The current, depreciated value of these assets is \$862 million or 57 per cent of their replacement cost, indicating that 43 per cent of the economic value of the portfolio has been consumed. Annual depreciation is \$30.1 million.

Table 7-26: Footpaths and cycleways valuation

Asset	Replacement cost \$m	Depreciated value \$m	Annual depreciation \$m
Cycleways	\$114.7	\$78.9	\$2.5
Footpaths	\$1,405.8	\$783.7	\$27.6
Total	\$1,520.5	\$862.6	\$30.1

7.5.1 Footpaths and cycleways – issues and potential responses

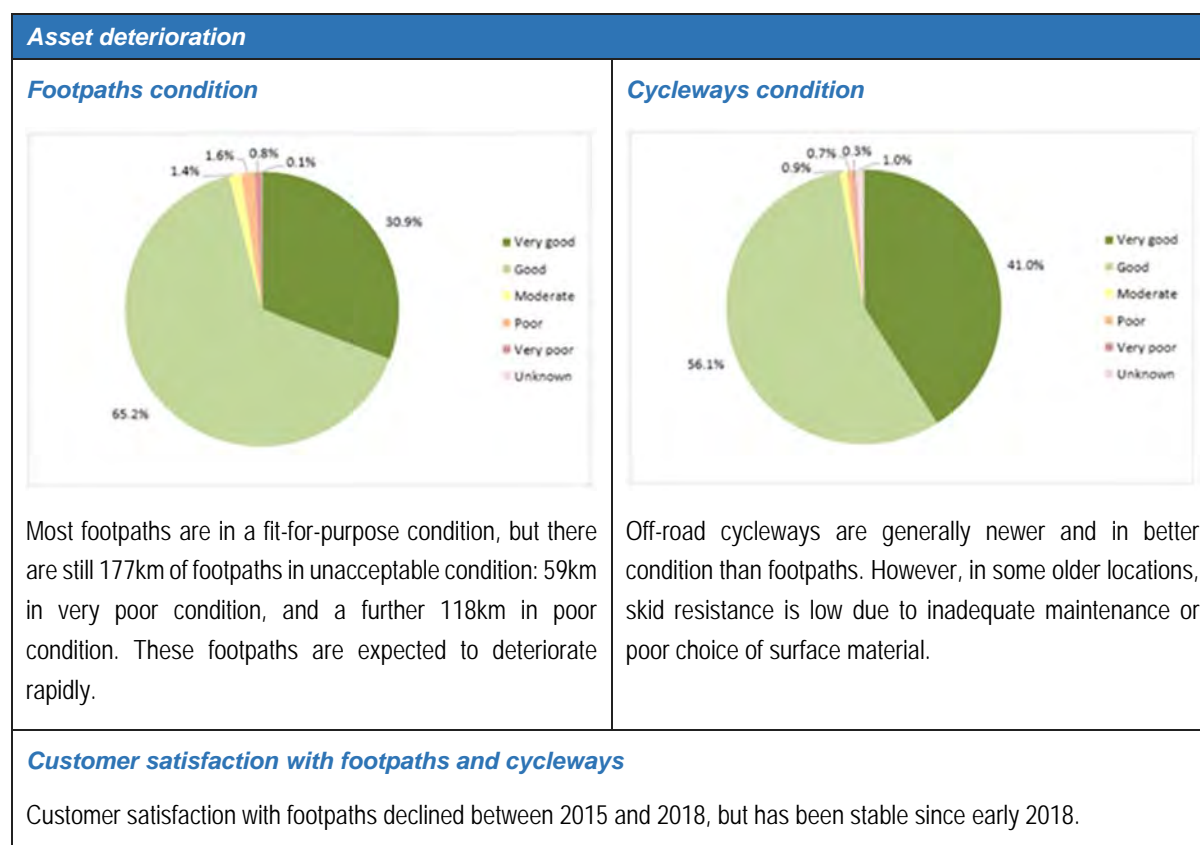
The root cause analysis in section 7 highlighted a range of issues and concerns relating to footpaths and cycleways, as well as potential responses to address these issues, as set out in Table 7-27.

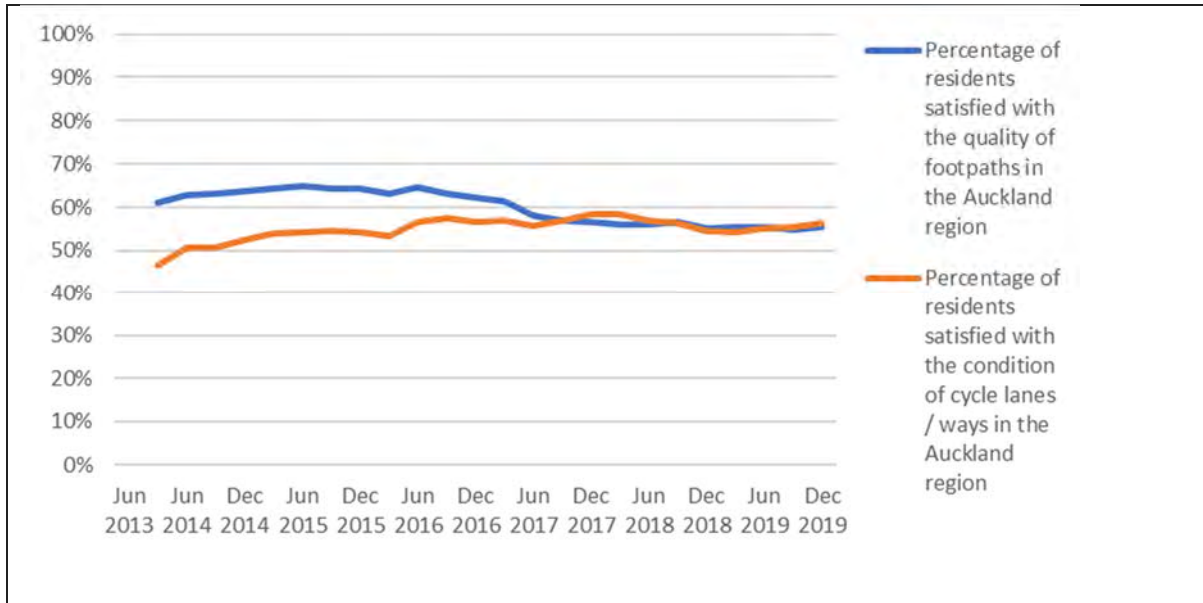
Table 7-27: Root cause analysis – potential responses for footpaths and cycleways

Root cause analysis	Potential responses
Asset deterioration	Continue to monitor condition using automatic sensing and visual inspections.
Asset deterioration	Increase budgets for footpath maintenance targeting localised repair needs.
Asset deterioration	Increase renewal programmes to target larger-scale problems.
Safety	Improved facilities for vulnerable users to provide a better level of protection in conflict zones, including separate space within the road corridor or alternative non-vehicular corridors.
Safety	Provide safe routes along and across the rail corridor to reduce trespassing.
Growth and demand	Develop safe, attractive and well-connected footpath and cycleway networks within the transport corridor.

7.5.2 Footpaths and cycleways – evidence of issues

The condition of footpaths in Auckland can be a safety issue, as shown in Figure 7-28.





Safety

Trips and slips on footpaths can cause serious injury, especially for older adults.



Footpath – trip lip



Footpath – crack broken



Footpath – vegetation and slippery

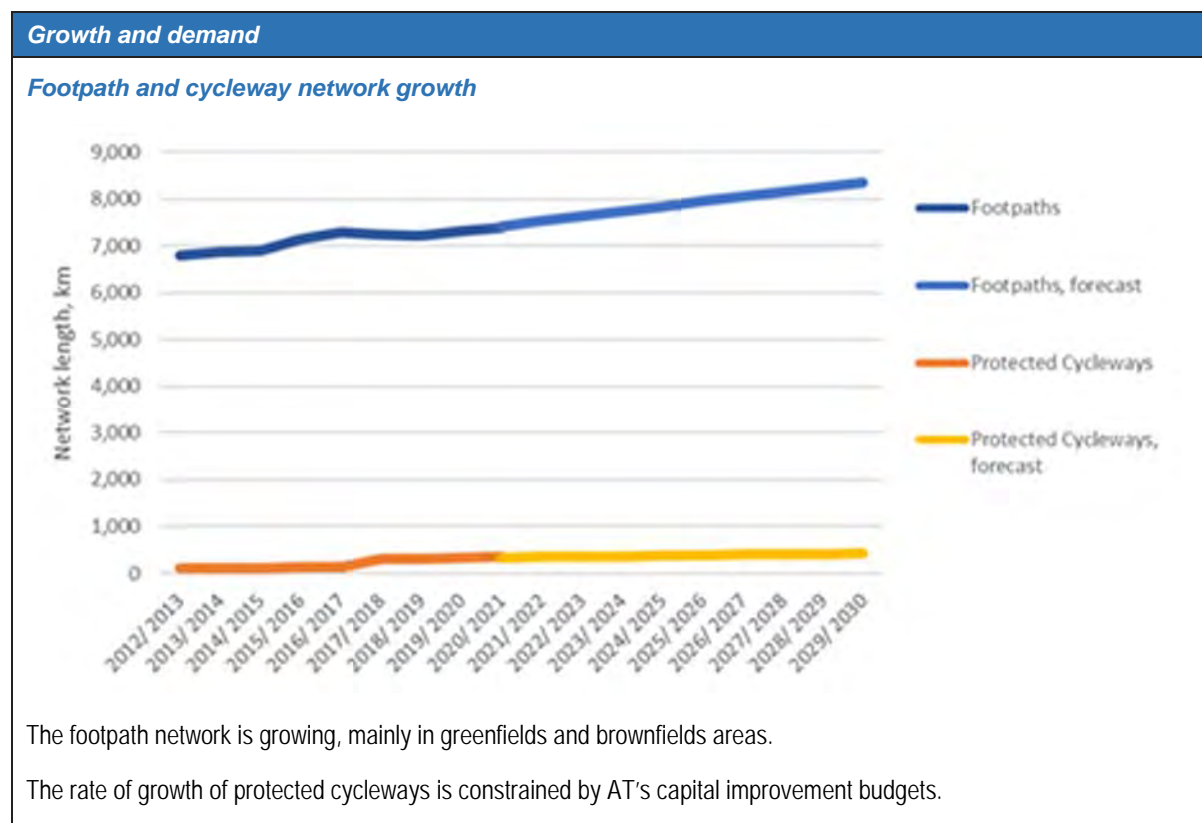


Figure 7-28: Footpaths and cycleways – evidence of issues

7.5.3 Footpaths and cycleways options analysis

AT used a multi-criteria analysis to rank six of the options identified in the root cause analysis for footpaths and cycleways in order of preference or importance. The results are shown in Table 7-28.

Together, these options represent a comprehensive approach to managing footpaths and cycleways while addressing strategic objectives for a multi-modal transport system. The highest priority options relate to managing the current asset base and its growth in size and value.

The overall investment programme set out in this AMP will incorporate all of the recommended options, with funding allocated to maintenance and renewal in this section, and capital improvements and other initiatives in other sections.

Table 7-28: Multi-criteria analysis of options for managing footpaths and cycleways

Option - Can we make	Yes/No	Rank	Reason											
<input type="checkbox"/> Intervention response timing change														
<input type="checkbox"/> Level of service adjustments	Yes	4	Invest in new capital improvements to improve levels of service, provide for mode separation, improve safety, address service gaps and perception issues											
<input type="checkbox"/> Use existing assets differently														
<input type="checkbox"/> Blending Work Categories differently														
<input type="checkbox"/> Risk - Hold Assets longer														
<input type="checkbox"/> Managing demand	Yes	(6.1) 6 (6.2) 2	(6.1). Promote and encourage more journeys being made by active modes to reduce demand for motor vehicle trips (6.2). Increase programmes to allow additional growth related assets to be managed											
<input type="checkbox"/> Route Management	Yes	3	Develop a network approach to footpaths and cyclepaths to form the basis for investment over time, and to inform the network operating framework											
<input type="checkbox"/> Alternative approaches – different solutions/technology														
<input type="checkbox"/> Maintenance vs Renewal adjustments	Yes	1	Address high risk safety concerns related to asset deterioration of footpaths and cycleways based on criticality - increase renewal programme over time.											
<input type="checkbox"/> ONRC Classification variance														
<input type="checkbox"/> Extended temporary management														
<input type="checkbox"/> Supply chain improvements														
<input type="checkbox"/> Improve systems and capability	Yes	5	Complete inventory stocktake and conduct systematic, consistent condition evaluation to inform renewal planning											
Criteria	Weighting (Importance) (Total to 100%)	How good is this option												
		Option 2 - new investment to improve levels of service		Option 6.1 - promote active modes		Option 6.2 - increase programmes for growth		Option 7 - Network approach to ped and cycling routes		Option 9 - renewals to address safety issues / very poor condition		Option 13 - improve data		
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	
Community Outcomes Achieved	20%	3	0.6	2	0.4	3	0.6	3	0.6	2	0.4	0	0	
Problem solving effectiveness	5%	2	0.1	2	0.1	3	0.15	3	0.15	3	0.15	3	0.15	
Benefits realised			0		0		0		0		0		0	
Good Environmental impacts	10%	2	0.2	2	0.2	0	0	2	0.2	0	0	0	0	
Value for Money	15%	2	0.3	3	0.45	2	0.3	2	0.3	2	0.3	3	0.45	
Closing Customer and Technical level of service gaps and impacts	15%	2	0.3	0	0	1	0.15	2	0.3	3	0.45	1	0.15	
Closing ONRC Performance gaps			0		0		0		0		0		0	
Asset preservation and sustainability	10%	0	0	0	0	3	0.3	0	0	2	0.2	2	0.2	
Total Cost of Ownership (whole of life Costs)	15%	-1	-0.15	0	0	-1	-0.15	-1	-0.15	-1	-0.15	0	0	
Life Cycle Management	10%	0	0	0	0	2	0.2	0	0	3	0.3	3	0.3	
COVID-19 Recovery			0		0		0		0		0		0	
Totals	100%		1.35		1.15		1.55		1.4		1.65		1.25	

7.5.4 Footpaths and cycleways – past investment

Past maintenance investment

Maintenance investment trends show a steep reduction in provision for maintenance of footpaths and cycleways between 2012/2013 and 2017/2018, as shown in Figure 7-29.

This reduction in maintenance budgets impacted on AT's ability to provide a safe walking and cycling environment, and contributed to a statistically significant decline in satisfaction with footpaths between 2016 and 2018.

This issue was addressed in the 2018/2019 AMP and additional maintenance funding provided, particularly for cycleways. Delivery of the maintenance programme was impacted in 2019/2020 by the Covid-19 lockdown, but provision is increased again in the current 2020/2021 budget.

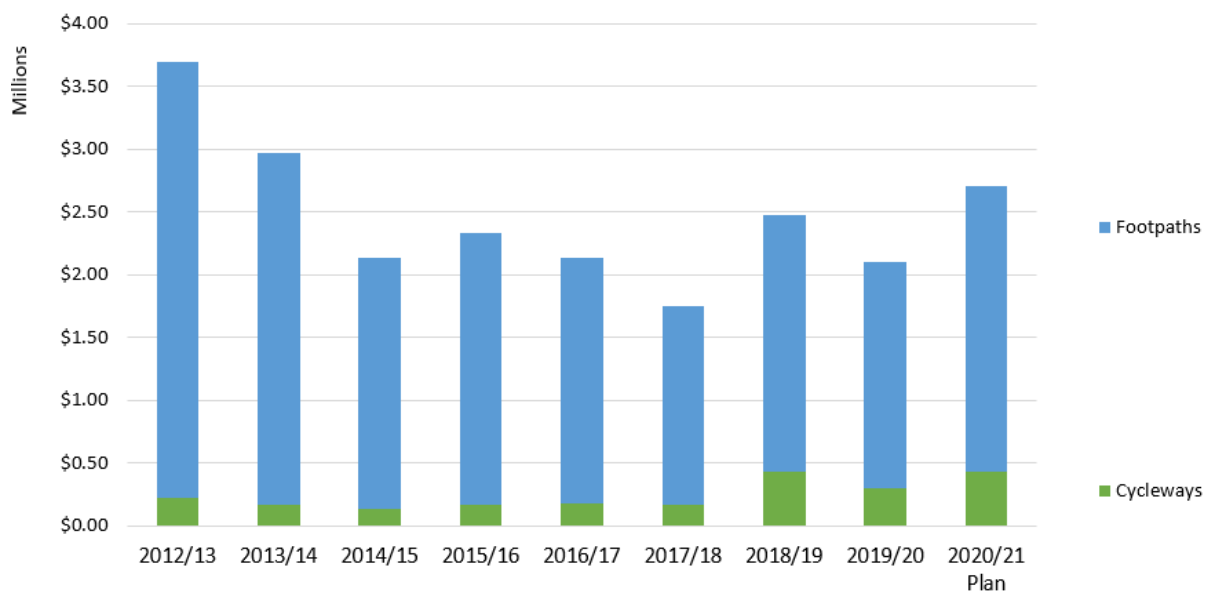


Figure 7-29: Footpaths and cycleways – past maintenance investment

Past operations investment

The main activity charged to operations budgets for footpaths and cycleways is regional condition rating surveys, and analysis of this data to inform asset management decision-making. Regional condition rating surveys ensure that we:

- take a consistent approach to fault inspection and condition assessment
- have access to quality data for proactive planning and network management
- achieve value for money, by reducing administrative overheads and by better directing maintenance and renewals funding to where it is most needed.

Regional surveys were introduced in 2017/2018, at a cost of around \$330,000 per year as shown in Figure 7-30.

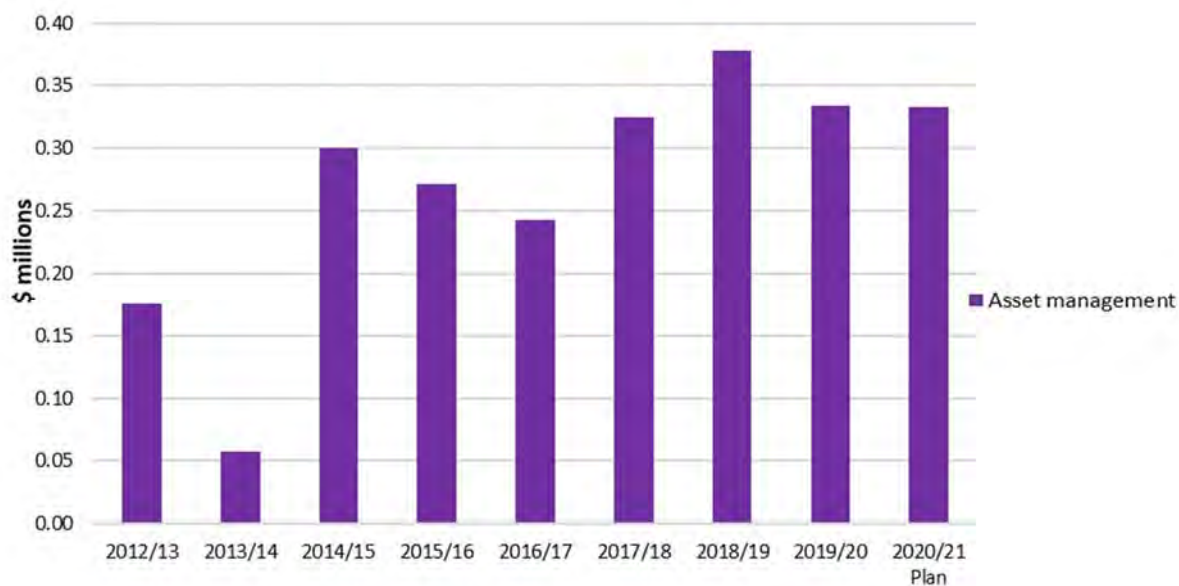


Figure 7-30: Footpaths and cycleways – past operations investment

Past renewals investment

Past investment in renewals of footpaths and cycleways is shown in Figure 7-31.

Renewals of cycleways to date have been minimal, as the majority of cycleway assets are still new and in good or very good condition.

Footpath renewals are relatively steady year to year, but the rate of renewals spending is lower than the rate of footpath depreciation, which is \$27.6 million per year. This indicates that the value of the asset may not be being sustained over time.

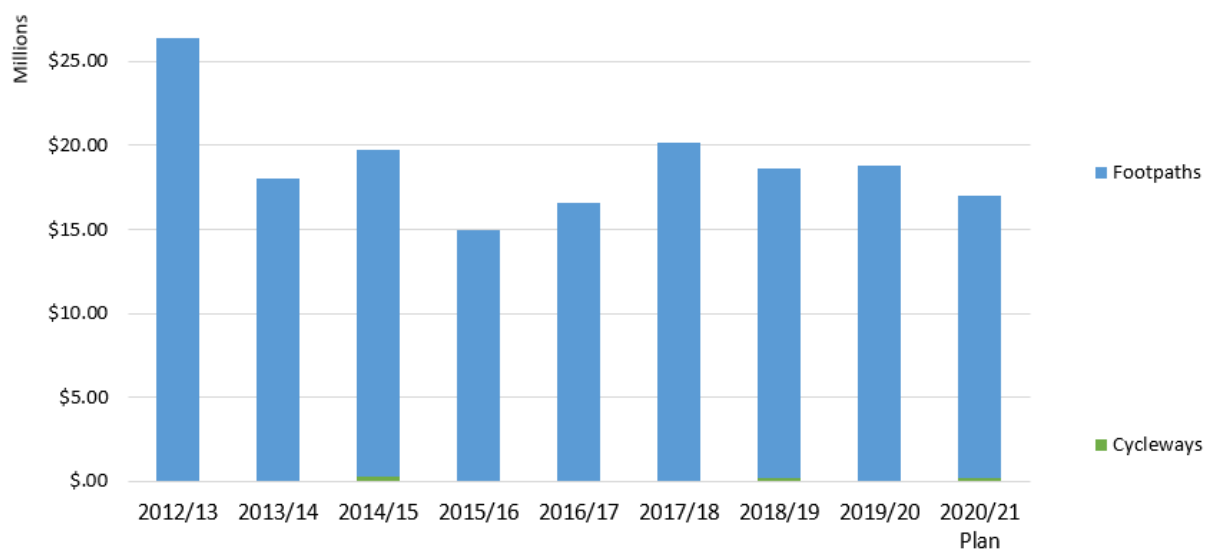


Figure 7-31: Footpaths and cycleways – past renewals investment

Two further issues impact on AT’s ability to renew footpaths in a timely manner, when they fall into very poor condition.

1. In the same manner as kerb and channel assets, footpaths can require renewal as part of pavement resurfacing projects.
2. Local board-initiated walking and cycling projects can create a need for renewals of existing assets, in order to create a connected network with a consistent level of service.

While both types of expenditure are important, the location and timing of these activities are not determined by footpath priorities.

7.5.5 Footpaths and cycleways – asset needs

AT has developed its recommended future investment needs for footpaths and cycleways based on the recommendations of the multi-criteria analysis.

High-ranked options in the multi-criteria analysis for footpath and cycleways maintenance are:

- address high-risk safety concerns related to asset deterioration of footpaths and cycleways based on criticality – this will require an increase in budgets for footpath maintenance that targets localised repair needs
- increase programmes to allow additional growth-related assets to be better managed.

Maintenance – recommended investment needs

This AMP is recommending a significant increase in footpath maintenance budgets, in order to find and fix small areas of footpaths in very poor condition, and to ensure that renewals budgets are available to address larger-scale problems.

Costs increase in future years, in proportion to the forecast growth in footpaths and cycleway assets, as shown in Figure 7-32 and [Table 7-29](#).

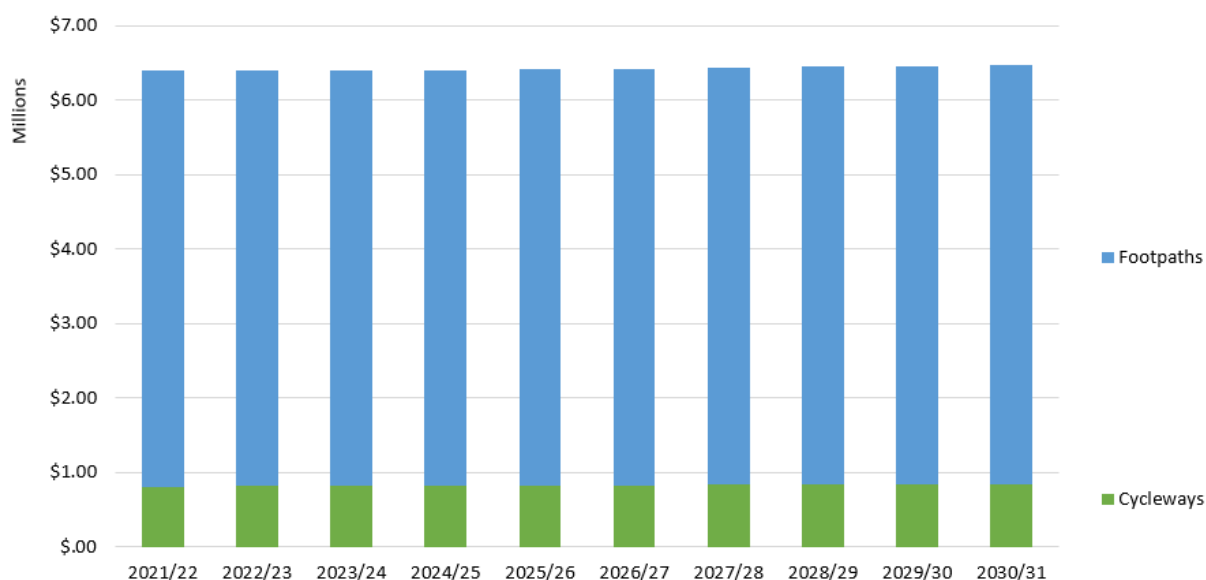


Figure 7-32: Footpaths and cycleways maintenance – recommended investment needs (uninflated)

Table 7-29: Footpaths and cycleways maintenance – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Footpaths	\$5.6	\$5.6	\$5.6	\$5.6	\$5.6	\$5.6	\$5.6	\$5.6	\$5.6	\$5.6
Cycleways	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8	\$0.8

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Total	\$6.4	\$6.4	\$6.4	\$6.4	\$6.4	\$6.4	\$6.4	\$6.4	\$6.5	\$6.5

Operations – recommended investment needs

High-ranked options in the multi-criteria analysis for footpath and cycleways operations are:

- develop network hierarchies for footpaths and cycleways to form the basis for investment over time
- improve data – complete an inventory stocktake and conduct systematic, consistent condition evaluation to inform renewal planning using automatic sensing and visual inspections.

This AMP proposes to continue collecting consistent data on footpath asset condition, and to improve the frequency of data collection, especially for priority areas. The definition of priority areas for footpaths and cycleways is itself a significant task, requiring regular updates.

Forward planning for these assets will become increasingly important as more journeys are made by walking and cycling, in line with national and regional goals.

This will increase operational budget requirements, as shown in Figure 7-33 and Table 7-30.

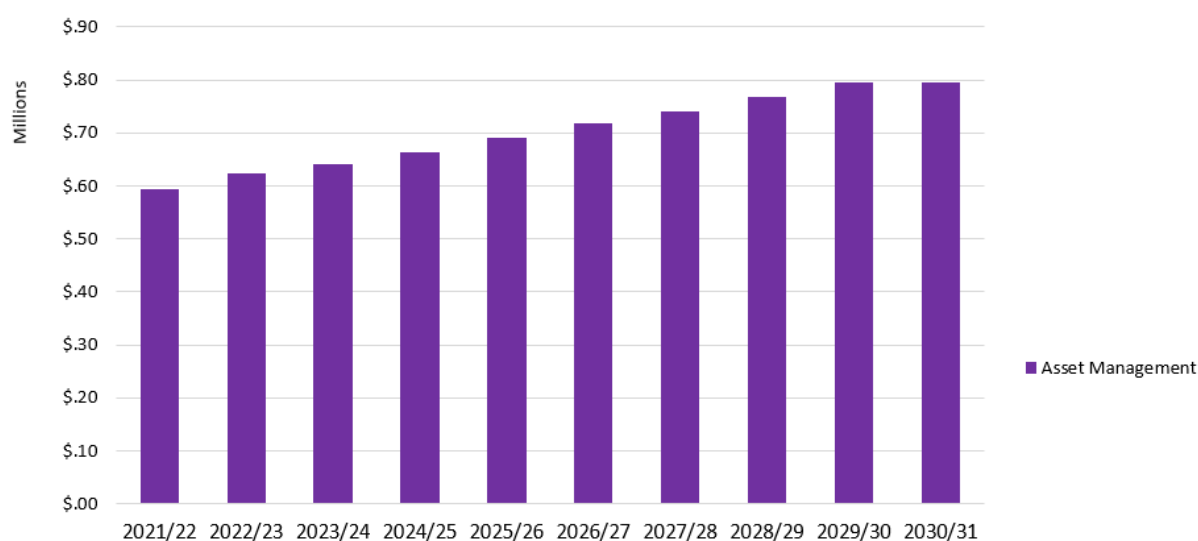


Figure 7-33: Footpaths and cycleways operations – recommended investment needs (uninflated)

Table 7-30: Footpaths and cycleways operations – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Asset management	\$0.6	\$0.6	\$0.6	\$0.7	\$0.7	\$0.7	\$0.7	\$0.8	\$0.8	\$0.8

Renewals – asset needs

High-ranked options in the multi-criteria analysis for footpath and cycleways renewals are:

- address high-risk safety concerns related to asset deterioration of footpaths and cycleways based on criticality – this will require an increase in budgets for future renewal programmes that target larger-scale problems over time.
- Increase programmes to allow additional growth-related assets to be better managed.

This AMP has demonstrated the need for a significant increase in investment in footpath renewals relative to past expenditure, as shown in Figure 7-34 and Table 7-31. However, renewals investment will still be less than the annual depreciation of these assets.

Renewals investment will need to increase in future years, especially for cycleways, where recent capital programmes to expand the cycleway network will generate later increases in renewals needs.

The asset needs investment plan also makes separate provision for:

- footpath replacements required as part of pavement resurfacing projects
- footpath and cycleway renewals required to complement local board-initiated walking and cycling improvements.

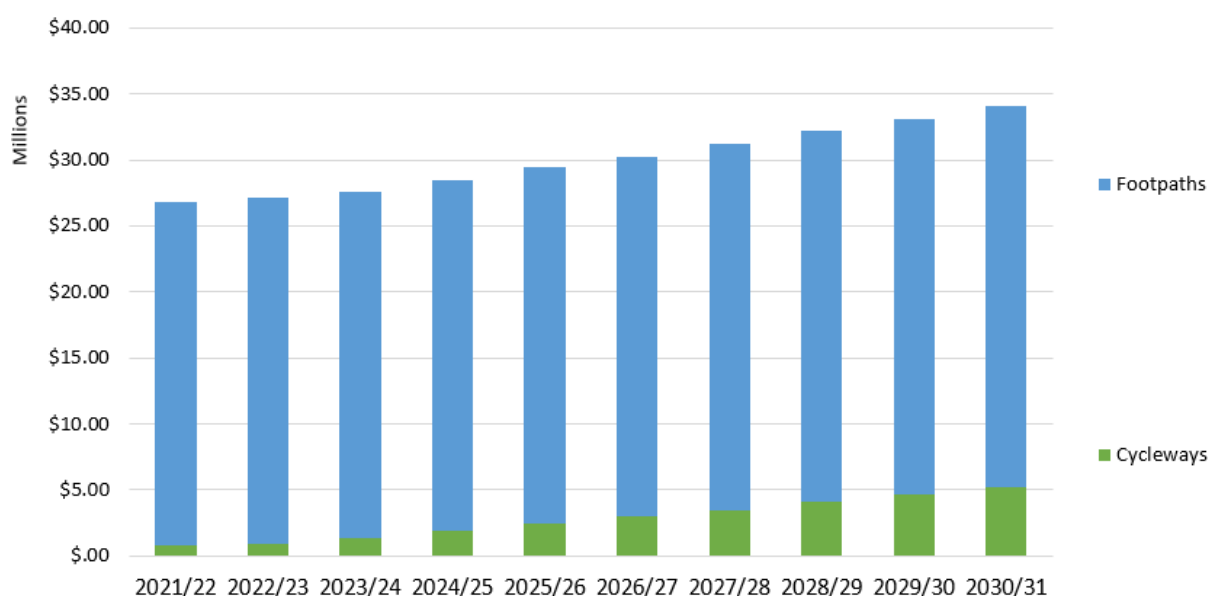


Figure 7-34: Footpaths and cycleways renewals – asset needs (uninflated)

Table 7-31: Footpaths and cycleways renewals – asset needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Footpaths – baseline needs	\$21.0	\$21.2	\$21.1	\$21.4	\$21.7	\$22.0	\$22.3	\$22.7	\$23.0	\$23.3
Cycleways – baseline needs	\$0.8	\$0.9	\$1.4	\$1.9	\$2.5	\$2.9	\$3.5	\$4.1	\$4.6	\$5.2
Footpaths – renewals to complement other works	\$4.0	\$4.0	\$4.1	\$4.1	\$4.2	\$4.2	\$4.3	\$4.3	\$4.4	\$4.4
Footpaths – local needs	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1
Total	\$26.8	\$27.1	\$27.6	\$28.5	\$29.4	\$30.3	\$31.2	\$32.2	\$33.1	\$34.1

7.5.6 Footpaths and cycleways – investment benefits

The performance indicators AT will use to measure the success of its investment in footpaths and cycleways are shown in Table 7-32.

Table 7-32: Footpaths and cycleways – performance indicators

Government investment benefits	Key performance indicators	Performance/service measure	2019/2020	Target
Impact of mode on physical and mental health	Increased walking and cycling	Number of cycle movements past selected count sites (26 sites)	1,072	3.826
		Proportion of morning peak trips into the city centre that are by walking and cycling	8%	(blank)
		Kilometres of new cycleway added to the regional cycle network	2.2	10
Impact on perception of safety and security	Customers feel safe	Percentage of customers satisfied with the overall safety of walking in the Auckland region	63%	TBD
		Percentage of customers satisfied with the overall safety of cycling in the Auckland region	21%	TBD
Impact on system reliability	Road assets are in acceptable condition	Percentage of cycleways in acceptable condition	99%	98%
		Percentage of footpaths in acceptable condition	98%	95%
		Percentage of pathways in acceptable aesthetic condition	New measure	(blank)
Impact on user experience of the transport system	Customers are satisfied with assets	Percentage of customers satisfied with the quality of footpaths in the Auckland region	55%	70%
		Percentage of customers satisfied with the quality of footpaths in their local area	55%	70%
Auckland Council group requirements	AT is responsive to customers	Percentage of customer service requests relating to roads and footpaths that receive a response within specified timeframes	82%	85%

7.6 Street lighting

Street lighting makes it safer for drivers, pedestrians and other road users to travel at night, improves personal security for pedestrians and neighbourhoods and aids crime prevention. Well-lit streets and pathways encourage night-time walking, cycling and use of local facilities.

The current valuation of street lighting assets is shown in Table 7-33.

Table 7-33: Street lighting asset valuation

Asset	Replacement cost \$m	Depreciated value \$m	Annual depreciation \$m
Luminaries	\$46.1	\$37.5	\$2.1
Controllers	\$12.1	\$10.9	\$0.5
Poles	\$210.3	\$109.8	\$8.9
Brackets	\$16.8	\$7.1	\$0.8
Total	\$285.3	\$165.3	\$12.2

7.6.1 Street lighting – issues and potential responses

The root cause analysis in section 7 highlighted some issues relating to street lighting, as well as potential responses to address these issues, as set out in Table 7-34.

Table 7-34: Root cause analysis – potential responses for street lighting

Root cause analysis	Potential responses
Asset deterioration	Continue with the street light LED conversion programme.
Asset deterioration	Continue with the street light pole replacement programme.
Safety	Erect more street lights to light a greater proportion of the AT pathways network.

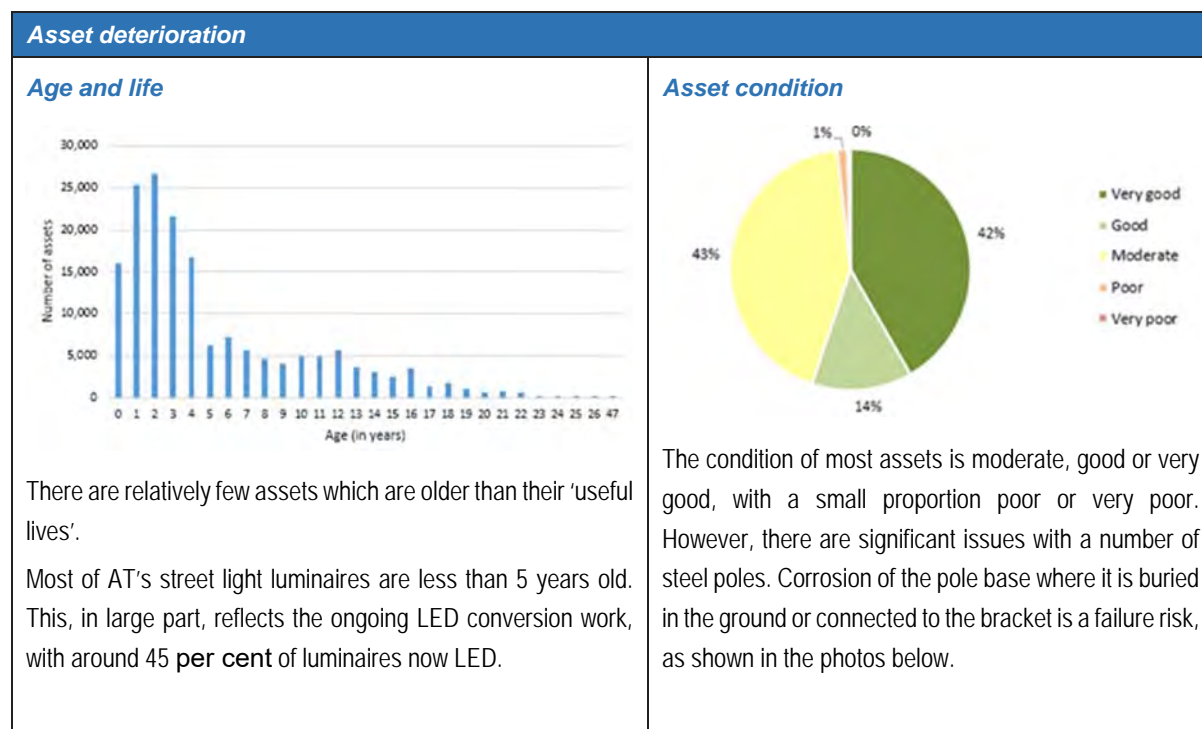
7.6.2 Street lighting – evidence of issues

Improved technology is leading to better performance and lower costs across the street light network.

Auckland’s street lights are being progressively upgraded to long-lasting, energy efficient LED luminaires. These luminaires use significantly less electricity and are watertight units which, if kept clean, require minimal maintenance. LED street lights also have a longer useful life, which reduces pressure on future renewals budgets.

Street light poles remain a significant concern, with some poorly designed or installed poles failing before their expected useful life.

Poor quality street light poles represent a risk to public safety, as shown in Figure 7-35. AT began an accelerated pole replacement programme in 2018 and needs to continue this programme until at least 2024. New street light poles that comply with AT’s design guide do not pose this level of risk and have an expected useful life of 30 years.

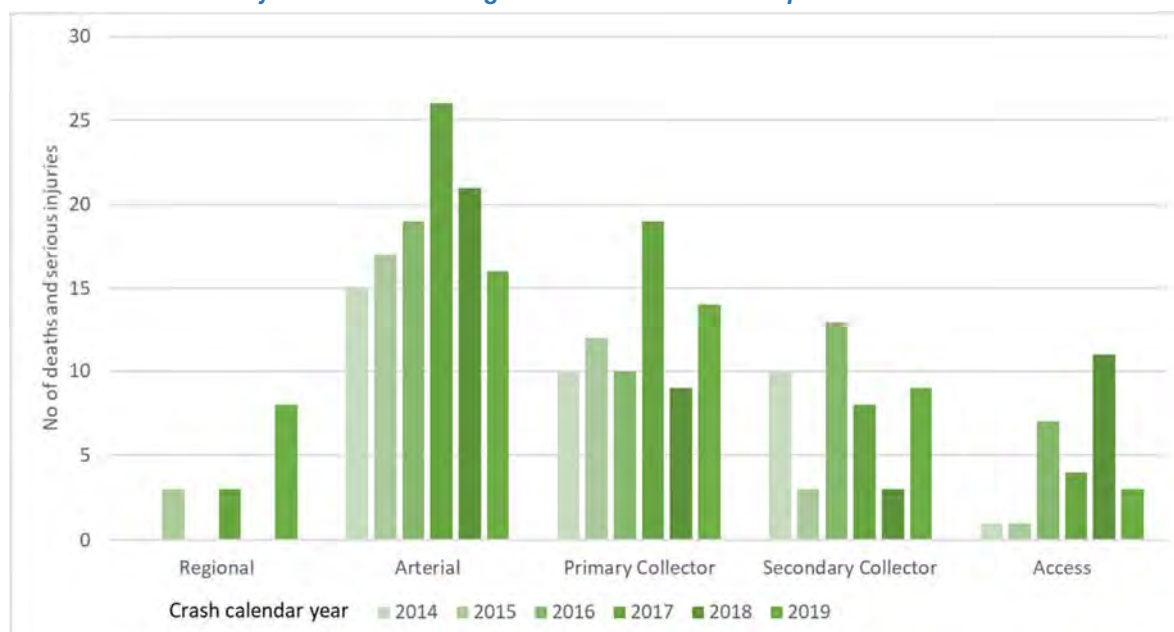


Examples of poor condition street light poles addressed by AT's pole replacement programme



Road safety

Deaths and serious injuries when street lights were either off or not present



Street lights make an important contribution to road safety. Improvements in street lighting are contributing to the overall reduction in deaths and serious injuries on the local road network.

Figure 7-35: Street lighting – evidence of issues

7.6.3 Street lighting options analysis

AT used a multi-criteria analysis to rank four of the options identified in the root cause analysis in order of preference or importance. The results are shown in Table 7-35 .

Table 7-35: Multi-criteria analysis of options for managing street lighting

Option - Can we make	Yes/No	Rank	Reason						
<input type="checkbox"/> Intervention response timing change									
<input type="checkbox"/> Level of service adjustments	Yes	4	Close Level of service gaps across the network to address infill lighting deficiencies and non-compliant illumination levels						
<input type="checkbox"/> Use existing assets differently									
<input type="checkbox"/> Blending Work Categories differently									
<input type="checkbox"/> Risk - Hold Assets longer									
<input type="checkbox"/> Managing demand	Yes	3	Increase programmes to allow additional growth related assets to be managed						
<input type="checkbox"/> Route Management									
<input type="checkbox"/> Alternative approaches – different solutions/technology	Yes	1	Complete roll-out of LED upgrade programme delivering energy cost savings and helping to achieve target illumination issues (see 2 above)						
<input type="checkbox"/> Maintenance vs Renewal adjustments	Yes	2	Accelerate pole renewal programme to address corrosion and safety issues						
<input type="checkbox"/> ONRC Classification variance									
<input type="checkbox"/> Extended temporary management									
<input type="checkbox"/> Supply chain improvements									
<input type="checkbox"/> Improve systems and capability									
Criteria	Weighting (Importance) (Total to 100%)	How good is this option							
		Option 2 - Close LoS lighting gaps		Option 6 - increase programmes for growth		Option 8 - complete LED upgrade		Option 9 - accelerate pole renewal programme	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	20%	3	0.6	3	0.6	1	0.2	3	0.6
Problem solving effectiveness	10%	3	0.3	3	0.3	2	0.2	3	0.3
Benefits realised			0		0		0		0
Good Environmental impacts	5%	0	0	0	0	3	0.15	0	0
Value for Money	15%	1	0.15	2	0.3	3	0.45	3	0.45
Closing Customer and Technical LoS gaps and impacts			0		0		0		0
Closing ONRC Performance gaps	10%	2	0.2	0	0	2	0.2	0	0
Asset preservation and sustainability	10%	1	0.1	0	0	2	0.2	2	0.2
Total Cost of Ownership (whole of life Costs)	20%	-2	-0.4	-1	-0.2	3	0.6	-1	-0.2
Life Cycle Management	10%	0	0	2	0.2	2	0.2	3	0.3
COVID-19 Recovery			0		0		0		0
Totals	100%		0.95		1.2		2.2		1.65

7.6.4 Street lighting – past investment

Past maintenance investment

Maintenance works are prioritised based on the criticality of the assets, the severity of the faults and service level requirements. Where possible, they are integrated with other road corridor works to minimise disruption to the public.

Past expenditure on street light maintenance is shown in Figure 7-36. The reduction in maintenance spend between 2015/2016 and 2019/2020 is due in part to better street light components, especially LED luminaires, that require less maintenance.

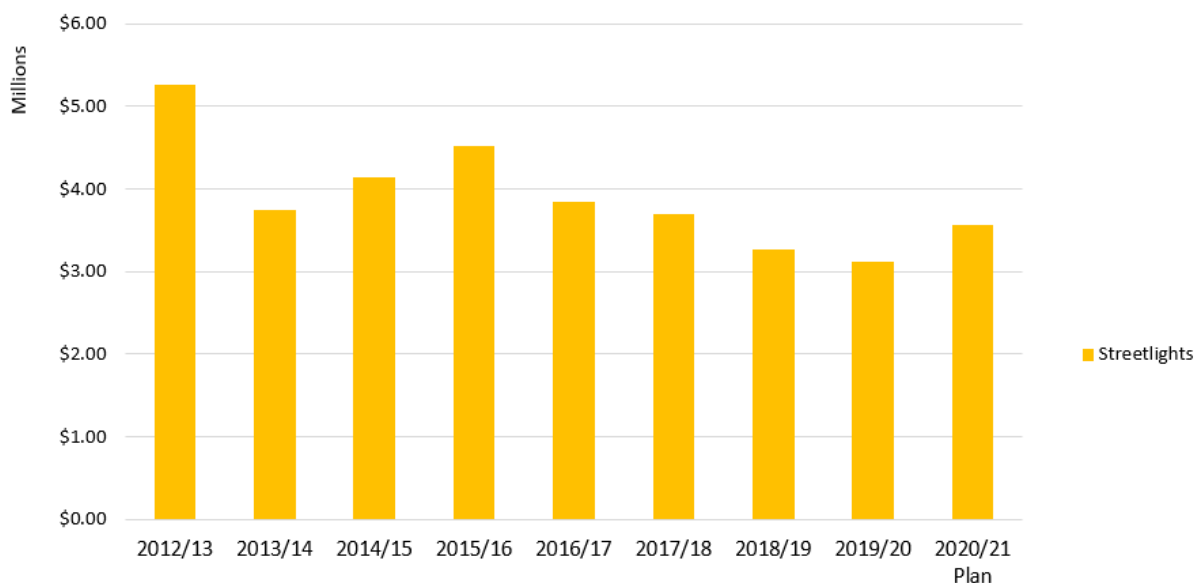


Figure 7-36: Street lighting – past maintenance investment

Past operations investment

Operational budgets for street lighting are predominantly electricity costs. Electricity costs increased steadily up to 2016/2017, when the LED replacement programme began to have a significant impact on electricity usage. Since then they have declined, as shown in Figure 7-37.

LED lighting is many times more energy efficient than older street light technologies. While it is not yet possible to meet the lighting standards for Auckland's busiest roads with LEDs, the technology is advancing rapidly and AT is proactively installing new technologies as they become available.

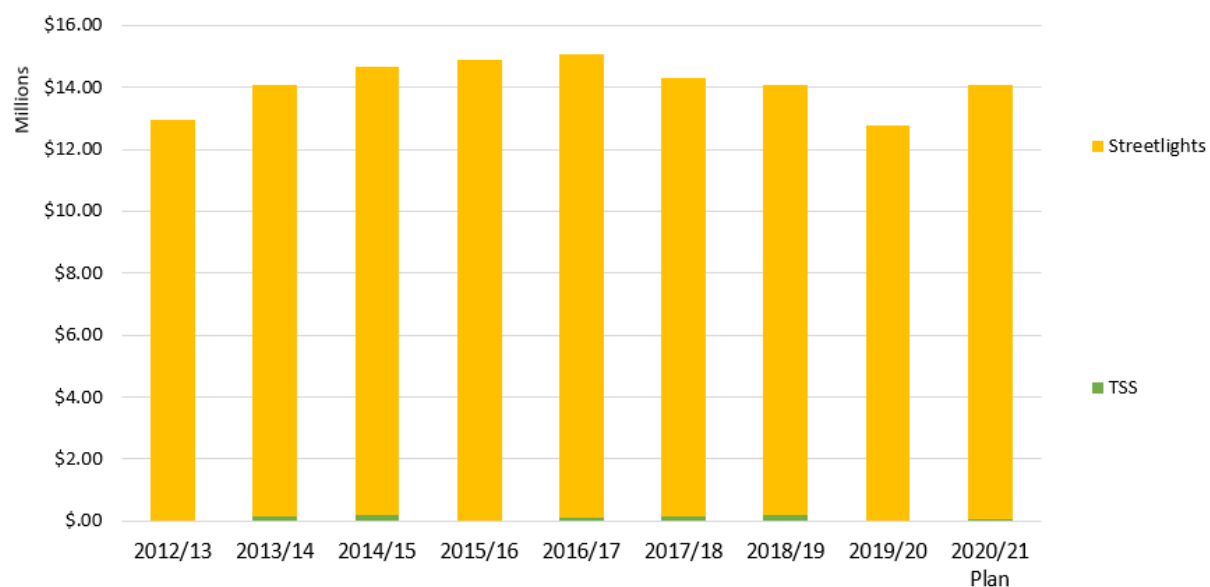


Figure 7-37: Street lighting – past operations investment

Past renewals investment

Past renewals expenditure for street lighting and associated technical support services is shown in Figure 7-38. The average renewals over the past 10 years is \$12.1 million, which is close to the rate of depreciation for these assets (which is \$12.2 million per year).

Since 2016/2017, some of the costs of replacing existing street lights with LED equivalents has been funded as renewals. There is also a capital improvement budget for LED replacements.

From 2018/2019, AT began an accelerated programme of pole replacement in response to an unacceptable risk posed by some pole types, as shown in Figure 7-35.

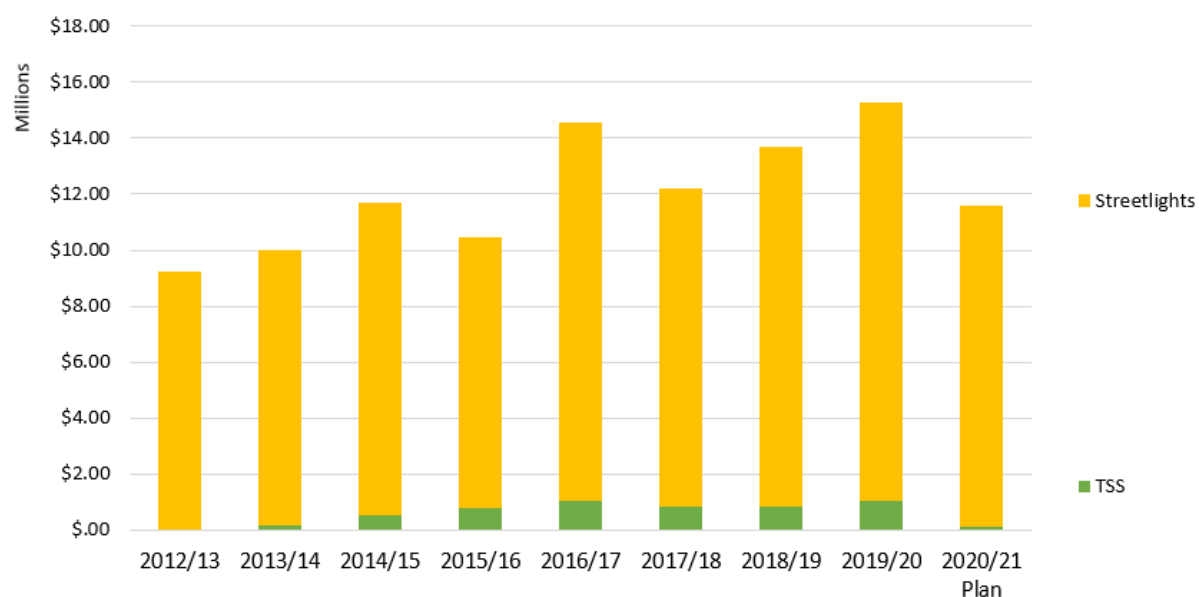


Figure 7-38: Street lighting – past renewals investment

7.6.5 Street lighting – recommended investment needs

AT has developed its recommended future investment needs for street lighting based on the recommendations of the multi-criteria analysis.

Maintenance – recommended investment needs

A high-ranked option in the multi-criteria analysis for street lighting maintenance is:

- increase programmes to allow additional growth related assets to be managed.

Recommended future investment needs for the maintenance of street lights are shown in Figure 7-39 and Table 7-36.

This recommended investment will enable AT to respond to the issues raised in the multi-criteria analysis by:

- including maintenance of LED luminaires and controllers installed from 2016/2017
- supporting the maintenance of a growing network of street lights, both in new urban growth areas and from improvements to lighting within the urban area.

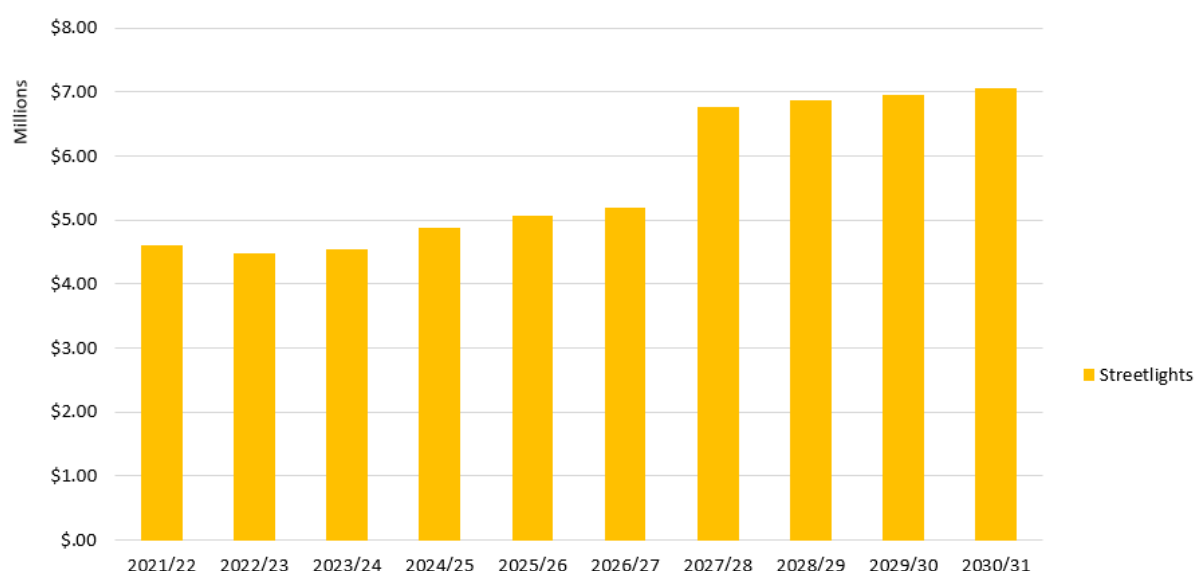


Figure 7-39: Street lighting maintenance – recommended investment needs (uninflated)

Table 7-36: Street lighting maintenance – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Street light maintenance	\$4.6	\$4.5	\$4.5	\$4.9	\$5.1	\$5.2	\$6.8	\$6.9	\$7.0	\$7.1

Operations – recommended investment needs

A high-ranked option in the multi-criteria analysis for street lighting operations is:

- increase programmes to allow additional growth related assets to be managed.

Recommended future investment needs for the operation of street lights are shown in Figure 7-40 and Table 7-37.

The recommended operations programme reflects the need to operate a growing network of street lights. At this stage there is no corresponding reduction from the better energy efficiency of LED lighting, as these savings will need to be negotiated with electricity providers.

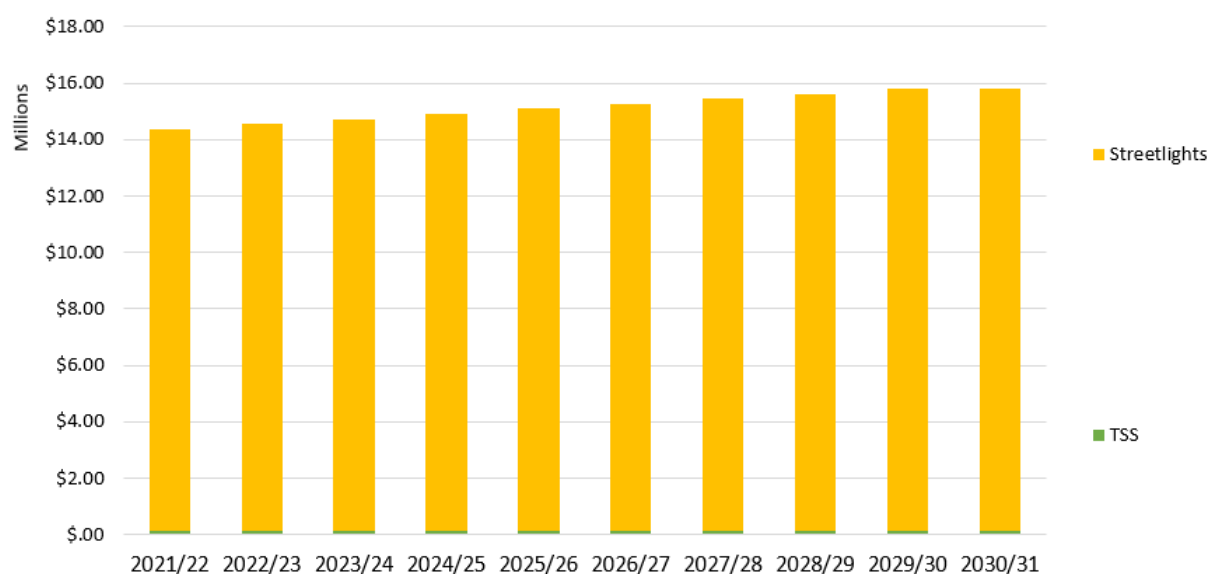


Figure 7-40: Street lighting operations – recommended investment needs (uninflated)

Table 7-37: Street lighting operations – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Street light operations	\$14.3	\$14.4	\$14.6	\$14.8	\$15.0	\$15.2	\$15.3	\$15.5	\$15.7	\$15.7
Technical support	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1
Total	\$14.4	\$14.6	\$14.7	\$14.9	\$15.1	\$15.3	\$15.4	\$15.6	\$15.8	\$15.8

Renewals – asset needs

High-ranked options in the multi-criteria analysis for street lighting renewals are:

- complete the roll-out of the LED upgrade programme delivering energy savings and helping to achieve target illumination levels.
- accelerate the pole renewal programme to address corrosion and safety issues.
- close level of service gaps across the network to address infill lighting deficiencies and non-compliant illumination levels.

Recommended future investment needs for the renewals of street lights are shown in Figure 7-41 and Table 7-38.

The work to improve lighting deficiencies will be achieved through capital improvements, including the low-cost low-risk safety programme.



Figure 7-41: Street lighting renewals – asset needs (uninflated)

Table 7-38: Street lighting renewals – asset needs (uninflated)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Renewals – baseline	\$14.2	\$13.8	\$13.8	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2	\$8.2
Technical support	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1
Local needs	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.6
Total	\$15.8	\$15.4	\$15.4	\$9.9	\$9.9	\$9.9	\$9.9	\$9.9	\$9.9	\$9.9

7.6.6 Street lighting – investment benefits

The performance indicators AT will use to measure the success of its investment in street lighting are shown in Table 7-39.

Table 7-39: Street lighting – performance indicators

Government investment benefits	Key performance indicators	Performance/service measure description	2019/2020	Target
Impact on social cost and incidents of crashes	Deaths and serious injuries are reduced	Deaths and serious injuries where loss of driver control at night was a contributing factor	62	Reduce in line with Vision Zero
Impact on system safety	Hazards are eliminated or minimised	Compliance with average level of illumination at major intersections – 7.5 lux	90%	100%

		Compliance with average level of illumination at commercial centres – 6 lux	>90%	100%
		Compliance with average level of illumination on: • collector roads – 3 lux • primary and secondary arterial roads – 4 lux	80%	100%
		Compliance with average level of illumination on residential streets – 2 lux	50%	100%
Impact on perception of safety and security	Customers feel safe	Compliance with safety and security design guidance	New measure	TBD
Impact on resource efficiency	Resources are used efficiently	Percentage of AT street lights that are energy efficient LED	45%	
Impact on system reliability	Road assets are in acceptable condition	Percentage of street light brackets in acceptable condition	100%	
		Percentage of street light columns in acceptable condition	99%	
		Percentage of street light luminaires in acceptable condition	100%	

7.7 Traffic systems

Traffic systems, signs and markings, and their operations, are integral parts of the transport network; helping deliver an effective and efficient transport system by optimising traffic flows and improving road safety at intersections.

The current valuation of AT's traffic system assets is shown in Table 7-40.

Table 7-40: Traffic systems asset valuation

Asset	Replacement cost \$m	Depreciated value \$m	Annual depreciation \$m
Traffic signals	\$110.20	\$53.30	\$7.70
CCTV	\$11.10	\$7.40	\$1.90
Electronic signs	\$19.30	\$9.80	\$1.20
Traffic signs and markings	\$70.40	\$37.10	\$4.30
Total traffic systems	\$210.90	\$107.60	\$15.20

7.7.1 Traffic systems – issues and potential responses

The root cause analysis in section 7 highlighted a range of issues and concerns relating to traffic systems, as well as potential responses to address these issues, as set out in Table 7-41.

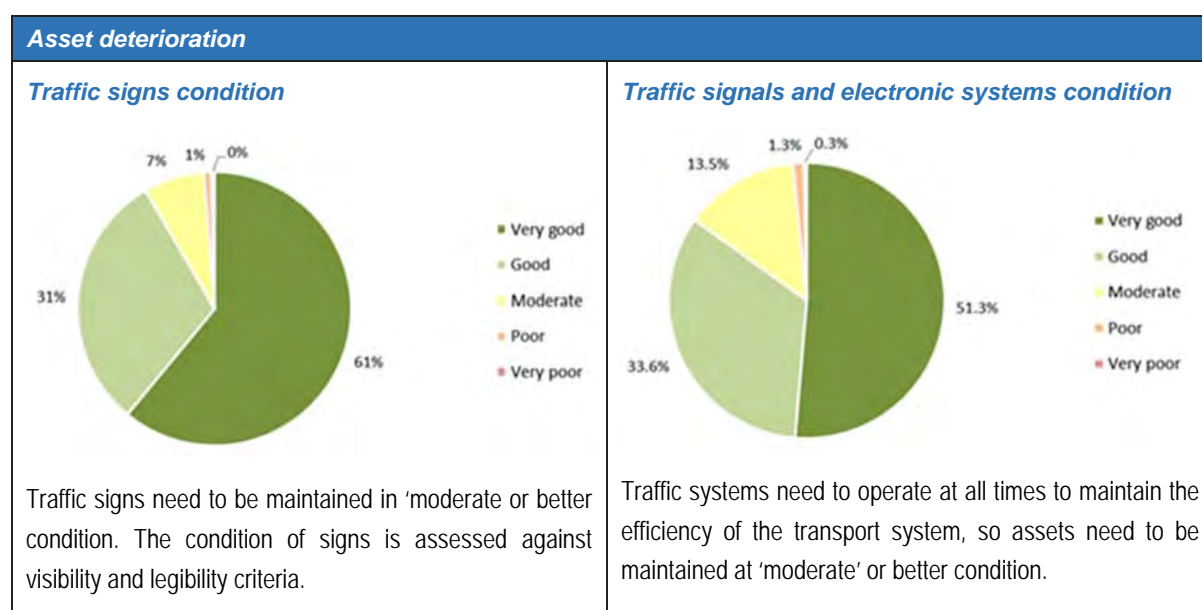
Table 7-41: Root cause analysis – potential responses for traffic systems

Root cause analysis	Potential responses
Asset deterioration	Inspect, maintain and replace traffic system components to achieve high levels of reliability.
Asset deterioration	Conduct regular inspections, audits and deficiency reviews of traffic signs including visibility and reflectivity testing.
Asset deterioration	Match the remarking frequency for road markings to the One Network road classification.
Asset deterioration	Monitor materials technology to improve the products used.
Asset deterioration	Continue signs cleaning, maintenance and replacement programmes.
Safety	Install safety initiatives such as providing islands, refuges, barriers, lighting, pedestrian priority, etc.
Safety	Review the appropriateness of existing intersection controls at poorly performing sites, e.g. give way and stop signs, roundabouts, traffic signals.
Growth and demand	Expand on the One Network approach demonstrated by the Auckland Traffic Operations Centre.
Growth and demand	Install targeted intersection improvements for priority road users, as identified in the Network Operating Plan.
Growth and demand	Expand capacity at Traffic Operations Centre to enable further optimisation of traffic signals for enhanced network performance.

7.7.2 Traffic systems – evidence of issues

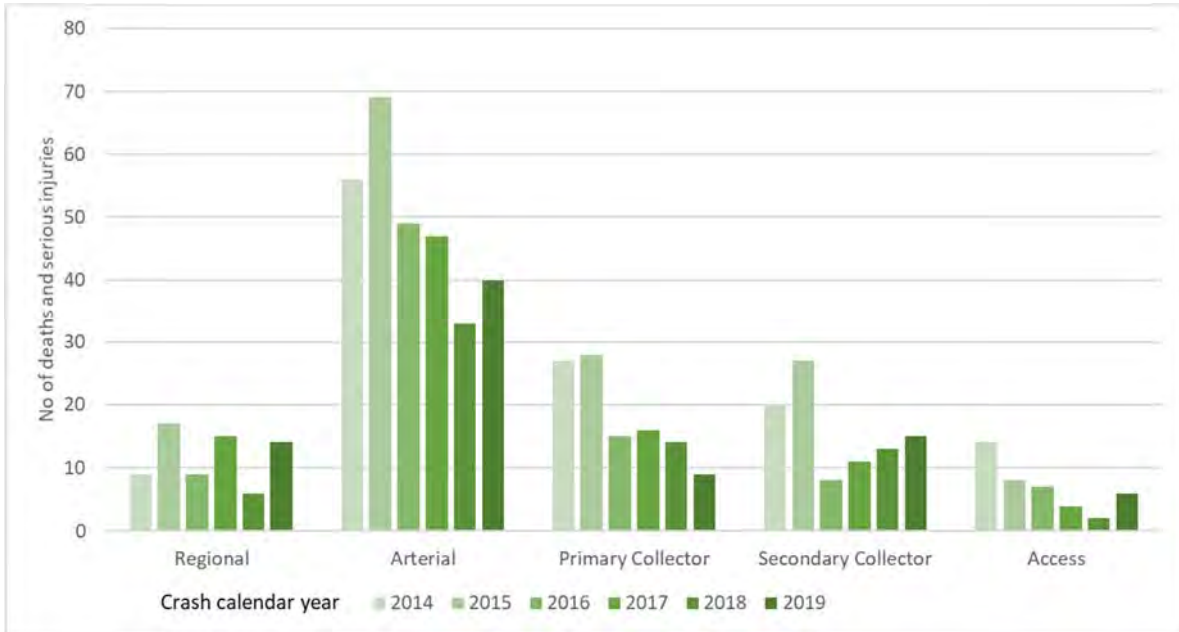
Traffic signals, signs and markings deteriorate quickly, but AT appears to be keeping up with deterioration, and the condition of our signs and traffic signal components is generally good.

The current issues relating to our traffic systems assets are summarised in Figure 7-42.



Road safety

Deaths and serious injuries where traffic signals or signs not being present was a contributing factor



Traffic signals can save lives as well as improving traffic flow, and there is significant potential to enhance road safety by providing more signals. AT’s programme of signalling and raising mid-block crossings, and addressing high-risk intersections on busy (regional, arterial and primary collector) roads is reducing road trauma.

Growth and demand

Investments in traffic systems are one of the few actions that AT can take in order to improve traffic flow. Traffic flow is the aspect of our transport network with the lowest customer satisfaction.

An example is the Whangaparaoa dynamic lanes project. Using signs, markings and electronic equipment the three lane road has two lanes inbound each morning, and two lanes outbound each evening. This enables more people and goods to travel within the existing road space.

Whangaparaoa dynamic lanes



Auckland Traffic Operations Centre

Investment in traffic system assets is only part of the story of how traffic flow and safety can be improved. Operational activities, including network optimisation and traffic signal management, are also needed to deliver the benefits of traffic systems.

The Auckland Traffic Operations Centre synchronises traffic signals to optimise safety and traffic flow across both local AT roads and the NZTA motorway network. The centre also



Figure 7-42: Traffic systems – evidence of issues

7.7.3 Traffic systems options analysis

AT used a multi-criteria analysis to rank the options identified in the root cause analysis in order of preference or importance. The analysis has been done in two parts.

For traffic signals and systems, the preferred options are shown in Table 7-42:

1. Maintenance and renewal – reliability engineering. Maintain and replace components to achieve high levels of reliability.
2. Introduce an intensive condition and performance monitoring regime.
3. Investigate new and emerging technologies for electronic systems to better optimise transport system operational efficiency.

For signs and markings, the preferred options are shown in Table 7-43:

1. Improve levels of service across the network by providing more signs, markings etc to address safety issues.
2. Manage demand – increase programmes to allow additional growth-related assets to be managed
3. Technology – investigate new materials to improve the performance of signs and markings
4. One Network road classification variance – improve levels of service on higher volume roads, and reduce levels of service on lower volume roads, for example, the standard of markings.

Table 7-42: Multi-criteria analysis of options for managing traffic signals and systems

Option - Can we make	Yes/No	Rank	Reason				
<input type="checkbox"/> Intervention response timing change							
<input type="checkbox"/> LoS adjustments							
<input type="checkbox"/> Use existing assets differently							
<input type="checkbox"/> Blending Work Categories differently							
<input type="checkbox"/> Risk - Hold Assets longer							
<input type="checkbox"/> Managing demand							
<input type="checkbox"/> Route Management							
<input type="checkbox"/> Alternative approaches – different solutions/technology	Yes	3	Investigate new and emerging technologies for electronic systems to better optimise transport system operational efficiency				
<input type="checkbox"/> Maintenance vs Renewal adjustments	Yes	1	Maintain and replace components to achieve high levels of reliability				
<input type="checkbox"/> ONRC Classification variance							
<input type="checkbox"/> Extended temporary management							
<input type="checkbox"/> Supply chain improvements							
<input type="checkbox"/> Improve systems and capability	Yes	2	Intensive condition and performance monitoring regime.				
Criteria	Weight	How good is this option					
		Option 8 - new technologies		Option 9 - reliability engineering		Option 13 - monitoring regime	
		Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	20%	1	0.2	3	0.6	1	0.2
Problem solving effectiveness	5%	3	0.15	3	0.15	2	0.1
Benefits realised	10%	1	0.1	3	0.3	2	0.2
Good Environmental impacts			0		0		0
Value for Money	10%	2	0.2	2	0.2	3	0.3
Closing Customer and Technical LoS gaps and impacts	5%	0	0	3	0.15	3	0.15
Closing ONRC Performance gaps	10%	0	0	3	0.3	3	0.3
Asset preservation and sustainability	10%	1	0.1	2	0.2	2	0.2
Total Cost of Ownership (whole of life Costs)	20%	2	0.4	2	0.4	3	0.6
Life Cycle Management	10%	1	0.1	2	0.2	3	0.3
COVID-19 Recovery			0		0		0
Totals	100%		1.25		2.5		2.35

Table 7-43: Multi-criteria analysis of options for managing traffic signs and markings

Option - Can we make	Yes/No	Rank	Reason						
<input type="checkbox"/> Intervention response timing change									
<input type="checkbox"/> Level of service adjustments	Yes	1	Improve levels of service across the network by providing more signs, markings etc to address safety issues						
<input type="checkbox"/> Use existing assets differently									
<input type="checkbox"/> Blending Work Categories differently									
<input type="checkbox"/> Risk - Hold Assets longer									
<input type="checkbox"/> Managing demand	Yes	2=	Increase programmes to allow additional growth related assets to be managed						
<input type="checkbox"/> Route Management									
<input type="checkbox"/> Alternative approaches – different solutions/technology	Yes	2=	Investigate new materials to improve performance of signs and markings						
<input type="checkbox"/> Maintenance vs Renewal adjustments									
<input type="checkbox"/> ONRC Classification variance	Yes	4	Improve levels of service on higher volume roads, reduce levels of service on lower volume roads						
<input type="checkbox"/> Extended temporary management									
<input type="checkbox"/> Supply chain improvements									
<input type="checkbox"/> Improve systems and capability									
Criteria	Weight	How good is this option							
		Option 2 - Improve levels of service for safety reasons		Option 6 - increase programmes for growth		Option 8 - new materials		Option 10 - refocus levels of service w. ONRC	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	20%	3	0.6	3	0.6	1	0.2	1	0.2
Problem solving effectiveness	10%	3	0.3	3	0.3	2	0.2	1	0.1
Benefits realised			0		0		0		0
Good Environmental impacts			0		0		0		0
Value for Money	20%	3	0.6	2	0.4	3	0.6	3	0.6
Closing Customer and Technical LoS gaps and impacts			0		0		0		0
Closing ONRC Performance gaps	10%	2	0.2	0	0	1	0.1	2	0.2
Asset preservation and sustainability	10%	0	0	0	0	0	0	-1	-0.1
Total Cost of Ownership (whole of life Costs)	20%	-1	-0.2	-1	-0.2	1	0.2	0	0
Life Cycle Management	10%	0	0	2	0.2	0	0	-1	-0.1
COVID-19 Recovery			0		0		0		0
Totals	100%		1.5		1.3		1.3		0.9

7.7.4 Traffic systems – past investment

Past maintenance investment

Past expenditure on traffic systems maintenance is shown in Figure 7-43.

The most significant trend is an increase in the cost of road markings. Repainting standard road markings is an operational cost and needs to be done every 6 months on busy roads to maintain safety standards. Reinstating large areas of thermoplastic marking could be a renewal, but the expanded use of thermoplastic marking is increasing pressure on maintenance budgets also.

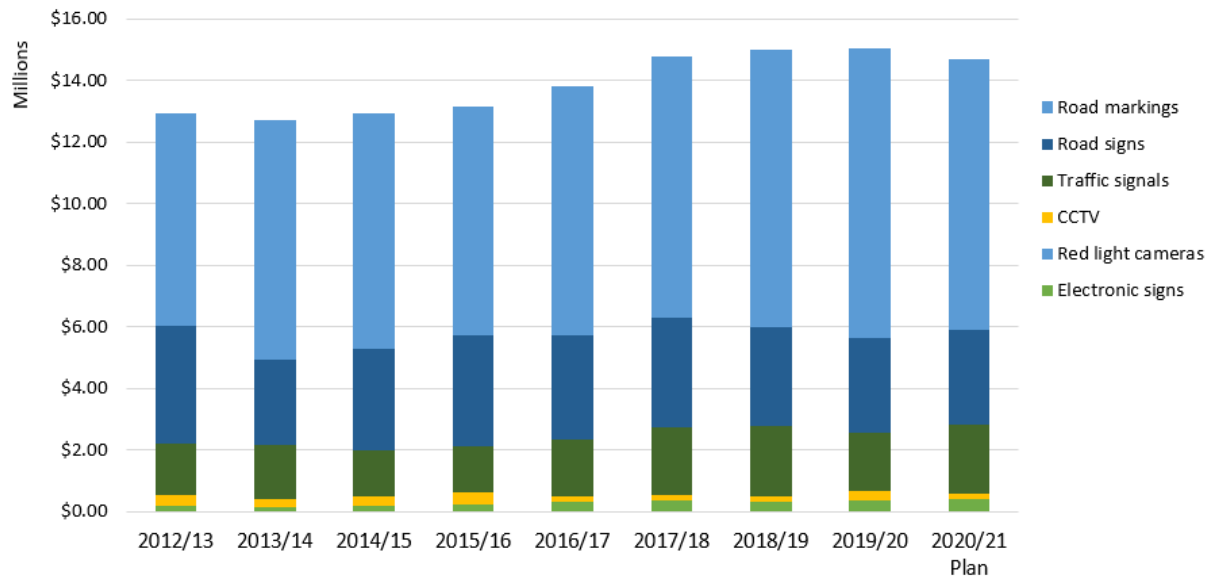


Figure 7-43: Traffic systems, signs and markings – past maintenance investment

Past operations investment

Operational budgets for traffic systems are shown in Figure 7-44. These costs relate to the operation of the Auckland Traffic Operations Centre, which monitors and controls traffic signals throughout the city to optimise traffic flows for different times of the day. AT partners with the NZTA in operating the centre, and leads the design of network performance initiatives to continuously improve the contribution that the centre makes to better traffic flow and a safer transport network.

The importance of this investment was emphasised in the 2018 Asset Management Plan, and budgets were increased to provide for more frequent review and optimisation of the network.

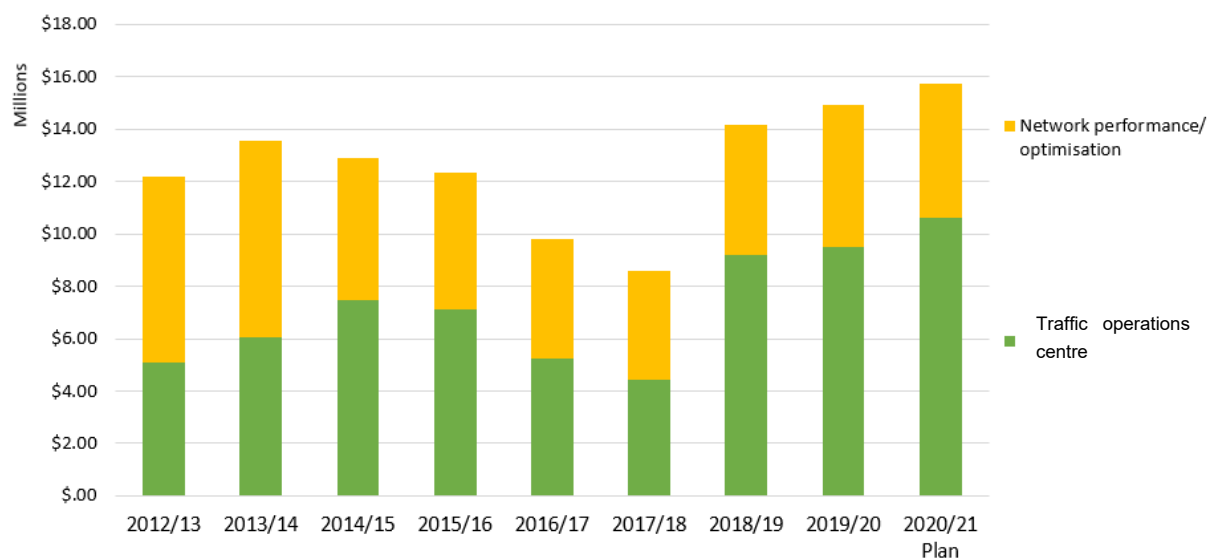


Figure 7-44: Traffic systems – past operations investment

Past renewals investment

Past renewals expenditure for traffic systems renewals is shown in Figure 7-45. The average renewals since 2012/2013 has been \$4.5 million per year, which is significantly less than the rate of depreciation (\$15.2 million per year).

This is partly a reflection of a new asset base, where relatively few assets have yet reached the end of their useful life. In some cases, the rate of technological change is so fast that assets become obsolete and are replaced as a capital improvement, rather than being renewed.

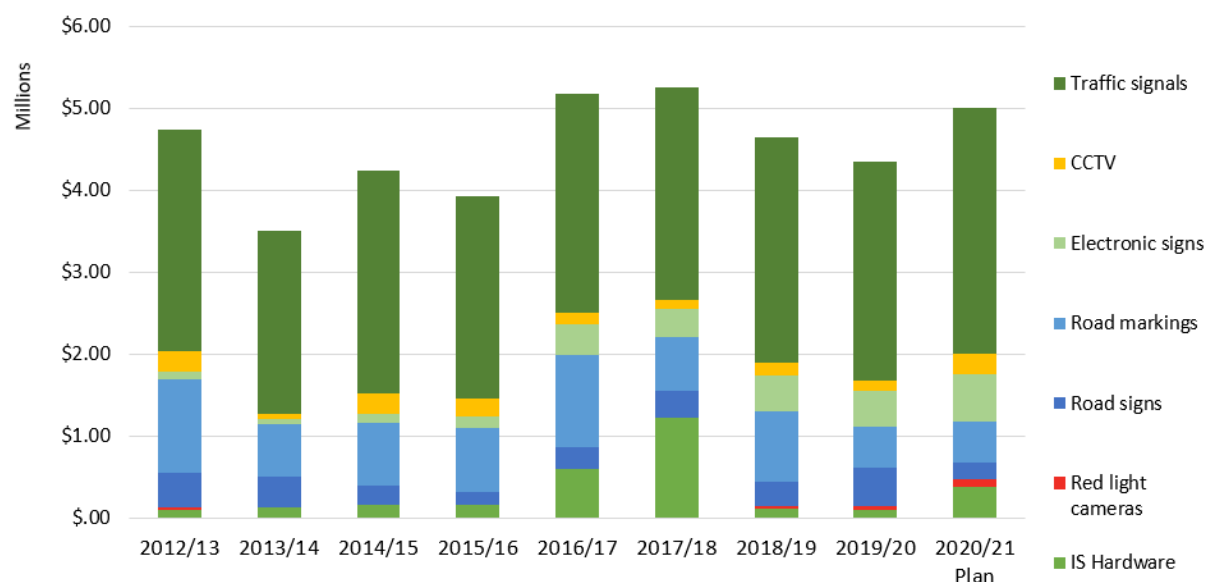


Figure 7-45: Traffic systems – past renewals investment

7.7.5 Traffic systems – recommended investment needs

AT has developed its recommended future investment needs for traffic systems based on the recommendations of the multi-criteria analysis.

Maintenance – recommended investment needs

Recommended investment needs for traffic systems maintenance are shown in Figure 7-46 and Table 7-44. As in past years, the majority of maintenance need is for road markings, followed by road signs.

This recommended level of maintenance investment will help achieve the preferred options from the multi-criteria analysis by:

- providing an increased maintenance budget for replacing traffic system components to achieve high levels of reliability
- increasing programmes in future years to allow additional growth-related assets to be managed

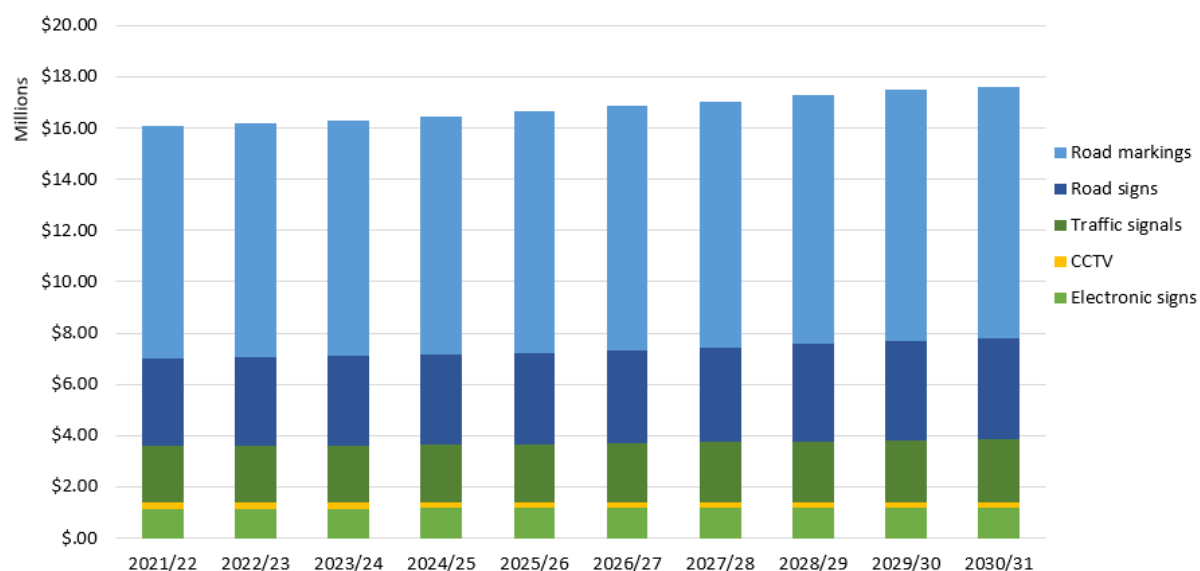


Figure 7-46: Traffic systems maintenance – recommended investment needs (uninflated)

Table 7-44: Traffic systems maintenance – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Road markings	\$9.1	\$9.1	\$9.2	\$9.3	\$9.4	\$9.5	\$9.6	\$9.7	\$9.8	\$9.8
Road signs	\$3.4	\$3.4	\$3.5	\$3.5	\$3.6	\$3.6	\$3.7	\$3.8	\$3.9	\$4.0
Traffic signals	\$2.2	\$2.2	\$2.2	\$2.3	\$2.3	\$2.3	\$2.3	\$2.4	\$2.4	\$2.4
CCTV	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2
Electronic signs	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2
Total	\$16.1	\$16.2	\$16.3	\$16.5	\$16.7	\$16.8	\$17.0	\$17.3	\$17.5	\$17.6

Operations – recommended investment needs

Recommended future budgets for traffic system operations are shown in Figure 7-47 and Table 7-45.

The recommended investment reflects the need for ongoing active management of traffic system assets, in order to deliver the benefits from network optimisation, dynamic lanes and other traffic management investments. It responds to the recommendations from the multi-criteria analysis by providing for:

- an intensive condition and performance monitoring regime
- ongoing optimisation of transport system operational efficiency, including the adoption of new and emerging technologies.

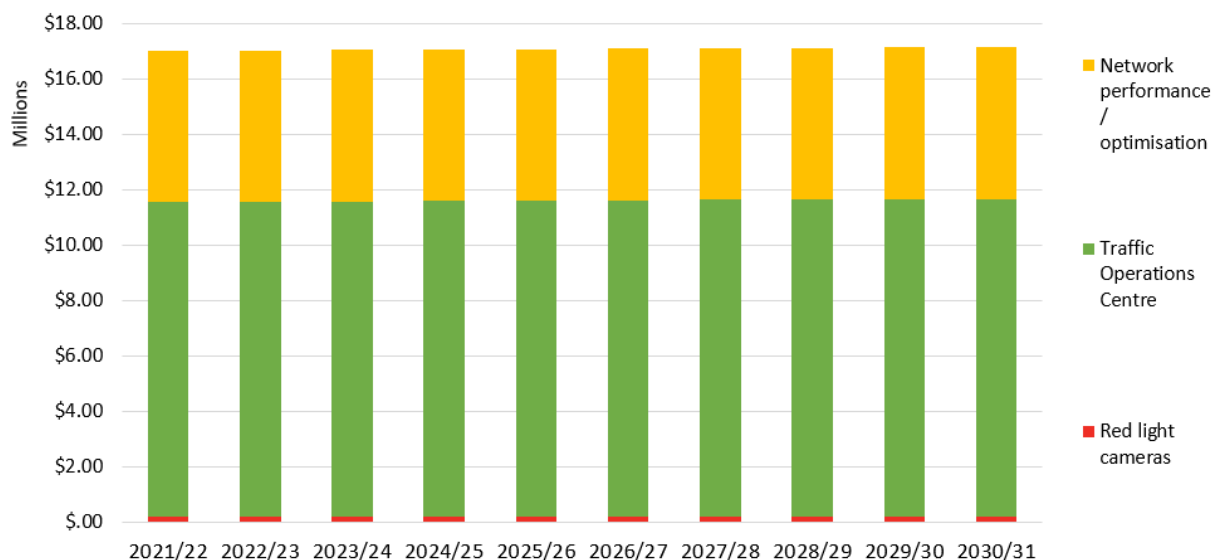


Figure 7-47: Traffic systems operations – recommended investment needs (uninflated)

Table 7-45: Traffic systems operations – recommended investment needs (uninflated)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Network performance/optimisation	\$5.5	\$5.5	\$5.5	\$5.5	\$5.5	\$5.5	\$5.5	\$5.5	\$5.5	\$5.5
Traffic Operations Centre	\$11.3	\$11.4	\$11.4	\$11.4	\$11.4	\$11.4	\$11.4	\$11.5	\$11.5	\$11.5
Red light cameras	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2
Total	\$17.0	\$17.0	\$17.0	\$17.1	\$17.1	\$17.1	\$17.1	\$17.1	\$17.1	\$17.1

Renewals – asset needs

The asset needs programme for traffic system renewals provides for the prompt replacement of traffic signals, signs, markings and other traffic system components that fall into poor or very poor condition.

This approach recognises the significant costs imposed on road users when traffic signals do not function properly, and supports the traffic flow and safety benefits from network optimisation.

The most significant change relative to past renewals is an accelerated programme for replacing CCTV cameras on the road network. New CCTV cameras perform a wider range of functions, including safety monitoring and counting traffic, pedestrians and other road users. The accelerated programme will also support more effective network optimisation, which considers all road users, not just vehicles.

The recommended renewals programme for traffic systems is set out in Figure 7-48 and Table 7-46. This level of investment will implement the following recommendation from the multi-criteria analysis:

- Investigate new and emerging technologies for electronic systems to better optimise transport system operational efficiency.

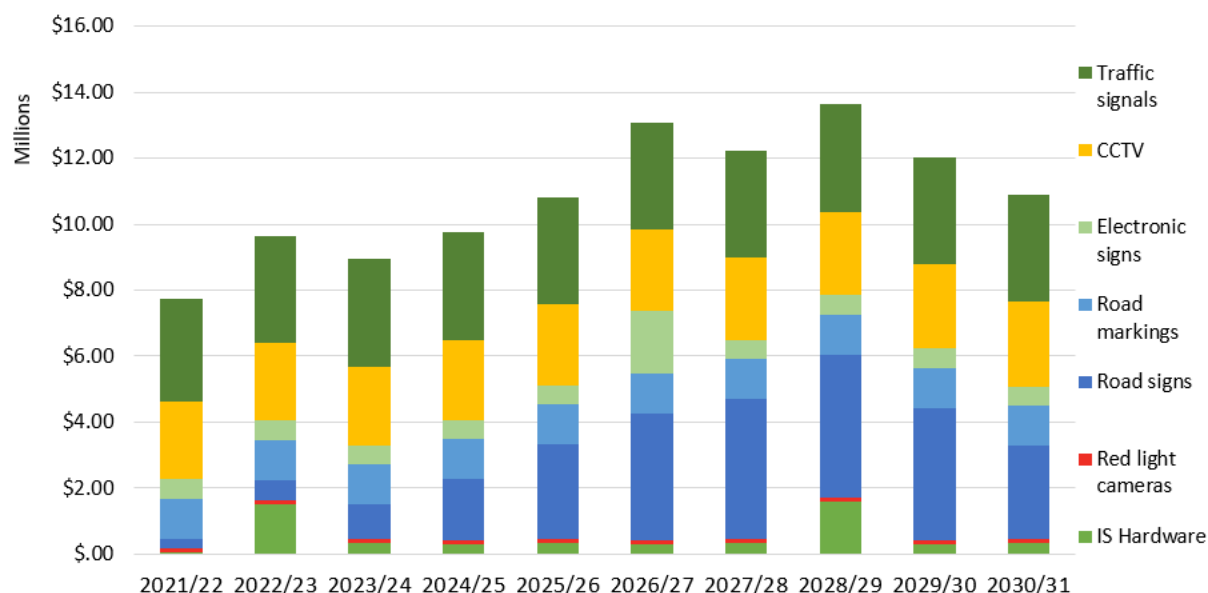


Figure 7-48: Traffic systems renewals – asset needs (uninflated)

Table 7-46: Traffic systems renewals – asset needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Traffic signals	\$3.1	\$3.2	\$3.2	\$3.3	\$3.3	\$3.3	\$3.3	\$3.3	\$3.3	\$3.3
CCTV - baseline	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3
Electronic signs	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$1.9	\$0.6	\$0.6	\$0.6	\$0.6
Road markings	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2	\$1.2
Road signs	\$0.3	\$0.6	\$1.0	\$1.9	\$2.9	\$3.9	\$4.2	\$4.3	\$4.0	\$2.8
Red light cameras	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1
Information systems hardware	\$0.1	\$1.5	\$0.3	\$0.3	\$0.4	\$0.3	\$0.3	\$1.6	\$0.3	\$0.3
Accelerated CCTV replacement	\$2.0	\$2.0	\$2.0	\$2.1	\$2.1	\$2.1	\$2.1	\$2.2	\$2.2	\$2.2
Total	\$7.7	\$9.6	\$8.9	\$9.7	\$10.8	\$13.1	\$12.2	\$13.6	\$12.0	\$10.9

7.7.6 Traffic systems – investment benefits

The performance indicators AT will use to measure the success of its investment in traffic systems are shown in Table 7-47.

Table 7-47: Traffic systems – performance indicators

Government investment benefits	Key performance indicators	Performance/service measure description	2019/2020	Target
Impact on social cost and incidents of crashes	Deaths and serious injuries are reduced	Deaths and serious injuries at intersections	186	0
Impact on system safety	Assets meet Vision Zero safety standards	Number of high-risk intersections and sections of road addressed by AT's safety programme	New measure	(blank)
	Hazards are eliminated or minimised	Number of red-light enforcement cameras		(blank)
Impact on perception of safety and security	Customers feel safe	Percentage of customers satisfied with overall road safety in the Auckland region	60%	
Impact on system reliability	Road assets are in acceptable condition	Percentage of traffic signs in acceptable condition	99.7%	95%
		Percentage of traffic systems in acceptable condition	99.9%	100%
Impact on user experience of the transport system	Customers are satisfied with assets	Percentage of customers satisfied with traffic flow in the Auckland region	22%	

7.8 Public transport assets

Prior to Covid-19, Auckland was experiencing a revival of public transport, led by infrastructure investment. The long term (50-year) trends for public transport patronage in Auckland are shown in Figure 7-49, and demonstrate that the last 25 years has shown steep growth for bus, rail and ferry.

The resurgence of rail began in 2003 with the opening of Britomart Station, and rail investments have continued to dominate the public transport capital programme. In 2018 there were over 20 million rail trips, almost all of which were on electric trains served by modern stations redeveloped since 2003.

Milestones for bus services include the opening of the Northern Busway stations in 2005 and the main Busway in 2008, the rollout of AT Hop cards to all bus services from 2014, and the Public Transport New Network which was fully implemented by late 2019.

Auckland now has a public transport network that provides more options and serves more journeys, which has been especially important in view of ongoing population growth and the lack of options to provide for more car travel. Good public transport has benefits not only for the customer directly, but for all users of the transport system through reduced congestion and improved safety. Public transport has important health and environmental benefits and makes more efficient use of limited road space.

The first six months of 2019/2020 continued the trend of growth in patronage but PT use in the 2019/2020 year was impacted directly by the first Covid-19 lockdown as well as indirectly by public concerns about the pandemic. During the first lockdown, the Auckland public transport network continued to provide travel options for essential workers. The PT network reopened in Level 3 with improved safety and sanitation practices, and by June 2020 had recovered to 65% of pre-Covid patronage – only to fall again in the second lockdown. In 2019/2020 there were 82.3 million public transport boardings, down from 100.8 million the previous year.

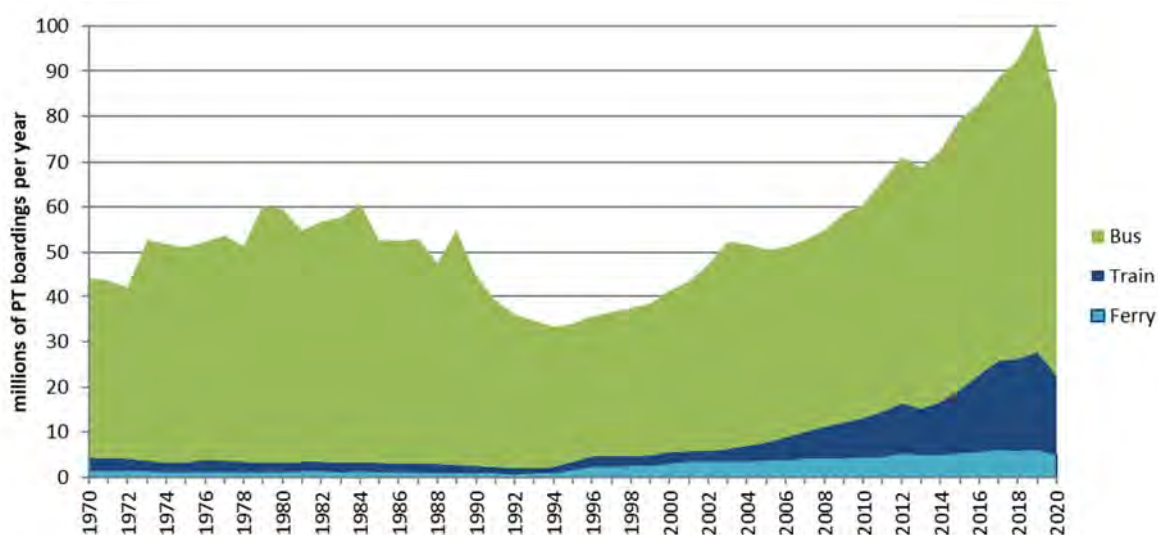


Figure 7-49: 50 years of public transport in Auckland

The long term future of public transport is a strategic issue and is being considered as part of the Auckland Transport Alignment Project. This AMP is based on current published plans and reflects the need to maintain and renew existing assets and to complete currently programmed improvements.

The current valuation of AT's public transport assets is shown in Table 7-48. With the exception of wharves, Auckland's public transport assets are still relatively new and the depreciated value is close to the replacement value.

Table 7-48: Public transport asset valuation

Asset	Replacement cost \$m	Depreciated value \$m	Annual depreciation \$m
Bus network	\$124.0	\$95.9	\$4.0
Rail stations and trains	\$1,364.8	\$1,091.3	\$60.6
Wharves	\$157.3	\$89.3	\$4.1
Total	\$1,646.1	\$1,276.5	\$68.7

7.8.1 Public transport assets – issues and potential responses

The root cause analysis in section 7 highlighted a range of issues and concerns relating to public transport, as well as potential responses to address these issues, as set out in Table 7-49.

Table 7-49: Root cause analysis – potential responses for public transport

Root cause analysis	Potential responses
Asset deterioration	Clean and maintain bus stations to a high level of service.
Asset deterioration	Replace busway station assets in poor or very poor condition.
Asset deterioration	Replace bus shelters in very poor condition.
Asset deterioration	Enhance bus shelter provision through partnerships that generate advertising revenue.
Asset deterioration	Replace/ upgrade Britomart plant and control rooms
Asset deterioration	Require CAF Ltd, the supplier of electric trains, to maintain train components in good or very good condition.
Asset deterioration	Prepare for hand-over of rolling stock maintenance to AT.
Asset deterioration	Carry out regular inspections and investigations for marine assets.
Asset deterioration	Replace wharves and ferry buildings in very poor condition or for public safety reasons.
Safety	Encourage more use of public transport as the safest mode.
Safety	AT's long-term strategy is to close or grade-separate all rail level crossings. Meanwhile, AT will continue to work with KiwiRail and other stakeholders to identify safety improvements, including security, visibility and warning devices.
Safety	Improve CCTV coverage and help points at public transport and parking facilities to improve personal safety.

7.8.2 Public transport – evidence of issues

Most public transport assets are in good or very good condition, consistent with their relatively recent construction. AT maintains its assets to a high level of service, as part of an overall customer experience intended to attract more people to use public transport.

The current issues affecting public transport assets are summarised in Figure 7-50.

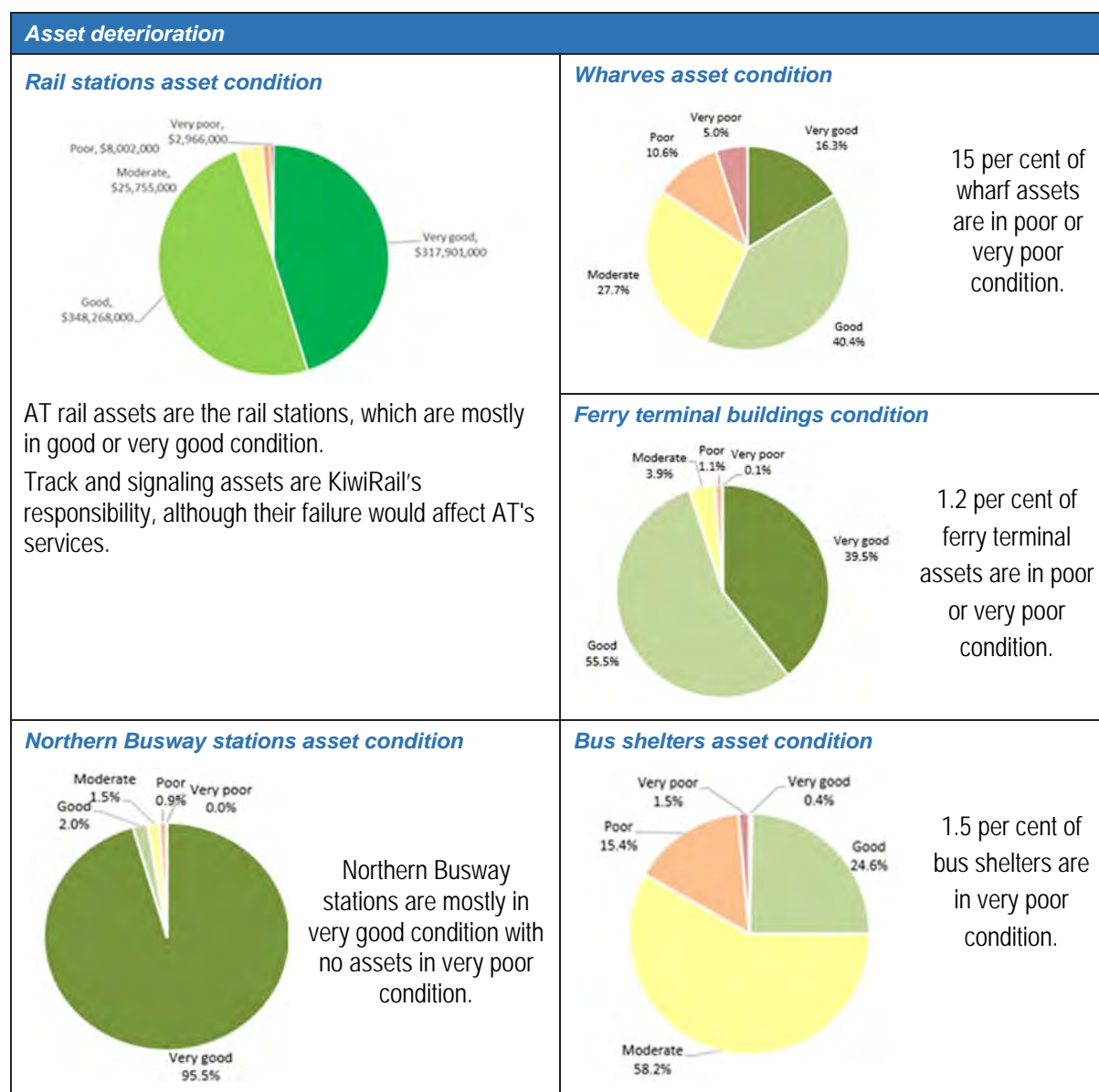


Figure 7-50: Public transport – evidence of issues

7.8.3 Public transport options analysis

AT used a multi-criteria analysis to rank the following options for public transport assets, in order of preference.

Bus

1. Renewal programmes – replace busway assets at condition grade 4 before they deteriorate further, with bus shelters replaced at grade 5.
2. Level of service – introduce enhanced cleaning programmes at bus stations and shelters to maintain visual amenity.
3. Intervention – delay the replacement of all assets until condition grade 5, as this has the effect of reducing funding demand.

Options 1 and 2 are preferred and incorporated in the recommended budgets. Option 3, while it reduces funding need, is negative in terms of community outcomes and service levels, and would be expected to reduce customer satisfaction levels.

Rail

1. Renewal programmes – replace Britomart assets currently at condition grade 4 or 5 or in conjunction with the City Rail Link project.
2. Supply chain – monitor the results of condition inspections carried out by the rolling stock supplier until AT takes responsibility in 2026, and ensure condition grade 1 or 2 are being achieved.
3. Level of service – introduce enhanced cleaning programmes at train stations to maintain visual amenity.
4. Intervention – delay the replacement of all assets until condition grade 5, as this has the effect of reducing funding demand.

Options 1, 2 and 3 are preferred and are incorporated in the recommended budgets. Option 4, while it reduces funding need, is negative in terms of community outcomes and service levels, and would be expected to reduce customer satisfaction levels with consequential impacts on patronage.

Ferry

1. Renewal programmes – increase programme for wharves to address existing deterioration, recognising the marine environment and risks of accelerated deterioration of structural components.
2. Level of service – introduce enhanced cleaning programmes at ferry terminals to maintain visual amenity.
3. Intervention – delay the replacement of ferry building assets until they reach condition grade 5.

Options 1 and 2 are preferred and incorporated in the recommended budgets. Option 3, while it reduces funding need, is negative in terms of community outcomes and service levels, and would be expected to reduce customer satisfaction levels.

Table 7-50: Multi-criteria analysis of options for managing public transport assets – bus

Option - Can we make	Yes/No	Rank	Reason						
<input type="checkbox"/> Intervention response timing change	Yes	3	Delay intervention for all assets until CG 5 - reduces funding demand						
<input type="checkbox"/> Level of service adjustments	Yes	2	Enhanced cleaning programmes to maintain or improve visual amenity						
<input type="checkbox"/> Use existing assets differently									
<input type="checkbox"/> Blending Work Categories differently									
<input type="checkbox"/> Risk - Hold Assets longer									
<input type="checkbox"/> Managing demand									
<input type="checkbox"/> Route Management									
<input type="checkbox"/> Alternative approaches – different solutions/technology									
<input type="checkbox"/> Maintenance vs Renewal adjustments	Yes	1	Replace busway assets at CG 4 before they deteriorate further, with bus shelters replaced at CG 5.						
<input type="checkbox"/> ONRC Classification variance									
<input type="checkbox"/> Extended temporary management									
<input type="checkbox"/> Supply chain improvements									
<input type="checkbox"/> Improve systems and capability									
Criteria	Weight	How good is this option							
		Option 1 - delay renewal		Option 2 - more cleaning		Option 9 - early intervention			
		Raw	Score	Raw	Score	Raw	Score		
Community Outcomes Achieved	20%	-1	-0.2	2	0.4	2	0.4		
Problem solving effectiveness	5%	1	0.05	2	0.1	2	0.1		
Benefits realised			0		0		0		
Good Environmental impacts			0		0		0		
Value for Money	20%	2	0.4	0	0	1	0.2		
Closing Customer and Technical LoS gaps and impacts	10%	-2	-0.2	3	0.3	2	0.2		
Closing ONRC Performance gaps			0		0		0		
Asset preservation and sustainability	10%	-1	-0.1	0	0	2	0.2		
Total Cost of Ownership (whole of life Costs)	20%	1	0.2	0	0	1	0.2		
Life Cycle Management	10%	-1	-0.1	0	0	3	0.3		
COVID-19 Recovery	5%	0	0	1	0.05	1	0.05		
Totals	100%		0.05		0.85		1.65		

Table 7-51: Multi-criteria analysis of options for managing public transport assets – rail

Option - Can we make	Yes/No	Rank	Reason							
<input type="checkbox"/> Intervention response timing change	Yes	4	Delay replacement programme for plant and control room assets - reduces funding demand							
<input type="checkbox"/> Level of service adjustments	Yes	3	Enhanced cleaning programmes at train stations to maintain visual amenity							
<input type="checkbox"/> Use existing assets differently										
<input type="checkbox"/> Blending Work Categories differently										
<input type="checkbox"/> Risk - Hold Assets longer										
<input type="checkbox"/> Managing demand										
<input type="checkbox"/> Route Management										
<input type="checkbox"/> Alternative approaches – different solutions/technology										
<input type="checkbox"/> Maintenance vs Renewal adjustments	Yes	1	Replace Britomart assets at CG 4 or CG 5 or in conjunction with City Rail Link							
<input type="checkbox"/> ONRC Classification variance										
<input type="checkbox"/> Extended temporary management										
<input type="checkbox"/> Supply chain improvements	Yes	2	Monitor results of condition inspections carried out by rolling stock supplier until AT takes responsibility in 2026 - ensure CG 1 or CG 2 achieved.							
<input type="checkbox"/> Improve systems and capability										
Criteria	Weight	How good is this option								
		Option 1 - delay intervention		Option 2 - more cleaning		Option 9 - Britomart renewals		Option 12 - monitor rolling stock		
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	
Community Outcomes Achieved	20%	-1	-0.2	2	0.4	2	0.4	1	0.2	
Problem solving effectiveness	5%	1	0.05	2	0.1	3	0.15	1	0.05	
Benefits realised			0		0		0		0	
Good Environmental impacts			0		0		0		0	
Value for Money	20%	2	0.4	0	0	2	0.4	3	0.6	
Closing Customer and Technical LoS gaps and impacts	10%	-2	-0.2	3	0.3	3	0.3	1	0.1	
Closing ONRC Performance gaps			0		0		0		0	
Asset preservation and sustainability	10%	-1	-0.1	0	0	2	0.2	2	0.2	
Total Cost of Ownership (whole of life Costs)	20%	1	0.2	0	0	1	0.2	0	0	
Life Cycle Management	10%	-1	-0.1	0	0	3	0.3	1	0.1	
COVID-19 Recovery	5%	0	0	1	0.05	1	0.05	0	0	
Totals	100%		0.05		0.85		2		1.25	

Table 7-52: Multi-criteria analysis of options for managing public transport assets – wharves

Option - Can we make	Yes/No	Rank	Reason						
<input type="checkbox"/> Intervention response timing change	Yes	3	Delay the replacement of ferry buildings until they reach CG 5						
<input type="checkbox"/> Level of service adjustments	Yes	2	Enhanced cleaning programmes at ferry terminals to maintain visual amenity						
<input type="checkbox"/> Use existing assets differently									
<input type="checkbox"/> Blending Work Categories differently									
<input type="checkbox"/> Risk - Hold Assets longer									
<input type="checkbox"/> Managing demand									
<input type="checkbox"/> Route Management									
<input type="checkbox"/> Alternative approaches – different solutions/technology									
<input type="checkbox"/> Maintenance vs Renewal adjustments	Yes	1	Increase renewal programme for wharves to address existing deterioration - note marine risk						
<input type="checkbox"/> ONRC Classification variance									
<input type="checkbox"/> Extended temporary management									
<input type="checkbox"/> Supply chain improvements									
<input type="checkbox"/> Improve systems and capability									
Criteria	Weight	How good is this option							
		Option 1 - delay intervention for buildings		Option 2 - more cleaning		Option 9 - increase wharves renewals			
		Raw	Score	Raw	Score	Raw	Score		
Community Outcomes Achieved	20%	-1	-0.2	2	0.4	3	0.6		
Problem solving effectiveness	5%	1	0.05	2	0.1	3	0.15		
Benefits realised			0		0		0		
Good Environmental impacts			0		0		0		
Value for Money	20%	2	0.4	0	0	2	0.4		
Closing Customer and Technical LoS gaps and impacts	10%	-2	-0.2	3	0.3	3	0.3		
Closing ONRC Performance gaps			0		0		0		
Asset preservation and sustainability	10%	-1	-0.1	0	0	2	0.2		
Total Cost of Ownership (whole of life Costs)	20%	0	0	0	0	1	0.2		
Life Cycle Management	10%	-1	-0.1	0	0	3	0.3		
COVID-19 Recovery	5%	0	0	1	0.05	1	0.05		
Totals	100%		-0.15		0.85		2.2		

7.8.4 Public transport – past investment

Past maintenance investment

The majority of AT’s investment in maintenance for public transport assets relates to maintaining rail stations, bus stations and wharves.

Until 2018, maintenance of bus, rail and ferry stations was not always budgeted separately from operation of these facilities. This makes the increase in past maintenance expenditure, shown in Figure 7-51, look steeper than it is, as expenditure before 2018 will be under-stated.

In future years, maintenance expenditure will inevitably increase as Auckland’s main public transport facilities become older, and as new facilities including the redeveloped Puhinui Station and the new Rosedale bus station are added to the network.

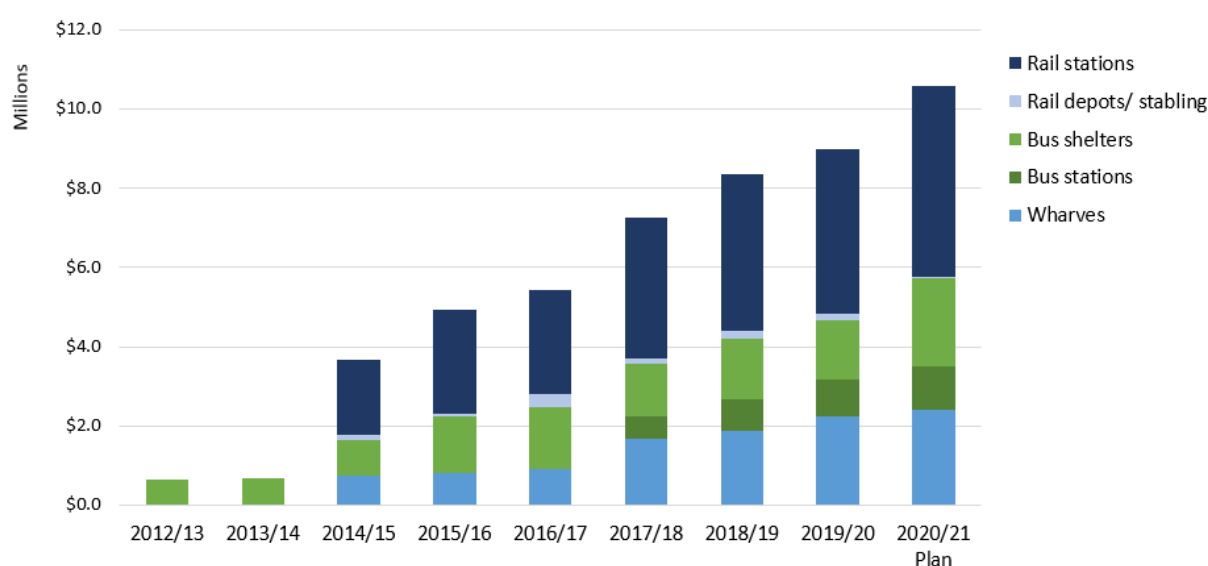


Figure 7-51: Public transport – past maintenance investment

Past operations investment

AT’s past investment in operations for public transport assets is summarised in Figure 7-52.

Past trends in operational expenditure for public transport are complex, reflecting the rapid pace of change in the public transport network since 2012/2013.

The following key events had a significant impact on operations investment.

- The AT HOP card was launched in October 2012 for use on trains from 27 October 2012, ferries in November 2012, and buses in 2013. Currently over 90 per cent of public transport trips in Auckland are paid for with AT Hop. The cost of operating the system is around \$20 million per year.
- AT took responsibility for the Harbourmaster function from Auckland Council on 1 July 2015.

- AT’s ageing fleet of diesel trains was replaced in 2015 with 57 electrical multiple units, which run on all lines except the Papakura to Pukekohe service. In 2020/2021, a further 15 electric trains are coming into service.
- Operational costs of bus and rail stations and of ferry wharves and ferry terminals include cleaning, staff costs and security. These costs increase when new stations are added to the network.

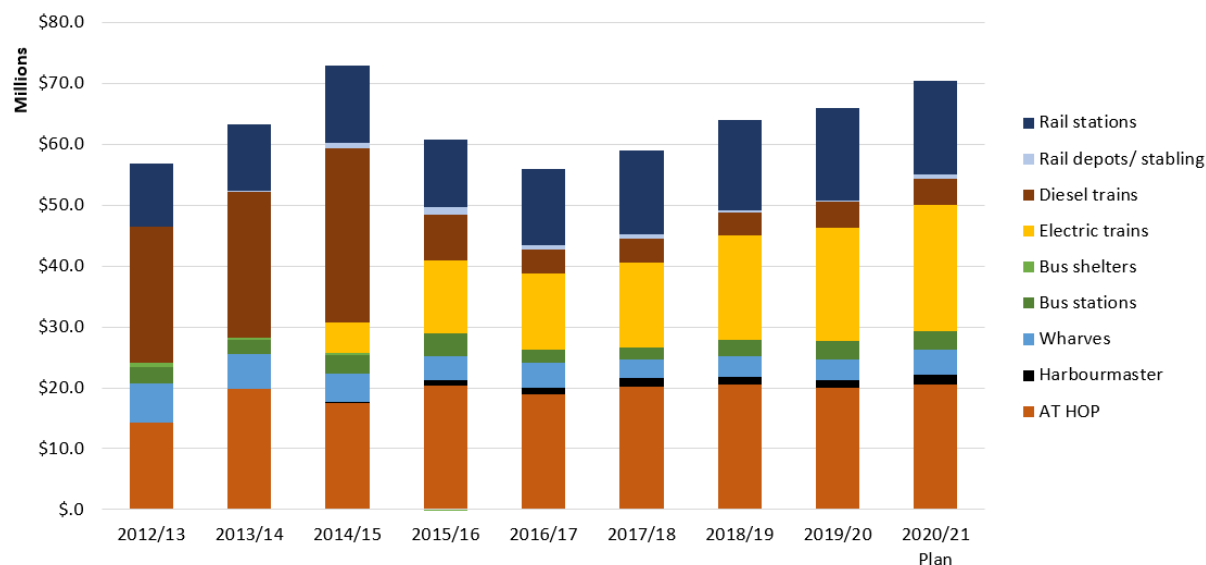


Figure 7-52: Public transport – past operations investment

Past renewals investment

AT’s past investment in renewals for public transport assets are summarised in Figure 7-52.

Past trends in renewals expenditure for public transport are also affected by changes in the public transport network since 2012/2013: some of the most significant are described below.

- Diesel train renewals were a significant component of total renewals in 2012/2013 and 2013/2014, the last full years of operation of the diesel service. Renewal of the 10 diesel trains serving the Papakura to Pukekohe service are becoming significant again in 2020/2021.
- Renewals of wharves were only a minor component of total renewals from 2012/2013 to 2016/2017, but have been the largest item in the renewals budget since 2017/2018. AT is currently addressing a significant backlog of wharf assets in poor or very poor condition, and this need continues into the future.
- Rail and bus stations have not required a high level of renewals in the past, because most assets have been constructed since the opening of Britomart in 2003 and are still relatively new. This will not be the case in future years, especially for mechanical and electrical components of stations, including lifts, automatic doors, and heating or air conditioning systems.

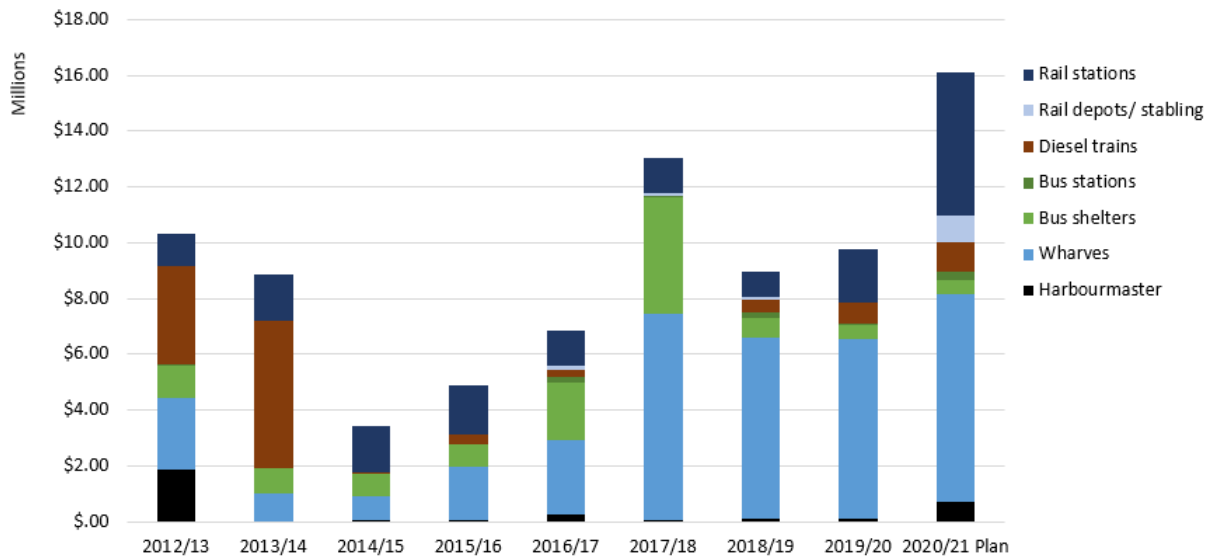


Figure 7-53: Public transport – past renewals investment

7.8.5 Public transport – recommended investment needs

Maintenance – recommended investment needs

Recommended maintenance needs for public transport assets are shown in Figure 7-54 and Table 7-53. Most of these costs relate to the maintenance of buildings, including rail stations, bus stations and ferry terminals. Maintenance costs are forecast to increase over time for bus and rail stations due to new stations being added the network, and as existing assets get older and require more maintenance.

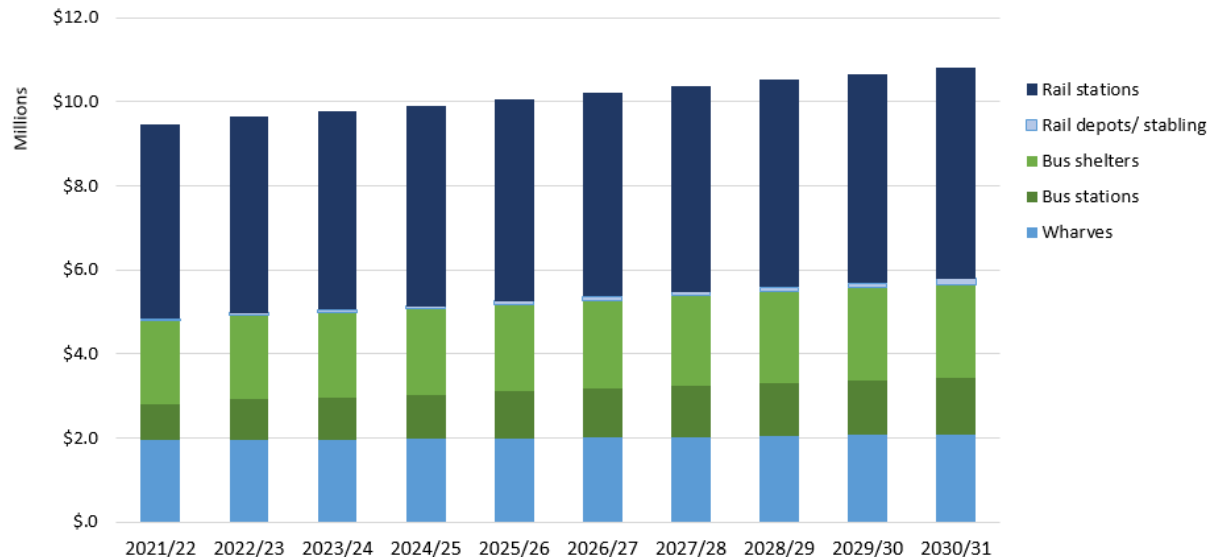


Figure 7-54: Public transport maintenance – recommended investment needs (uninflated)

Table 7-53: Public transport maintenance – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Rail stations	\$4.6	\$4.7	\$4.7	\$4.8	\$4.8	\$4.8	\$4.9	\$4.9	\$5.0	\$5.0
Rail depots/stabling	\$0.0	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1
Bus stations	\$0.9	\$1.0	\$1.0	\$1.1	\$1.1	\$1.2	\$1.2	\$1.3	\$1.3	\$1.3
Bus shelters	\$2.0	\$2.0	\$2.0	\$2.0	\$2.1	\$2.1	\$2.1	\$2.2	\$2.2	\$2.2
Wharves	\$1.9	\$1.9	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$2.0	\$2.1	\$2.1
Total	\$9.5	\$9.7	\$9.8	\$9.9	\$10.1	\$10.2	\$10.4	\$10.5	\$10.7	\$10.8

Recommended future budgets do not include maintenance costs for City Rail Link stations, but do include ongoing maintenance (based on past maintenance costs) for Britomart station.

The public transport asset options analysis process did not recommend any changes to maintenance activities. The recommended budgets are therefore aimed at continuing to deliver the current level of service.

Operations – recommended investment needs

Recommended operations investment for existing public transport assets is shown in Figure 7-55 and Table 7-54.

There is a one-off drop in 2025/2026, reflecting the planned withdrawal of diesel trains from operations, based on the estimated completion date of the KiwiRail project to electrify the rail line from Papakura to Pukekohe.

The largest single operational cost in all years is the cost of electric trains. This reflects the way that these trains are funded, with regular payments made to the supplier (CAF) under a build, operate and maintain contract. Under the contract, CAF is responsible for maintaining and operating these trains, and for the intermediate overhauls, which begin to fall due in 2021. As a result, the operational costs shown for electric trains also covers maintenance and an element of renewals.

AT will be responsible for asset management of the first tranche of 57 electric multiple units from 2026. Over the next 3 years, AT will need to become progressively more involved in the train's management, including condition inspections, to prepare for this handover.

Electric train costs increase in 2026/2027, the estimated arrival date of the next tranche of rains, which will expand the fleet from 72 to 94 electric multiple units. The timing and size of this purchase are not yet confirmed and will need to align with key Regional Land Transport Plan decisions.

The recommended investment does not provide for any of the operational costs of the new City Rail Link stations.

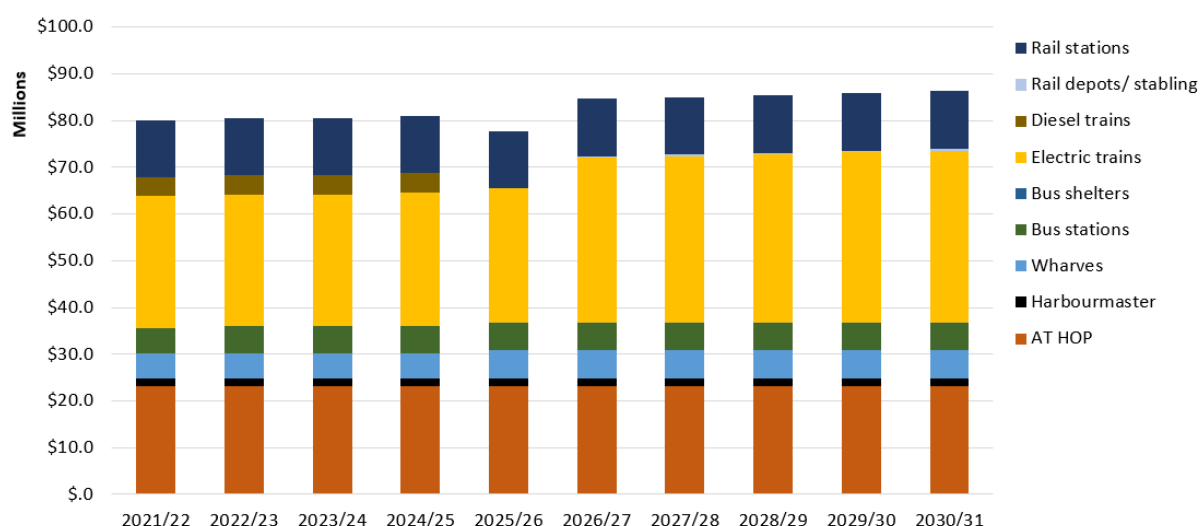


Figure 7-55: Public transport operations – recommended investment needs (uninflated)

Table 7-54: Public transport operations – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Rail stations	\$12.1	\$12.2	\$12.2	\$12.2	\$12.2	\$12.2	\$12.3	\$12.3	\$12.3	\$12.3
Rail depots/stabling	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3
Electric trains	\$28.1	\$28.1	\$28.1	\$28.4	\$28.7	\$35.3	\$35.6	\$36.0	\$36.4	\$36.8
Diesel trains	\$4.2	\$4.2	\$4.2	\$4.2	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Bus stations	\$5.4	\$5.8	\$5.8	\$5.8	\$5.8	\$5.8	\$5.8	\$5.8	\$5.8	\$5.8
Bus shelters	\$0.0	\$0.0	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.2	\$0.2	\$0.2
Wharves	\$5.6	\$5.6	\$5.6	\$5.6	\$6.1	\$6.1	\$6.1	\$6.1	\$6.1	\$6.1
Harbourmaster	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5	\$1.5
AT HOP	\$23.2	\$23.2	\$23.2	\$23.2	\$23.2	\$23.2	\$23.2	\$23.2	\$23.2	\$23.2
Total	\$80.0	\$80.5	\$80.6	\$80.9	\$77.6	\$84.6	\$85.0	\$85.4	\$85.8	\$86.2

The public transport options analysis process has not recommended any significant changes to public transport operations, but does emphasise the need for regular cleaning programmes at bus, rail and ferry facilities to maintain visual amenity.

Renewals – recommended investment needs

Recommended renewals needs for public transport assets are shown in [Figure 7-56](#) and [Table 7-55](#).

The steep increase in renewals in the first 3 years mirrors the large step up in public transport (especially rail) construction 20 years earlier, as well as an ongoing backlog in wharf renewals.

Rail station renewals increases in 2022/2023 and 2023/2024 to provide for works to be done that would be more difficult once the City Rail Link opens. Any works that require rail tracks to be closed would be better scheduled in these years, to avoid delays and disruptions in the early years of the City Rail Link.

From 2024/2025, AT’s contract with CRL for the maintenance and renewal of the original fleet of 57 electric multiple units ends, and AT must pick up these costs. This includes the cost of a major refurbishment of each train, to be scheduled in the years 2024/2025, 2025/2026 and 2026/2027.

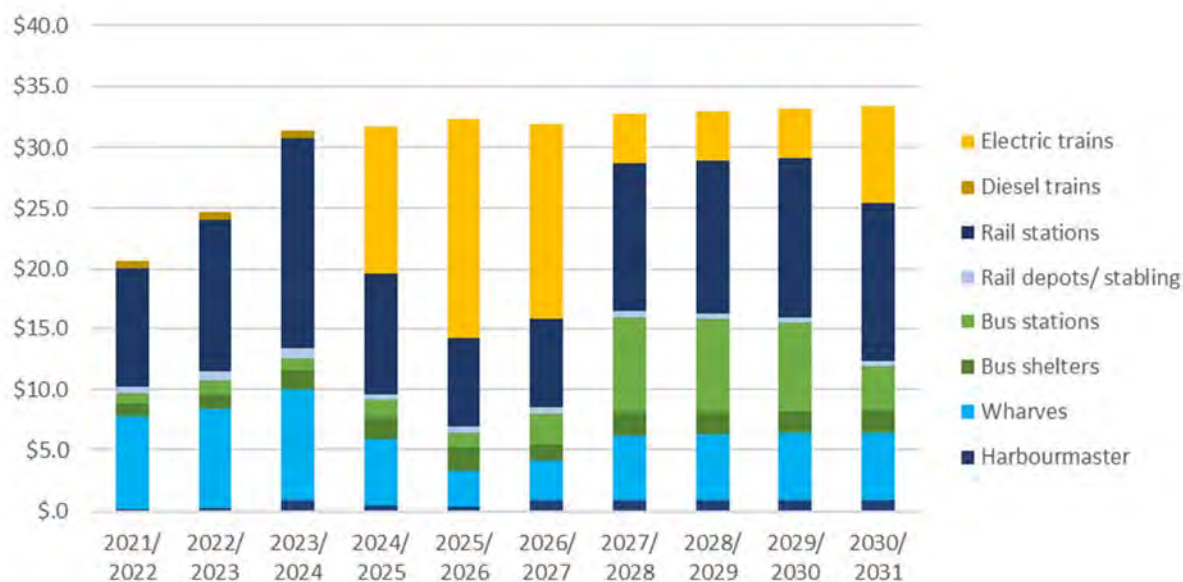


Figure 7-56: Public transport renewals – asset needs (uninflated)

Table 7-55: Public transport renewals – asset needs (uninflated)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Bus shelters	\$1.1	\$1.1	\$1.7	\$1.8	\$1.8	\$1.3	\$1.8	\$1.8	\$1.9	\$1.9
Bus stations	\$0.8	\$1.2	\$0.9	\$1.5	\$1.3	\$2.5	\$7.9	\$7.6	\$7.3	\$3.6
Total bus	\$1.9	\$2.3	\$2.6	\$3.3	\$3.1	\$3.8	\$9.7	\$9.5	\$9.1	\$5.5
Diesel trains	\$0.6	\$0.6	\$0.6	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Electric trains	\$0.0	\$0.0	\$0.0	\$12.0	\$18.0	\$16.0	\$4.0	\$4.0	\$4.0	\$8.0
Rail depots/ stabling	\$0.6	\$0.8	\$0.8	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5
Rail stations	\$9.8	\$12.6	\$17.3	\$10.1	\$7.3	\$7.4	\$12.3	\$12.7	\$13.2	\$13.1
Total rail	\$11.0	\$14.0	\$18.8	\$22.5	\$25.8	\$23.9	\$16.8	\$17.2	\$17.7	\$21.5
Harbourmaster	\$0.2	\$0.2	\$0.9	\$0.5	\$0.4	\$0.9	\$0.9	\$0.9	\$0.9	\$0.9
Wharves	\$7.6	\$8.2	\$9.1	\$5.3	\$3.0	\$3.3	\$5.4	\$5.4	\$5.5	\$5.5
Total ferry	\$7.8	\$8.4	\$10.0	\$5.8	\$3.4	\$4.2	\$6.2	\$6.3	\$6.4	\$6.4
Total public transport renewals	\$20.7	\$24.7	\$31.3	\$31.7	\$32.3	\$31.9	\$32.7	\$33.0	\$33.2	\$33.4

7.9 Parking and airfields

This section of the AMP is limited to providing the valuation and funding details for airfields and off-street parking, in order to arrive at a complete picture of AT's finances.

Information relating to the other parking assets that AT manages has been included in other sections:

- on-street parking areas form part of the sealed road asset class
- parking signs and markings form part of the traffic signals, signs and markings asset class
- park-and-ride assets at public transport interchanges form part of the relevant public transport asset class (bus, rail or wharves).

7.9.1 Airfields and off-street parking

AT's roles and responsibilities for airfields and off-street parking assets are different from the other transport assets it manages. Section 37 of the Local Government (Auckland Council) Act 2009 states that:

- AT is responsible for managing on-street parking
- AT is responsible for park-and-rides
- Auckland Council is responsible for council-owned off-street parking.

Airfields are also specifically excluded from AT's responsibilities, as they are not part of the land transport network. Auckland Council controls two airfields, at Claris and Okiwi on Great Barrier Island.

The Act also enables Auckland Council to delegate activities to AT, and the council has subsequently delegated the control and management of council-owned off-street parking and the two airfields to AT. Where the operation of these assets generates net income, AT may retain this income to offset its net operational costs.

Compared to AT's authority to manage the transport network overall, the delegation in relation to off-street parking and airfields is quite restrictive. The benefits of these activities are economic benefits, not land transport benefits. AT is therefore not responsible for setting the levels of service for off-street parking and airfields, but only for delivering the level of service that the council has set in the delegation, at an efficient cost.

The NZTA does not fund any activities relating to the off-street carparking assets covered in this section

The valuation of the airfield and off-street parking that AT manages on behalf of Auckland Council are given in Table 7-56.

Table 7-56: Off-street parking and airfields asset valuation

\$m	Replacement value \$	Current (depreciated) value \$	Annual depreciation \$
Carpark Buildings (10 buildings)	\$294.2	\$158.4	\$4.7
Pay by plate machines	\$4.7	\$3.1	\$0.5
At-grade carpark	\$118.5	\$83.4	\$2.6
Airfields	\$8.7	\$4.3	\$0.3
Total parking and airfields	\$426.0	\$249.3	\$8.0

The recommended maintenance investment needs for airfields and off-street parking assets are shown in Table 7-57.

Table 7-57: Off-street parking and airfields maintenance – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Carpark buildings	\$2.3	\$2.3	\$2.3	\$2.3	\$2.3	\$2.3	\$2.3	\$2.3	\$2.3	\$2.3
At-grade carparks	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7
Airfields	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6
Total	\$3.6	\$3.6	\$3.6	\$3.6	\$3.6	\$3.6	\$3.6	\$3.6	\$3.6	\$3.6

The recommended investment needs for parking are shown in Table 7-58, and include on-street parking operational costs. These costs relate to parking payment machines, the AT Park app, and administration of residents' parking zones. This cost is more than offset by revenue and is included here to provide a complete picture of AT's total expenditure.

Table 7-58: Parking and airfields operations – recommended investment needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Carpark buildings	\$2.8	\$2.8	\$2.8	\$2.8	\$2.8	\$2.8	\$2.8	\$2.8	\$2.8	\$2.8
At-grade carparks	\$1.8	\$1.8	\$1.8	\$1.8	\$1.8	\$1.8	\$1.8	\$1.8	\$1.8	\$1.8
On-street parking	\$1.8	\$1.8	\$1.9	\$1.9	\$2.0	\$2.2	\$2.3	\$2.3	\$2.4	\$2.4
Total	\$6.4	\$6.4	\$6.4	\$6.5	\$6.6	\$6.7	\$6.8	\$6.9	\$6.9	\$7.0

Recommended renewals needs for off-street parking are shown in Table 7-59. Significant renewals budgets are recommended for Auckland Council-owned carpark buildings that AT operates. This renewals work is needed to address a backlog of work, including replacement of lifts, but needs to be confirmed by Auckland Council.

Table 7-59: Off-street parking and airfields renewals investment – asset needs (uninflated)

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Carpark buildings	\$3.8	\$4.1	\$5.2	\$9.3	\$8.5	\$7.7	\$7.0	\$6.2	\$5.5	\$4.7
At-grade carparks	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7	\$0.7
Total	\$6.4	\$7.5	\$8.7	\$9.9	\$9.2	\$8.4	\$7.7	\$6.9	\$6.1	\$5.4

8.0 Total asset investment needs

This section sets out AT’s overall recommended investment for the assets it manages. It covers maintenance, operations and renewals, and details the benefits that AT forecasts could be realised from the recommended investment.

The asset management investment plan set out in this AMP comprises two parts:

- an asset operations and maintenance investment plan
- an asset renewals investment plan.

This AMP proposes a single investment plan for asset operations and maintenance. Effective operations and timely maintenance are especially important when funding is constrained, as neglecting these issues can exacerbate safety risks and accelerate long term asset damage. Allowing for inflation, the total cost of asset operations and maintenance over 10 years is forecast to be **\$2.53 billion**, detailed in Table 8-1.

The asset renewals investment plan has been developed in two stages:

- an asset needs renewals investment plan – this plan sets out our recommended optimal renewals programme: it balances cost, risk and levels of service, before constraints on funding are taken into account. Total investment (inflated) for the asset needs plan over 10 years is **\$4.83 billion**, detailed in Table 1-2.
- a constrained renewals investment plan – this second plan has been developed with input from AT executives. It has lower costs and, as a result, a higher level of managed risk and some targeted changes to levels of service. Total investment (inflated) for the funding constrained plan over 10 years is **\$3.931 billion**, detailed in Table 1-3. It is the constrained plan for renewals that is included in AT’s proposed budget.

The overall investments are expressed in terms of the two transport networks that AT is responsible for – roading, and public transport – rather than the classes of assets within them. Parking is also included to give a complete picture of expenditure. More detailed budgets were provided for each asset class in Section 7. Total asset investment needs include provision for inflation using the inflation factors provided by Auckland Council; these are shown in Table 8-1.

Table 8-1: Inflation factors used in the 2021 Auckland Council Long Term Plan and AT’s 2021 Plans

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Inflation factor	1.01	1.03	1.04	1.06	1.08	1.10	1.12	1.15	1.17	1.19

In section 9.0, we discuss the funding constraints AT currently faces, in particular the uncertain impacts of the Covid-19 pandemic, and put forward a funding constrained renewals investment plan.

8.1 Recommended operations and maintenance investment needs

Asset operations and maintenance are AT’s second largest item of operational expenditure (the largest is the cost of operating public transport services).

Major items covered by operations and maintenance budgets include:

- maintaining the road pavement surface, for example by filling cracks and patching potholes
- maintaining road markings and replacing damaged road signs
- operating street lights and optimising traffic signals to improve network performance
- operating and maintaining rail and bus stations, ferry wharves and bus shelters.

The costs of maintaining and operating Auckland’s transport network will increase steadily as Auckland grows and new assets are added to the network. These costs, including inflation, are forecast to be \$228.2 million in 2021/2022, increasing to \$290.8 million in 2030/2031. Most of this increase is the consequential costs of maintaining and operating new assets built or vested in AT over the 10-year period.

The 10-year recommended investment plan to cover these asset operations and maintenance costs is shown in Figure 8-3 and Table 8-2.

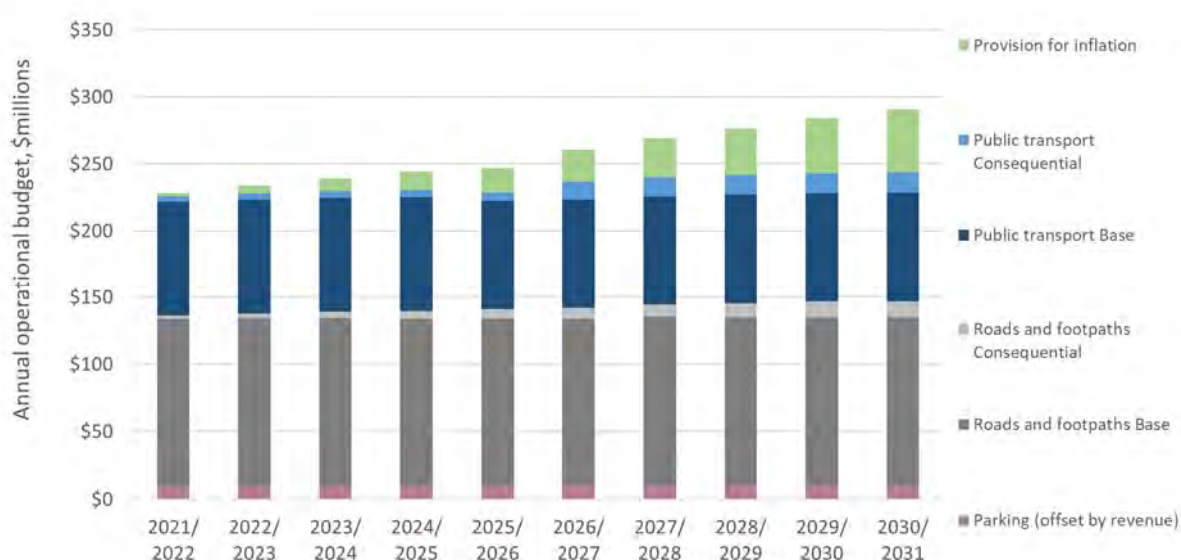


Figure 8-1: Recommended asset maintenance and operations investment (includes inflation)

Table 8-2: Recommended asset maintenance and operations investment (includes inflation)

Operations and maintenance \$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Roading (base)	\$124.1	\$124.2	\$124.2	\$123.8	\$123.6	\$123.4	\$124.8	\$124.6	\$124.4	\$124.2
Roading (consequential)	\$2.4	\$3.6	\$4.9	\$6.0	\$7.2	\$8.3	\$9.3	\$10.6	\$11.8	\$12.3
Public transport (base)	\$85.6	\$85.6	\$85.6	\$85.6	\$81.4	\$81.4	\$81.4	\$81.4	\$81.4	\$81.4
Public transport (consequential)*	\$3.9	\$4.6	\$4.8	\$5.2	\$6.3	\$13.4	\$13.9	\$14.5	\$15.1	\$15.6

Operations and maintenance \$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Parking (offset by revenue)	\$9.9	\$10.0	\$10.0	\$10.1	\$10.2	\$10.3	\$10.4	\$10.4	\$10.5	\$10.5
Provision for inflation	\$2.3	\$5.7	\$9.5	\$13.9	\$18.1	\$23.9	\$29.5	\$35.1	\$40.9	\$46.8
Total opex*	\$228.2	\$233.7	\$238.9	\$244.6	\$246.8	\$260.6	\$269.4	\$276.6	\$284.1	\$290.8
10 year total (inflated)										\$2,573.8

Note: excludes opex requirements for City Rail Link

The maintenance and operations programme to be funded by this investment will address the following problems, identified in the root cause analysis.

- **Asset deterioration** will be addressed by providing adequate maintenance budgets so AT can find and fix small problems early. The programme is expected to significantly reduce long-term costs.
- **Road safety** can be partly be addressed through maintenance budgets. This is especially the case on rural roads, where clear signs and markings, skid resistant pavements and well-maintained road shoulders and sightlines can save lives. For urban roads, this plan provides for the maintenance of new urban safety assets including midblock crossings and protected cycleways.
- **Impacts of growth** are the main reason for increased operational costs. There will be more roads and related assets, and existing road assets will be used more intensively. The public transport network needs to grow even faster than the road network, as the only way to increase the capacity of certain key roads in the network is by moving more people in fewer vehicles.

Operational costs related to the [City Rail Link](#), which is due for completion in late 2024, are not included in the above recommendation.

8.2 Asset needs renewal programme

Our calculation of the 10-year asset renewals needs of AT's transport assets is shown in Figure 1-4 and Table 1-2.

Asset renewals needs, in today's dollars, are forecast to be \$338.5 million in 2021/2022, increasing to \$505.5 million in 2030/2031. The renewals costs for both road and public transport assets will increase over time, as assets age and reach the end of their useful lives.

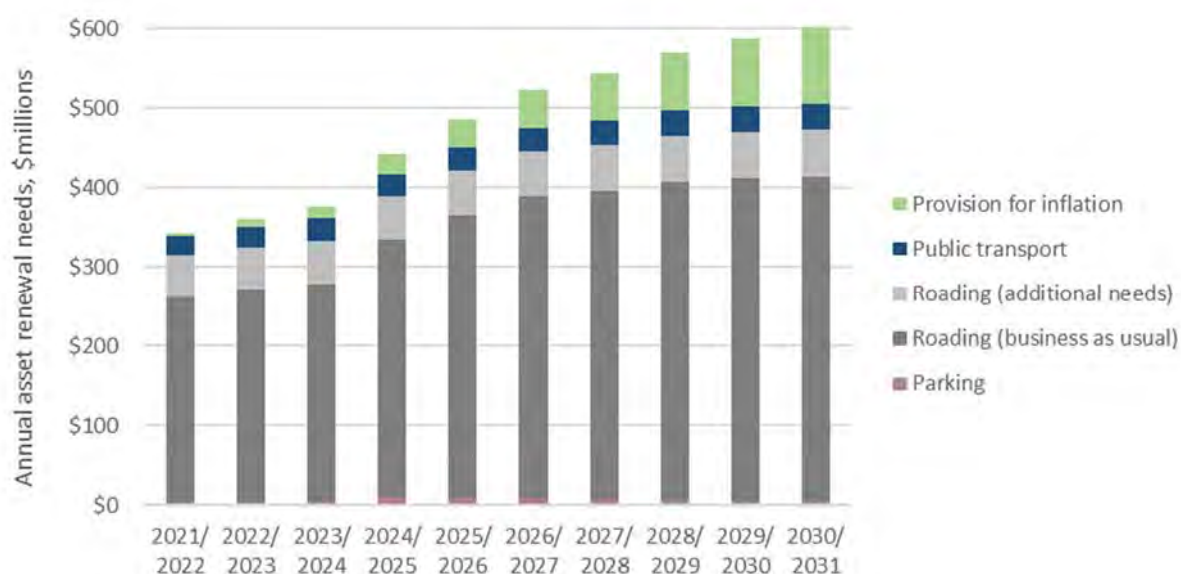


Figure 8-2: Asset needs renewals investment plan

Table 8-3: Asset needs renewals investment plan

\$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Rooding (business as usual)	\$257.6	\$266.8	\$272.1	\$324.3	\$355.9	\$380.5	\$388.5	\$400.1	\$405.4	\$408.6
Rooding (additional needs)	\$53.5	\$54.2	\$54.8	\$55.5	\$56.2	\$56.9	\$57.6	\$58.3	\$59.0	\$59.7
Public transport	\$23.6	\$25.5	\$29.6	\$27.4	\$28.8	\$29.2	\$30.9	\$32.0	\$32.2	\$31.8
Parking	\$3.8	\$4.1	\$5.2	\$9.9	\$9.2	\$8.4	\$7.7	\$6.9	\$6.1	\$5.4
Asset needs renewals	\$338.5	\$350.6	\$361.7	\$417.2	\$450.1	\$475.0	\$484.6	\$497.3	\$502.7	\$505.5
Provision for inflation	\$3.4	\$8.8	\$15.0	\$25.2	\$35.7	\$48.0	\$59.6	\$72.3	\$84.6	\$96.9
Asset needs renewals (inflated)	\$341.9	\$359.4	\$376.8	\$442.3	\$485.9	\$523.0	\$544.2	\$569.6	\$587.3	\$602.4
Ten year total (inflated)										\$4,832.8

The asset needs renewals programme addresses the following problems, identified in the root cause analysis.

- **Asset deterioration:** will be addressed by increasing our ability to respond promptly when road pavements are damaged, including in new growth areas and intensification areas. AT’s ability to respond comprehensively to asset deterioration will also be improved by ensuring:
 - renewals complement other works; for example by arranging for kerb and channel, footpath and CCTV assets to be improved as part of road pavement rehabilitation projects

- renewals respond to local needs, in particular any priority asset renewal needs that have been agreed with local boards.
- **Resilience:** will be improved through:
 - climate change strengthening measures for sealed roads, stormwater assets and bridges
 - seismic retrofitting for bridges and gantries
 - slip repairs for retaining walls.

The asset needs renewal programme will contribute to the RLTP initiatives by:

Supporting growth

Providing \$185 million (inflated) over 10 years for renewals complementing development. This programme would enable AT to take up cost-effective opportunities to integrate with developers, especially in brownfields sites, to renew assets with modern equivalent assets in support of a consistent level of service in growth areas.

Providing \$53 million (inflated) over 10 years to address intensification impacts in greenfield and brownfield development areas, where construction traffic has irreversibly damaged existing road pavements.

Providing \$53 million (inflated) over 10 years to renew roads impacted by construction traffic but outside of direct development areas, including key routes to quarries, cleanfill and landfill sites.

Improving safety

Providing \$133 million (inflated) over 10 years for a programme of slip remediation to “build back better” and create a road network that is less prone to disruption and safety risks during extreme weather events.

Providing \$160 million (inflated) over 10 years for seismic retrofitting of AT bridges, gantries and buildings to meet earthquake safety standards.

Accelerating better transport choices

This objective is more relevant to the capital improvements programme than to renewals. The renewals programme supports these projects by ensuring that new assets are connected to an effective network of existing transport assets.

Addressing sustainability issues especially climate change

Providing \$100 million (inflated) over 10 years to begin targeted climate change resilience improvements to sealed roads, stormwater systems, and retaining walls on links that have been identified through AT’s natural hazard risk assessment as at risk of coastal inundation and/or surface flooding. The investment in slip remediation will also contribute to improving network resilience to climate change impacts.

Improving connectivity

Providing **\$16 million** (inflated) over 10 years to support local needs for road corridor renewals, prioritising those opportunities identified by local boards to complement local board improvement projects. The investment in slip remediation will also contribute to improving connectivity.

The roading renewals additional needs, listed above, are shown in more detail in Table 8-4.

Table 8-4: Asset renewals additional needs

Renewals additional needs \$m	2021/ 2022	2022/ 2023	2023/ 2024	2024/ 2025	2025/ 2026	2026/ 2027	2027/ 2028	2028/ 2029	2029/ 2030	2030/ 2031
Climate change response – sealed roads	\$5.0	\$5.1	\$5.1	\$5.2	\$5.2	\$5.3	\$5.4	\$5.4	\$5.5	\$5.6
Climate change response – catchpits and leads	\$7.0	\$7.1	\$7.2	\$7.3	\$7.5	\$7.6	\$7.7	\$7.8	\$7.9	\$8.1
Climate change response – retaining walls	\$5.0	\$5.1	\$5.1	\$5.2	\$5.2	\$5.3	\$5.4	\$5.4	\$5.5	\$5.6
Seismic retrofitting – bridges	\$8.0	\$8.1	\$8.2	\$8.3	\$8.4	\$8.5	\$8.6	\$8.7	\$8.8	\$8.9
Seismic retrofitting – gantries	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1
Slip repairs – retaining walls	\$6.0	\$6.1	\$6.1	\$6.2	\$6.3	\$6.4	\$6.4	\$6.5	\$6.6	\$6.7
HCV damage response – sealed roads	\$5.0	\$5.1	\$5.1	\$5.2	\$5.2	\$5.3	\$5.4	\$5.4	\$5.5	\$5.6
Intensification impact response – sealed roads	\$5.0	\$5.1	\$5.1	\$5.2	\$5.2	\$5.3	\$5.4	\$5.4	\$5.5	\$5.6
Renewals complementing other works – kerb and channel	\$4.0	\$4.0	\$4.1	\$4.1	\$4.2	\$4.2	\$4.3	\$4.3	\$4.4	\$4.4
Renewals complementing other works – footpaths	\$4.0	\$4.0	\$4.1	\$4.1	\$4.2	\$4.2	\$4.3	\$4.3	\$4.4	\$4.4
Renewals complementing other works – CCTV	\$2.0	\$2.0	\$2.0	\$2.1	\$2.1	\$2.1	\$2.1	\$2.2	\$2.2	\$2.2
Local needs – footpaths	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1
Local needs – street lights	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.6
Total additional needs	\$53.5	\$54.2	\$54.8	\$55.5	\$56.2	\$56.9	\$57.6	\$58.3	\$59.0	\$59.7

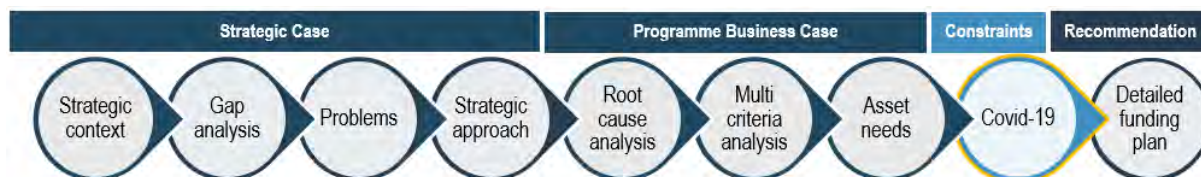
8.3 Forecast benefits from the recommended investment achievements

AT forecasts the following benefits from its recommended programme of operations, maintenance and renewals activities.

Government investment benefits	Performance/service measure description	2019/2020	Target 2024
Impact on system reliability	Proportion of road assets in acceptable condition	97%	97%
	The percentage of public transport trips that are punctual	97%	92%
	The proportion of the arterial road network operating at level of service A to C in the morning peak	(blank)	(blank)
	Percentage of public transport assets in acceptable condition	TBA	99%
Impact on social cost and incidents of crashes	Deaths and serious injuries on Auckland local roads	533	Reduce
	Collective risk – deaths and serious injuries per kilometre of road	0.17	Reduce
	Personal risk – deaths and serious injuries per 100 million vehicle kilometres travelled	6.96	Reduce
	Number of deaths and serious injuries involving public transport, including public transport occupants	0	0
Impact on system safety	Percentage of rural vehicle kilometres travelled on roads that provide safe system primary and supporting treatments (e.g. three star equivalent or better)	10	Improve
	Number of health and safety incidents involving injury to AT employees, agents or other persons	16	(blank)
Impact on network productivity and utilisation	Proportion of the freight network operating at level of service C or better during the inter-peak	87%	85%
Impact on perception of safety and security	Percentage of public transport customers satisfied with personal safety at their stop or station	80%	Improve
	Public and customer safety and security incidents across public transport network	New measure	New measure
Impact on mode choice	Total public transport boardings	100.7 million	93.01
	Total annual boardings on rapid or frequent public transport networks	49.2 million	Increase
Impact of mode on physical and mental health	Number of cycle movements past selected count sites	1,072	3,826
	Kilometres of new cycleway added to the regional cycle network	2.2	10
	Active and sustainable mode share at schools where Travelwise programme is implemented	(blank)	(blank)

Government investment benefits	Performance/service measure description	2019/2020	Target 2024
	Active and sustainable mode share for morning peak commuters where a Travelwise Choices programme is implemented		(blank)
Impact on resource efficiency	Percentage of AT street lights that are energy efficient LED	45%	
Impact of air emissions on health, Impact on greenhouse gas emissions	Reduction in CO2e (emissions) generated annually by AT corporate operations (from 2017/2018 baseline)	7% increase	49% reduction
	Number of buses in the Auckland bus fleet classified as low emission	7	
Impact on user experience of the transport system	Road roughness as measured by smooth travel exposure for rural roads	94%	92%
	Road roughness as measured by smooth travel exposure for urban roads	87%	81%

9.0 The funding-constrained investment plan



Funding for transport has been constrained for many years, and the search for more sustainable funding sources has been a focus for the Auckland Transport Alignment Project since its first full report in 2018. Covid-19 has reduced available funding even further, without greatly affecting asset management costs. AT recognises the need to set priorities in the face of funding constraints, and has developed the following amended funding recommendation in response to these constraints.

9.1 How Covid-19 is affecting assets

Covid-19 has had huge impacts in NZ and around the world, but the need to maintain and renew existing transport assets remains.

Auckland’s two lockdowns have seen less vehicle travel, many more people working from home, steep drops in public transport patronage, and an increase in walking and cycling. Freight movements have mostly been able to continue during the lockdowns, and there has been a rise in online shopping and home deliveries.



Figure 9-1: Quay Street at Covid alert level 4

None of these impacts is forecast to significantly change the rate of deterioration of existing transport assets or the need for

ongoing maintenance and renewals. While public transport patronage has declined, the system remained open, even during the level 4 lockdown, and continued to provide for the travel needs of essential workers. Asset-based operations costs including staffing and cleaning were still incurred, along with additional costs for worker protection, extra cleaning and other Covid-19 initiatives.

The major impact of Covid-19 on this AMP arises from the loss of AT revenue from public transport fares, parking charges and the regional fuel tax. AT’s two funding partners, Auckland Council and the NZTA, are themselves facing significant declines in revenue, without a corresponding decline in costs.

Now is not the time, and this AMP is not the place, to make predictions about what the long-term impacts of Covid-19 might be. The Auckland Transport Alignment Project has not yet arrived at a view on what Covid-19 is likely to mean for transport infrastructure and funding. A very significant unknown is the extent to which people will return to public transport after the pandemic.

This AMP simply recognises the impacts of Covid-19 on revenue and hence on AT’s ability to invest in asset management activities.

9.2 Operations and maintenance investment

The funding-constrained investment plan has the same maintenance and operations needs as in our recommended asset investment needs plan described in Section 8.1 of this AMP. Maintaining existing assets is not an optional activity, and becomes even more important when renewals need to be postponed.

9.3 Process to develop the constrained renewals investment plan

Unlike operations or maintenance, renewals can be postponed in order to redistribute costs over time, although this will impact on levels of service and increase the level of managed risk.

In the face of funding constraints including the impacts of Covid-19 on both Auckland Council and AT revenue, AT has developed a set of adjustments to its asset needs renewals programmes. These scenarios postpone some renewals activities in order to arrive at a more affordable option. Funding requirements for each scenario are shown in Figure 9-2.

Asset needs renewals investment – **\$4.832 billion renewals programme (inflated) over 10 years**

This programme was calculated based on the asset needs identified in Section 7 and summarised in Section 8.

Scenario 1 – **\$4.694 billion renewals programme (inflated) over 10 years**

This option addresses the backlog of assets that are below AT's current levels of service at a slower rate than the AMP recommendation, but includes all of the initiatives listed above to contribute to RLTP outcomes.

Scenario 2 – **\$4.524 billion**

This option addresses the backlog at the same rate as Scenario 1, and also delays the implementation of AT's climate change response.

Scenario 3 - **\$4,446 billion**

This option is the same as Scenario 2, but also delays AT's growth response initiatives. This will reduce the ability of AT to invest in renewals complementing development, and to address the impacts of intensification on existing assets, in the early years of the RLTP.

Scenario 4 - **\$4,368 billion**

This scenario delays implementation of almost all of the ATAP/RLTP initiatives listed above, with the one exception of renewals to meet local needs.

Scenario 5 - **\$4,152 billion**

This scenario introduces an additional delay to the programme to address the backlog of assets below levels of service, and postpones investment in all of the identified ATAP/RLTP initiatives.

Constrained renewals programme – **\$3,931 billion**

This is the programme for which AT is requesting funding. We recommend that this is the lowest cost option that is consistent with AT's risk policies and local government responsibilities.

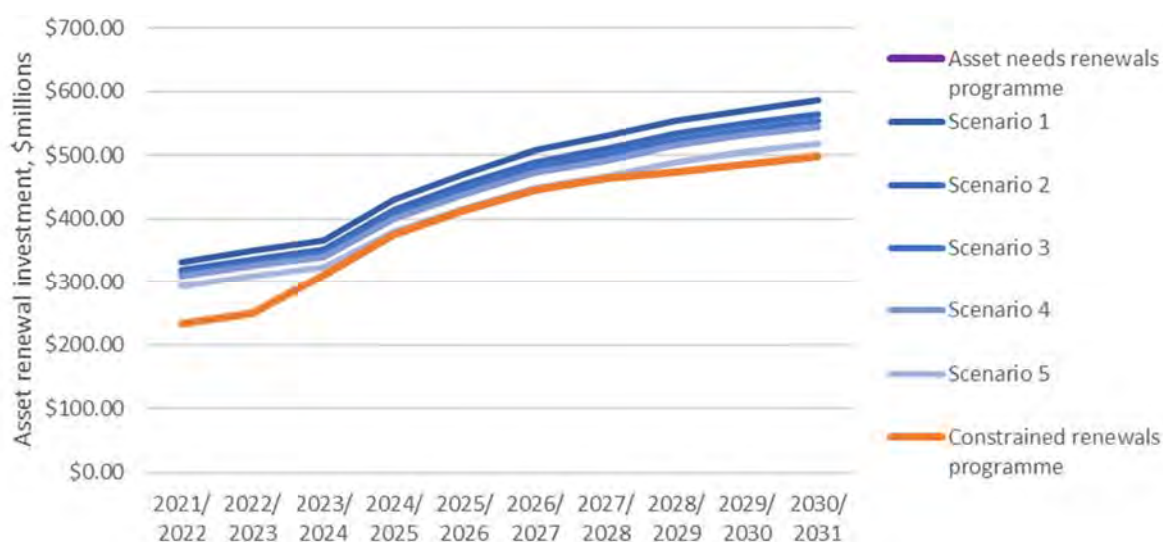


Figure 9-2: Asset investment programmes considered

9.4 The constrained renewals programme

The constrained renewals programme has a total cost over ten years of **\$3,931 million**. This programme has the lowest cost, and the highest level of managed risk, of all of the options considered. It defers all of the RLTP initiatives beyond the first three years, and postpones climate change investments beyond the ten years of this RLTP. Reduction in the backlog of assets already in very poor condition is slower under this option, however the programme has been optimised to:

- restrict impacts on levels of service to less critical assets
- ensure that assets are safe and serviceable
- avoid additional costs caused by unexpected asset failure.

The funding constrained renewals investment plan is set out in Figure 9-2 and Table 9-1, and is included in AT’s draft 2021 RLTP.

9.4.1 The constrained renewals investment plan

AT must set its priorities for assets renewals taking into account the funding constraints it faces.

Transport investment needs have outstripped available funding for many years, and the Auckland Transport Alignment Project (which AT is part of) has been searching for more sustainable funding sources since 2018. Covid-19 has reduced available funding even further, but without having any great effect on our costs.

Unlike maintenance, asset renewals can be postponed, if necessary, in order to redistribute costs over time. However, taking this approach affects levels of service and increases the level of managed risk.

Taking into account current funding constraints, AT is recommending that the asset renewals plan set out in Figure 1-5 and Table 1-3 should be adopted. This constrained renewals investment plan will:

- restrict the impacts on levels of service to less critical assets
- ensure that assets are safe and serviceable
- avoid additional costs caused by unexpected asset failure.

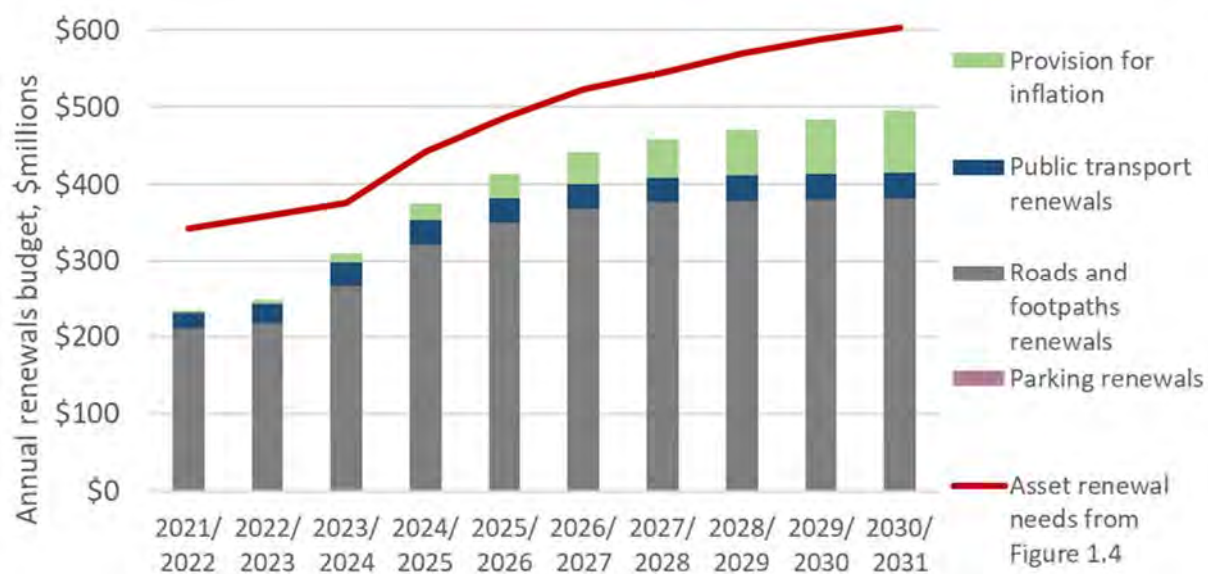


Figure 9-3: Constrained asset renewals investment (included in proposed AT budget)

Table 9-1: Constrained asset renewals investment (included in proposed AT budget)

\$m	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
Roads and footpaths	\$207.5	\$214.2	\$261.3	\$318.8	\$347.5	\$366.2	\$373.3	\$375.2	\$377.2	\$379.2
Public transport	\$20.7	\$24.7	\$31.3	\$31.7	\$32.3	\$31.9	\$32.7	\$33.0	\$33.2	\$33.4
Parking	\$3.8	\$4.1	\$5.2	\$3.0	\$3.0	\$3.0	\$3.0	\$2.9	\$2.9	\$2.8
Provision for inflation	\$2.3	\$6.1	\$12.4	\$21.3	\$30.4	\$40.5	\$50.3	\$59.8	\$69.6	\$79.7
Total	\$234.4	\$249.1	\$310.1	\$374.7	\$413.1	\$441.5	\$459.3	\$470.9	\$482.8	\$495.1
10-year total (inflated)										\$3,931.0

The funding-constrained renewals programme postpones most of the required initiatives to target climate change, seismic strengthening, improved resilience or local needs beyond the first 3 years.

AT undertakes to review its renewals forward works programme and to prioritise these activities within the constraints of available funding, before adopting its final AMP in early 2021.

9.5 Asset investment needs by NZTA work category

The 3-year asset investment needs is presented by NZTA work category in Table 9-2. This incorporates the recommended maintenance and operations needs, and the funding-constrained asset renewals programme. It includes provision for inflation and for the administration of the programme.

Table 9-2: Asset investment needs by NZTA work category

Expenditure reporting line	NZTA WC	WC description	Activity breakdown	FY 2021/22	FY 2022/23	FY 2023/24	3-yr Total
Maintenance	111	Sealed pavement maintenance	Routine pavement repairs	17.40	17.70	18.03	53.13
			Pre-seal repairs	16.16	15.96	19.81	51.93
			WC 111 Total cost	33.56	33.66	37.84	105.06
	112	Unsealed road pavement maintenance		3.83	3.89	3.95	11.67
	113	Routine drainage maintenance	Street cleaning	11.29	12.16	12.81	36.26
			Drainage maintenance	4.40	4.48	4.55	13.43
			WC 113 Total cost	15.69	16.64	17.36	49.69
	114	Structures maintenance	Bridge maintenance	1.51	1.54	1.57	4.63
			Maintenance other structures	0.02	0.02	0.02	0.07
			WC 114 Total cost	1.53	1.56	1.60	4.69
	124	Cycle path maintenance		0.86	0.88	0.90	2.64
	125	Footpath maintenance		5.96	6.05	6.15	18.16
Maintenance Total				61.44	62.68	67.80	191.92
Operations	121	Environmental maintenance	Vegetation control	9.47	9.85	10.25	29.58
			other environmental maintenance	1.39	1.41	1.44	4.25
			WC 121 Total cost	10.87	11.27	11.68	33.82
	122	Network services maintenance	Traffic services power supply	15.22	15.64	16.07	46.93
			Traffic services maintenance	19.35	19.62	20.13	59.11
WC 122 Total cost			34.57	35.26	36.21	106.04	



Expenditure reporting line	NZTA WC	WC description	Activity breakdown	FY 2021/22	FY 2022/23	FY 2023/24	3-yr Total
			Maintenance of operational infrastructure	2.81	2.86	2.92	8.60
	123	Network operations	Management and operations of traffic systems	14.14	14.37	14.62	43.13
			WC 123 Total cost	16.95	17.23	17.54	51.73
			Network management (incl inspections)	9.21	9.43	9.64	28.28
	151	Network and asset management	Network user information	5.14	5.36	5.55	16.05
			Management of asset inventory systems	1.25	1.27	1.29	3.81
			WC 151 Total cost	15.60	16.06	16.49	48.14
Operations Total				77.99	79.82	81.92	239.73
	211	Unsealed road metalling		2.02	1.99	2.48	6.49
			Chip sealing	25.70	26.99	33.76	86.46
	212	Sealed road resurfacing	Thin asphaltic surfacing	45.29	47.64	59.59	152.51
			WC 212 Total cost	70.99	74.63	93.35	238.97
			Culvert renewals	10.37	10.84	13.28	34.49
	213	Drainage renewals	Kerb and channel renewals	10.70	11.05	13.35	35.10
			WC 213 Total cost	21.07	21.89	26.64	69.59
Renewals	214	Sealed road pavement rehabilitation		40.23	43.14	53.65	137.02
			Bridge component replacement	9.65	12.25	15.03	36.93
	215	Structures component replacements	Retaining wall component replacement	4.33	4.54	4.87	13.74
			Other structure component replacements	0.79	0.84	0.81	2.45
			WC 215 Total cost	14.78	17.63	20.71	53.12
	216	Bridges and other structures renewals	Bridge full replacement	3.17	1.06	1.27	5.50
			Retaining wall full replacement	0.55	0.53	1.06	2.14

Expenditure reporting line	NZTA WC	WC description	Activity breakdown	FY 2021/22	FY 2022/23	FY 2023/24	3-yr Total
			Other structure full replacements	0.26	0.26	0.53	1.06
			WC 216 Total cost	3.99	1.85	2.85	8.69
	222	Traffic services renewals		24.46	25.74	32.20	82.40
	224	Cycle path renewal		0.39	0.41	0.48	1.28
	225	Footpath renewal		21.94	23.02	28.56	73.52
Renewals Total				199.86	210.30	260.92	671.09
Local Road Maintenance Total				339.30	352.80	410.64	1,102.74

10.0 Asset management improvements

Asset management practice improvement is an on-going task which has been recognised as essential to achieve excellence in our AM practices.

AT’s enterprise business plan outcomes are linked to the asset management goals as illustrated below. The continuous AM improvement programme will ensure these goals are achieved efficiently and effectively.





Enterprise Business Plan Key Deliverables		Asset Management Goal
Deliver Safe Outcomes		We make safety a priority by integrating it into our approach to asset development, maintenance, and management.
Excellent Customer Experience		Our asset management approach supports a “customer-centric” approach and puts accessibility and user-experience at the forefront of decision-making.
Effective Transport Journeys		Our asset management practices enable Auckland Transport to operate a transport system that is optimised, innovative, and progressive.
Integrated Transport Networks		Asset management approaches and practices enable integrated network outcomes across Auckland Transport and its delivery partners to create a stronger network framework and improved service outcomes.
Financial Accountability and Benefit Realisation		We achieve value for money by increasing the efficiency and effectiveness of asset management and delivery.
Collaborative Partnering		We cooperate with other agencies to effectively deliver and manage assets and integrate the transport system region wide.
Enhance Capability		Our asset management practice captures feedback from system performance to improve outcomes whilst continuing to evolve and provide for emergent requirements.
Enable our Business		Our asset framework supports Auckland Transport’s strategic direction and provides a robust framework for other parts of our organisation that operate across the asset lifecycle so our strategic outcomes can be achieved.



The Asset Management team has embarked on a comprehensive improvement programme, informed by independent assessments and audits, including:




- Waka Kotahi Audits
- AECOM 2018 Business Review
- 2020 Infrastructure Management Assessment
- Road Efficiency Group Excellence Programme

The team’s overall improvement programme has over 100 tasks. The tasks most relevant to improving our Asset Management planning and delivery are set out in Table 93.

Table 10-1: Summary of asset management improvement activities

AT ref	Improvement Required	How this will be reflected in 2024 AMP
 Enable our business		
1.3	Develop AM policy and strategy using ISO55000.	2022 AM Policy and AM Strategy inform 2024 AMP Development.
1.4	Strengthen key strategic themes and KPIs to drive “sustaining and maintaining the resilience and integrity of existing infrastructure”.	Identification and capture of strategic themes to inform 2024 AMP.
1.5	Develop and review asset related guidelines, policies and strategies.	All AM Guidelines and other supporting elements reviewed and ready to inform 2024 AMP Development.
1.8	Ensure AM Policy and Strategy are independently reviewed prior to final approval.	
 Collaborative partnering		
	Apply the One Network Framework to determine the function of our roads and streets, and inform decision making.	One Network Framework informs decision making in 2024 AMP.
4.5	Work with key stakeholders to complete asset accountability review.	Reduce the number of assets where ownership is unknown or under review
2.3	Agree Stormwater levels of service with Auckland Council and introduce governance overview of performance to agreed levels.	Review, refine and refresh governance process implementation.
 Effective transport journeys		
2.1	Review the current levels of service for each portfolio, confirm they remain appropriate and where these do not currently exist establish new levels of service and related performance measures.	Reviewed Levels of Service in place to inform 2024 AMP.
2.4	Develop a trade-off model to assess options for increasing or decreasing levels of service, which considers risk, costs and benefits across portfolios.	Trade off model in place to inform 2024 AMP.
3.2	Incorporate the roles of other AT teams in the demand forecasting process and subsequent maturity reviews.	Co-ordinated, effective demand forecasting informs 2024 AMP.
3.3	Monitor and respond to the impacts of rapid heavy vehicle growth on roads and structures.	FFP Approach to understanding and responding to HV Impacts.
 Integrated transport networks		
5.1	Investigate reporting of climate change targets including targets for low carbon construction.	Refer Chief Engineer’s Environmental Plan
4.1	Improve the documentation of AT’s data management rules and procedures including data ownership, transfer, management and maintenance of asset data.	Data Management Policy embedded and supporting NZTA Data Standards outcomes.
4.2	Targeted / risk based programmes of data improvements, supported by maintenance contract and professional services data contracts.	Improved data to inform decision making in the 2024 AMP.

AT ref	Improvement Required	How this will be reflected in 2024 AMP
4.3	Make improvements to data across a range of areas – including asset inventory, criticality, condition and maintenance history.	
5.1	Review requirements for reporting and consider development of automated dashboard of performance measures.	Progressive development and maintenance of dashboard reporting.
9.1	Develop a more integrated planning process that works across AT to optimise the opportunities to renew, improve levels of service or increase capacity for growth.	Continue to formalise Service Level Agreements with other AT departments and to use these to improve integration.
	Deliver safe outcomes	
7.1	Review the current risk profile for the Integrated Networks Group to ensure all high-level risks across all portfolios are captured, understood, and where necessary escalated.	Risks listed in ACMPs are embedded and maintained in corporate Asset Risk Management system and supported by risk reporting protocols / dashboards.
7.2	Improve reporting of major asset risks to enable the appropriate level of visibility at senior level.	
8.1	Embed the criticality framework across each of the asset portfolios ensuring that those tasked with delivery operations are fully aware of the framework and what it means operationally.	Criticality Framework embedded across all asset portfolios.
7.4	Improve identification of critical assets – what assets can't be allowed to fail?	Refine and communicate asset criticality management and reporting.
7.5	Identify assets at high risk and develop suitable management strategies.	Refine and communicate asset condition/ failure risk management and reporting.
7.7	Assess the resilience of the critical assets of the transport network against factors such as climate change, sea level rise, extreme weather events, seismic events etc.	Resilience scorecards and assessments inform 2024 AMP and forward works programmes.
7.8	Create Emergency Preparedness Procedure/Resilience Plan for key assets.	Emergency preparedness plans implemented and maintained.
7.9	Build on AT natural hazard assessments to develop and Implement a Climate change adaptation plan.	Climate Change adaptation plan informs 2024 AMP.
	Financial accountability and benefit realisation	
8.2	Where budgets do not align with asset needs, ensure this is escalated as a priority risk and the consequences fully detailed and communicated.	2024 AMP has improved connection between financial decisions and the risk and level of service consequences.
8.3	Review the process for building maintenance budgets to ensure input from all areas of the business (such as technical input) is considered.	Maintenance budgets in 2024 AMP are developed with cross-AT input.
8.6	Develop diagnostic and forward thinking processes, such as root cause analysis and the application of smart technology, in order to adapt forward AM strategies.	Improved asset diagnostic and performance strategies inform 2024 AMP.

AT ref	Improvement Required	How this will be reflected in 2024 AMP
10.1	Complete a review of AT’s in-house (ROM) renewals model to determine its accuracy and robustness. Consider improving or replacing the system, and ensure all aspects are formally documented.	2024 AMP has improved renewals optimisation modelling.
10.4	Review the Consequential Opex model to determine its accuracy, and improve link with capital decisions.	Improved Consequential Opex modelling in 2024 AMP.
10.5	Review unit rates model. Consider improving or replacing the system, and ensure all aspects are formally documented.	Improved unit rates used in 2023 Valuation and in renewals forecasting for 2024 AMP.
10.7	Improve the capture of maintenance expenditure to better inform unit rates models.	
	Enhance capability	
11.4	Review the role of AM in the organisation and develop an AM competencies framework and a comprehensive succession planning process.	AM planning team has required capacity and competency to successfully deliver the 2024 AMP Development.
12.4	Review the format and content of the AMP and ACMPs, considering the audience, purpose and timing. Develop a more streamlined format that allows each to be updated more efficiently.	2024 AMP is a roll-up of all transport Asset Class Management Plans.
12.1	Improve the asset management planning processes to more effectively engage other teams within AT including Delivery, Finance and Planning teams.	2024 AMP is understood and supported across the organisation.
	Excellent customer experience	
15.2	Develop a more robust contract performance management framework, including clear responsibilities for critical assets. Incorporate at contract renewal time	AM contract performance management framework operational to implement 2024 AMP programme
	Enable our business	
13.1	Ensure relevant AM practices are included within the AT Quality Assurance Framework.	AM practices are embedded and maintained in corporate Quality Assurance system.
13.3	Document asset management business processes and identify opportunities for improvement.	All core / essential AM business processes documented.
13.5	Develop and adopt a common asset management language across the organisation. This can be reinforced by ensuring all asset management documents contain a common glossary of terms and abbreviations aligned to ISO55000 terms and abbreviations.	Core AM language / data dictionary implemented.
16.3	Implement formal monitoring and reporting of this Improvement Plan progress to a governance group.	