



Asset Class Management Plan

Street lighting

2020



Read me first: what it means that this document has been approved for retention by Auckland Council

Status of this document

On 6 May 2026, the New Zealand Government passed the Local Government (Auckland Council) (Transport Governance) Amendment Act. This legislation changed transport decision-making and responsibility for Auckland.

As part of this legislation, Auckland Council was required to review all transport-related and in-force Auckland Transport policies and plans to decide whether to retain, amend or revoke the policy or plan.

On 21 September 2026, Auckland Council approved the retention and transfer of this document to the council. In accordance with the Act, the document continues in effect until it is reviewed, replaced, or revoked.

This document remains in effect but should be considered alongside Auckland Council's current strategic direction and statutory transport planning requirements.

Alignment with Auckland Council group strategic direction and transport planning requirements

Auckland Council current strategic direction provides the wider context for how this document should now be interpreted and applied. This includes relevant Auckland Council strategies, policies, plans, investment decisions, regulatory settings, and local board direction.

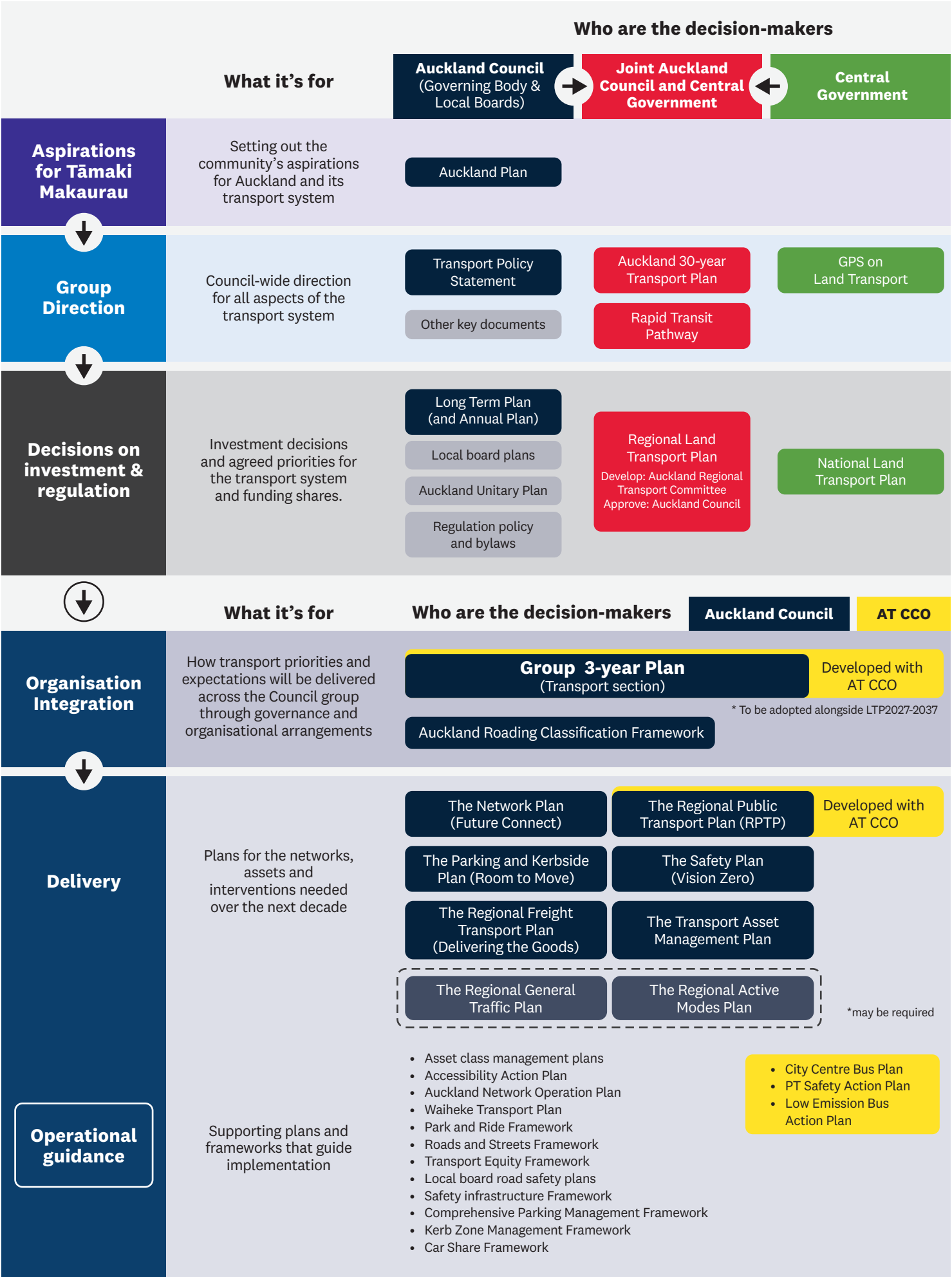
Transport planning is also guided by legislation and related planning documents introduced through the reforms. This includes the Auckland Council Transport Policy Statement, the Auckland Regional Transport Committee, the 30-year Transport Plan for Auckland, the Regional Land Transport Plan, and related transport governance and planning requirements.

The Auckland Council Group Strategic Framework (Transport view), shown below, provides context for how transport-related strategies, plans and frameworks fit together. It is intended as an evolving guide and will continue to be refined as documents are reviewed and updated. The Asset Class Management Plan – Street lighting was prepared under previous governance arrangements. While it remains in effect, the way it should be interpreted and applied, and its relationship with the broader framework today may differ from how it was originally intended. To ensure accurate interpretation, advice should be sought jointly from Auckland Council's Group Strategy and Transport Policy functions.

Auckland Council Group Strategic Framework

(Transport view)

Simplified view only. Documents often span multiple layers and relationships. Higher-order direction takes precedence. Seek guidance where interpretation is required. Subject to ongoing refinement.



Application within Auckland Council's shared governance model

Auckland Council's shared governance model allocates decision-making responsibilities between the Governing Body and local boards. The transport reform legislation changed how this model applies to transport by assigning additional responsibilities to local boards for local and collector roads, while arterial roads and specific precincts are wholly under the decision-making responsibility of the Governing Body.

The Auckland Roding Classification Framework determines the split in road type and therefore decision making, and shows individual road categories.

By retaining this document, the Governing Body confirmed that it remains part of Auckland Council's approach to transport planning and decision-making. It should be taken into account when Auckland Council plans, funds, regulates, and delivers transport services and infrastructure.

The Allocation of Decision-Making Framework sets out the respective responsibilities of the Governing Body and local boards. Local board decision-making responsibilities for local and collector roads include:

- **Parking and stopping controls:** Such as no stopping restrictions (broken yellow lines), angle parking, time restricted parking, parking zones,
- **Traffic Controls:** Such as community streets (community led play streets), pedestrian crossings, speed humps, speed limits,
- **Road corridor and network access permissions and conditions:** Corridor access approvals for events (excluding Eden Park events that impact arterial roads),
- **Property and landowner (road reserve) decisions:** Such as removal of hazardous encroachments affecting road safety, airspace and subsoil leases,
- **Infrastructure:** Such as footpaths and cycle paths (new or modified), installing monuments, removal of third-party structures.

Where local boards are responsible for decisions covered by this document, they should take it into account when making those decisions. The document does not change or limit local board decision-making powers.

Asset class management plan – street lighting



Street Lighting Asset Class Management Plan

Street lighting Asset class management plan

SharePoint link: [Street Lighting ACMP](#)

Status of document: Final draft

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Glossary

Acronym or term	Meaning
TDM	Transport Design Manual: It introduces consistent transport infrastructure design standards for all of Auckland.
HPS	High-pressure sodium: This type of lamp is commonly used in street lighting. It has a long operating life, but consumes more electricity than the energy-efficient lights. HPS lamps provide a characteristic yellow or orange (photopic) illumination, which the human eye reacts less sensitively to.
Illumination	Refers to the amount of light falling on a given surface. For street lighting, illumination is measured on the ground in units called 'lux'.
LED	Light-emitting diode: A solid-state lamp that uses light-emitting diodes as the source of light. LED lamps offer long service life and high energy efficiency. They emit a white light that provides high levels of scotopic lumens allowing street lights with lower wattages and lower photopic lumens.
LOS	Level of service: The defined service quality for a particular activity or service area, against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, regulatory and environmental acceptability, and cost.
Luminaire	The light fitting that houses the lamp and reflector
RAMM	Road assessment and maintenance management system: An asset management system for roads, developed as an asset inventory and treatment selection tool.
MFP	Multi-function pole: Pole accommodating a range of accessories required for the urban environment, such as lights, traffic signals, signs, banners, CCTV, etc.
OHUG	Overhead to underground: The replacement of overhead cables providing electrical power with underground cables.
SOI	Statement of Intent: The SOI sets out Auckland Transport's strategic approach and priorities for the next 3 years, and how they contribute to the longer-term outcomes Auckland Council is seeking to achieve.
SLIMS	Street lighting information management system: A module of the RAMM system.

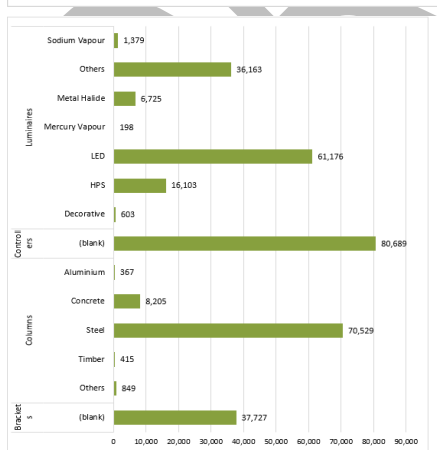
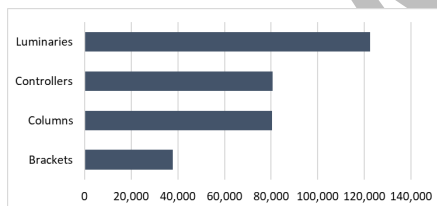
Executive summary

Street Lighting Purpose: <i>Street lighting is an important amenity and an essential part of Auckland's transport network.</i> <i>Good street lighting enables vehicles and pedestrians to move safely and easily in the transport network during the hours of darkness.</i> <i>It improves road safety, reduces night-time road traffic accidents, improves security for pedestrians and neighbourhoods, and aids crime prevention.</i> <i>It also encourages night-time use of local facilities and active transport modes, such as walking and cycling.</i>		Key Levels of Service In addition to those that apply to the road network, the following measures are specific to this asset class. Current performance for 2019/20 is also shown.		
Asset Management key result area	Asset Management key service value	Performance/ service measure	Current	Target
Safe	Road network safety	Deaths and serious injuries where loss of driver control at night was a contributing factor	29	0
		Compliance with average illumination on collector roads – 3 lux; arterial roads – 4 lux	80%	100%
		Compliance with average illumination at commercial centres – 6 lux	>90%	100%
		Compliance with average illumination at major intersections – 7.5 lux	90%	10%
		Compliance with average illumination on residential streets – 2 lux	50%	100%
Sustainable	Environmentally sustainable	Percentage of network installed with energy efficient (LED) lamps	62%	66%

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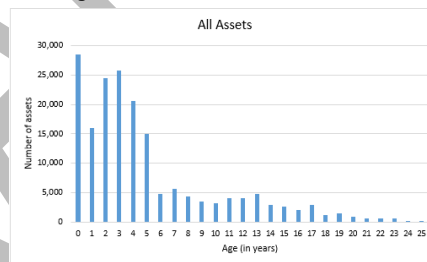
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The Asset Portfolio – What we look after



Over the past few years, AT's street lighting network has grown by approximately 2.5% each year (an estimated 3,000 new lights a year) and is expected to continue at the same rate for at least the next five years.

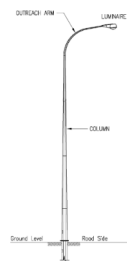
Asset Age and Life



The average effective lives of existing street lighting assets, regardless of their materials or types, are:

- Columns – 30-40 years
- Brackets – 20 years
- Luminaires – 15-20 years

Many of the city's assets are less than 5 years old, in large part reflecting the ongoing LED conversion work. There are relatively few assets which are beyond their "useful lives".



A typical streetlight

Street Lighting Asset Class Management Plan

The conversion to LED is continuing, with around 45% of luminaires now LED.

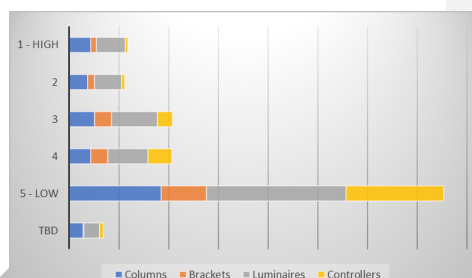
Lighting performance and design for new development or maintenance must comply with AS/NZS1158 lighting standards

Asset Valuation

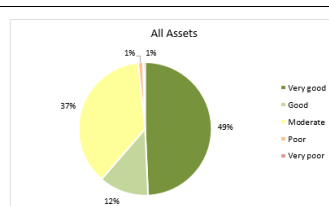
Service potential (economic) consumption of the portfolio is around 46%, with annual depreciation of \$9.3 million.

Asset	ORC \$m	ODRC \$m	AD \$m
Brackets	\$16.8	\$7.1	\$1.6
Luminaires	\$46.1	\$37.5	\$2.1
Poles	\$210.3	\$109.8	\$8.9
Controllers	\$12.1	\$10.9	\$0.5
TOTAL	\$285.3	\$165.3	\$12.2

Critical Assets



Street Lighting Asset Condition



Condition assessment is based on three-yearly visual inspections. These incorporate safety factors, structural defects, and the aesthetic and visual amenity of streetlights.

Typical condition issues include:

- Lamps (bulbs) burning out
- Diffusers losing effectiveness through dirt or cracking with age
- Cleanliness of lantern covers
- Corrosion, especially in coastal areas
- Bent, broken or damaged poles and brackets

Performance Issues

Factors affecting performance include:

- Luminaires in poor condition reducing light output
- Luminaires that are not sustainable long term or are high energy use.
- Assets below standard or required illumination level or new urban design requirements.
- Columns that are not suitable to host the required services such as traffic signals, CCTVs, etc.
- Mature trees causing shadowing

There are other issues, including:

- Infill lighting gaps
- Amenity lighting in busy areas

MANAGING OUR RISKS

Asset Integrity

Risks associated with physical status of assets, design standards and construction quality

Natural Hazards

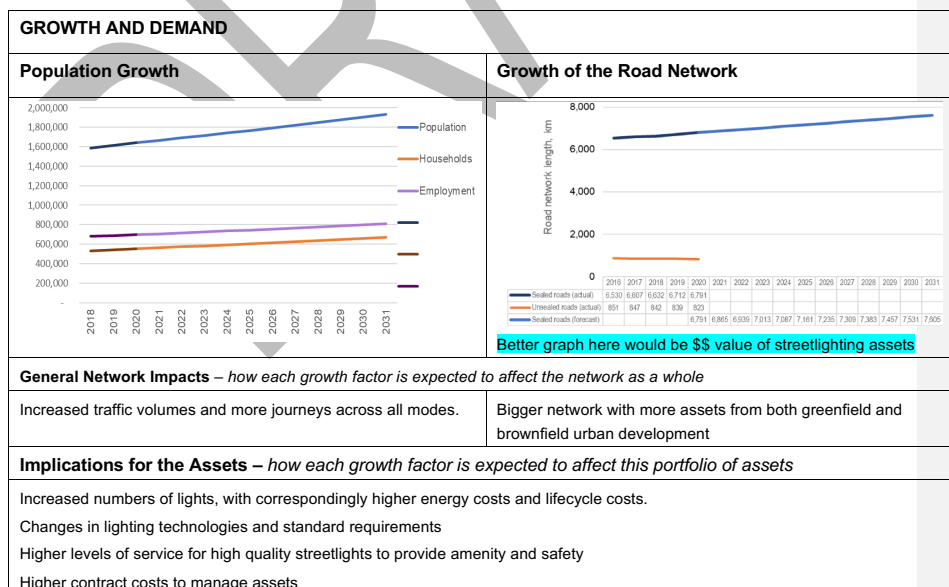
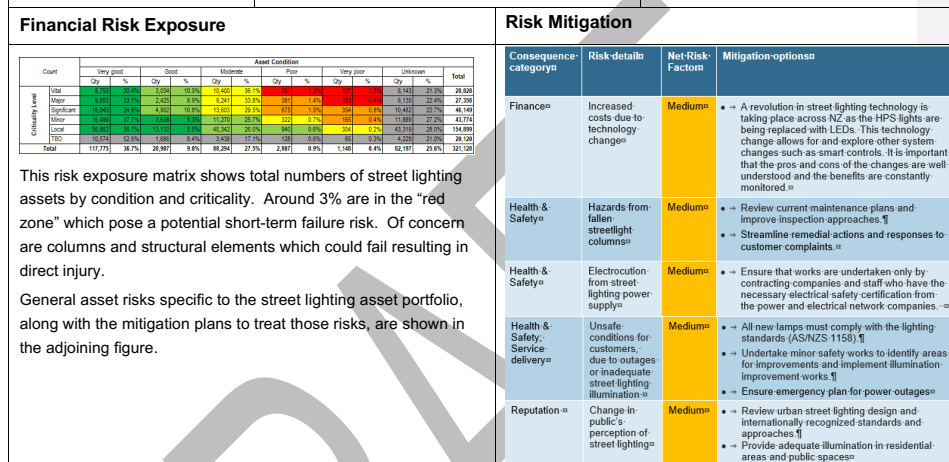
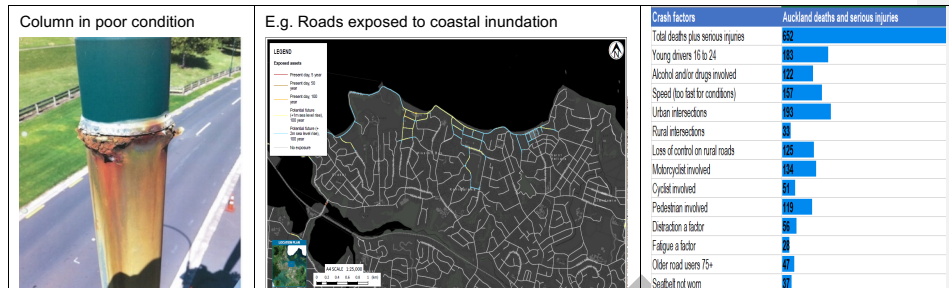
Risks arising from exposure to natural hazards and vulnerability of assets

Safety

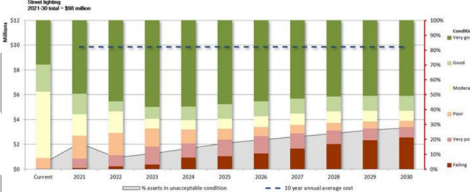
Safety issues arising from the utilisation of assets

Car vs pole crashes (Waka Kotahi NZ's Communities at Risk Register)

Street Lighting Asset Class Management Plan



Street Lighting Asset Class Management Plan

LIFECYCLE STRATEGIES	
How we Manage the Asset – Objectives: Serviceability – focused on safety, condition, reliability and customer requirements to meet the needs of different transport modes and users Prudent risk management – safer roads that are free from potential hazards and obstructions with critical routes always available Perpetuity of assets – addressing inter-generational loss of service potential due to asset deterioration through appropriate operational, maintenance and renewal activities Value-for-money – optimising and prioritising investments to achieve best whole-of-life costs, while meeting agreed levels of service	Strategies we use: Using competent and capable people – asset engineers, contractors and customer services staff with specified roles and responsibilities, suitable skills and experience to deliver our services Establishing asset management systems – processes, information management systems, governance and management structures Optimising service delivery mechanisms – outsourcing service delivery contracts, using competitive bidding in the open market and industry accepted procurement processes, to effectively and efficiently deliver our programmes Developing lifecycle management plans
Operational Activities - Asset inspections and monitoring – detailed, routine, night-time. Identify defects and rate condition. Frequencies depend on location and function, e.g. pedestrian crossings, town centres, and ONRC roads. - Power supply – to operate lights. - Central management system (CMS) controls light levels by switching and dimming and monitors asset performance. - Customer service and emergency response activities	Maintenance Activities - Routine/cyclic maintenance – ongoing repetitive work - Planned/ programmed maintenance – to repair identified defects and faults - Unplanned maintenance and fault management – reactive response to faults and service requests - Emergency work – response to unexpected events that are a public safety risk
Renewals Activities - Programmed renewal – to address risk, LoS and deterioration - Reactive renewal – damage due to storms or crashes - Other renewal – in conjunction with other projects Key Issues: - Condition issues – e.g. water ingress and faded diffusers for luminaires; damage, corrosion, breaks for brackets and poles - Growth impacts – network growth and new subdivisions - Cost trends – increasing - Conversion to LED – see Asset Improvements	 Overall, the renewal strategy will result in more assets being in good or very good condition. However, the projection is a growing number in poor or worse condition. This trend will need to be monitored to ensure that none of these assets pose a risk to public safety.
Asset Improvement Activities Corridor improvement programme. New technology and the rollout of LED street lighting – currently in Stage 2 with completion in XXX. Expected to deliver power and maintenance savings of \$73m over a 20-year period. Improvements to areas with known lighting deficiencies. Visuals?? Case study??	Asset Disposals Aluminium lighting columns are 100% recyclable, lightweight, maintenance free and impact-safe, non-aluminium components are designed to be easily separated at the end of the useful life. Contractors are encouraged to reuse or recycle assets where possible.

FINANCIAL PROGRAMMES	
Historical Costs	Proposed Programmes

Street Lighting Asset Class Management Plan



IMPROVING OUR PRACTICES

Street Lighting Asset Class Management Plan

Key result area ^a	Actions ^a	AMP Section ^a	Priority ^a	Status ^a
Finance ^a	Complete asset valuation of the street light assets in old Franklin areas currently owned by Counties Power as part of due diligence. ^a	Current status ^a	Medium ^a	Yet to start ^a
Finance ^a	Start tracking historical expenditure trends of street lighting operation and maintenance, and renewal expenditure by asset type and expenditure type. ^a	O&M, Renewals ^a	High ^a	Yet to start ^a
Finance ^a	Understand the impact of maintenance budget reductions on the service levels. ^a	LOS, O&M ^a	High ^a	Yet to start ^a
Service Delivery/Asset Management ^a	Install a formal feedback loop so the Street Lighting Team is informed about changes in traffic volume data to enable the currency of the lighting registers. ^a	Current status, Key issues ^a	Medium ^a	In process ^a
Service Delivery/Asset Management ^a	Undertake testing programme to identify old columns at risk with any unplanned additional loading such as banners particularly in the old Central areas. ^a	Risk, Current status ^a	High ^a	Yet to start ^a

1 About this plan

This asset class management plan explains how Auckland Transport will manage Auckland's street lighting assets over the coming three years.

It draws on what we know about the activities and costs required to manage these assets in the past, to plan how we will continue to manage them in the future.

The plan describes, in depth, the assets it covers, and how we will maintain and develop those assets to provide the services that Auckland needs. This includes information about:

- the asset network
- the levels of service the assets provide
- the impacts of growth and demand
- how we manage risk
- how we manage the assets throughout their lifecycle and the investment needed to enable this
- how we plan to improve particular assets and why.

1.1 How this plan fits in our asset management framework

Auckland Transport manages a significant network of transport assets. Together, they provide safe, efficient and effective transport services for the Auckland region.

Auckland Transport develops plans for these assets to ensure that the network and its services are efficiently managed.

There are two levels of plans:

- an overarching network-level asset management plan, which acts as an umbrella plan, capturing all of the network's requirements
- asset class management plans, which focus on the requirements of each of the 15 asset classes. The asset class management plans are designed to be used in conjunction with the asset management plan.

Figure 1-1 shows how this asset class management plan fits into Auckland Transport's overall asset management framework.

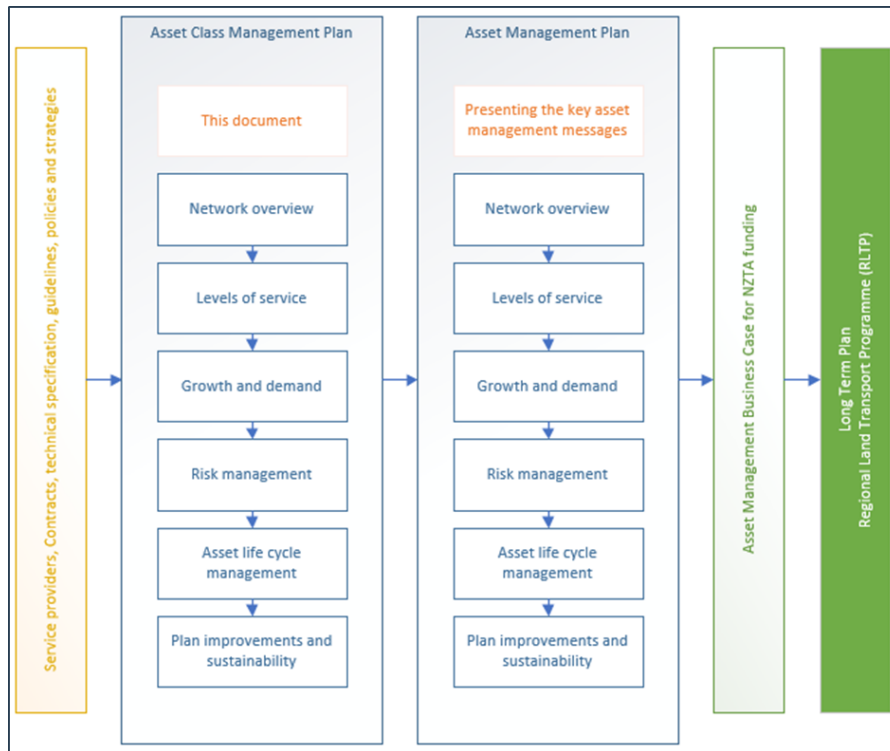


Figure 1-1: Auckland Transport's asset management framework

1.2 Relationship to regional and national plans

Auckland Transport's asset class management plans and asset management plan feed into Auckland Council's and the government's asset management regimes. Together, they enable Auckland Transport to deliver a strategic response to:

- the Auckland Plan, which sets out a comprehensive 30-year strategy for Auckland's growth and development
- the Government Policy Statement on Land Transport, which sets out the government's priorities for investment in land transport over the next 10 years
- the Auckland Regional Land Transport Plan 2018-2028, which is a 10-year investment programme of works for transport in Auckland. The regional land transport plan was developed by Auckland Transport, together with the Waka Kotahi NZ and KiwiRail to respond to the growth and other challenges facing Auckland over the next decade.

Figure 1-2 shows how the various strategic and planning documents work together.

Street Lighting Asset Class Management Plan

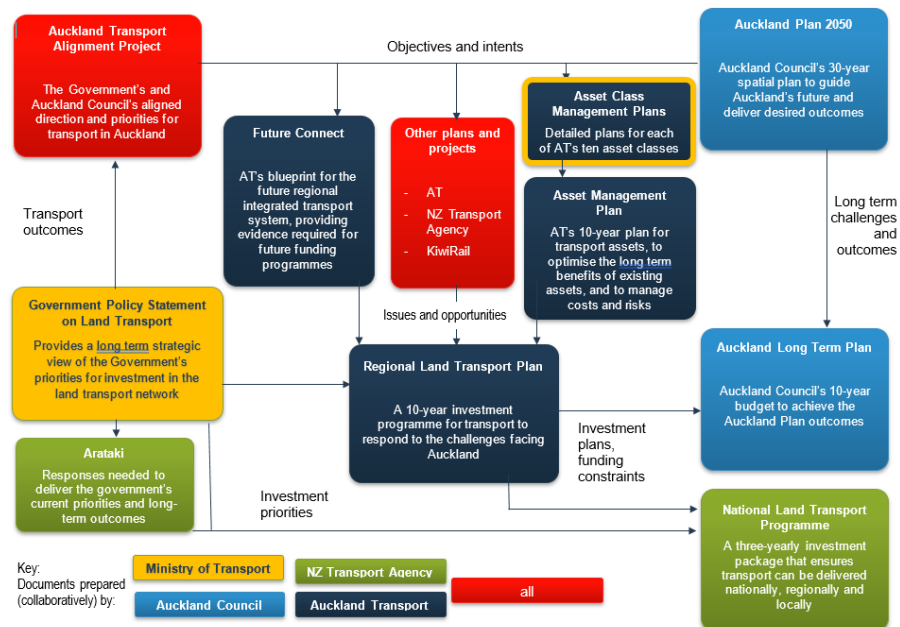


Figure 1-2: National and regional transport asset management planning documents

Source: Asset management team (to be updated)

1.3 The importance of street lighting assets

Street lighting is an important amenity and an essential part of Auckland's transport network.

Good street lighting enables vehicles and pedestrians to move safely and easily within the transport network, during the hours of darkness. It improves road safety, reduces night-time road traffic accidents, improves security for pedestrians and neighbourhoods, and aids crime prevention. It also encourages night-time use of local facilities and active transport modes, such as walking and cycling.

Auckland Transport works closely with the New Zealand Police to improve lighting standards in areas where public safety is a concern. This work is set to continue, with the aim of increasing night-time activities and use of local facilities, developing and revitalising pedestrian-friendly areas, and encouraging use of public transport and active transport modes.

2 Assets covered by this plan

In this section we outline the number and classes of the assets covered by this plan, and provide an overview of their current condition, age, performance and valuation.

We also consider the data we need to collect to be able to manage these assets effectively, and describe how that data is collected through inspections.

2.1 Responsibility for managing assets

In general, Auckland Transport owns and manages street lights located within the Auckland-Transport-owned road corridor.

Auckland Transport-owned street light luminaires may also be attached to poles owned by other infrastructure agencies, including telecommunication companies (such as Vodafone, Telecom) and power companies (such as Vector, Mercury).

Auckland Transport has recently purchased 110 street lights in Franklin ward, which were previously owned by Counties Power, but are now owned and managed by us.

The Waka Kotahi NZ is responsible for street lights associated with the motorway and state highway networks.

Auckland Council is responsible for street lights in parks, council carparks, and other public recreation areas.

2.2 Numbers and components of assets

Auckland Transport's street lighting network illuminates 4,585km of local urban roads, footpaths and accessways, and 332km of cycleways and shared paths, as well as car parks, bus shelters and public transport centres. Belisha beacon lighting on pedestrian-crossing poles are also part of our network.

Over the past few years, this network has grown by approximately 2.5 per cent each year (an estimated 3,000 new lights a year). **It is expected to continue to grow at the same rate for at least the next 5 years.** This growth is mainly as a result of new subdivisions, the overhead-to-underground (OHUG) in-fill lighting programme, cycleway projects and road corridor improvement projects.

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Street lighting within the network is made up of the following key components:

- columns – also known as poles or vertical support poles
- brackets and outreach arms – the structural members that attach luminaires to columns
- luminaires – also known as lanterns, lamps and light bulbs, these include the control gear and housings
- light point controller or luminaire controller – a control interface that enables luminaires to communicate with the tele-management system for lighting control. Auckland Transport is currently installing controllers in all of its LED luminaries to enable more energy efficient use of street lighting.

Figure 2-1 shows the components of a typical street light.

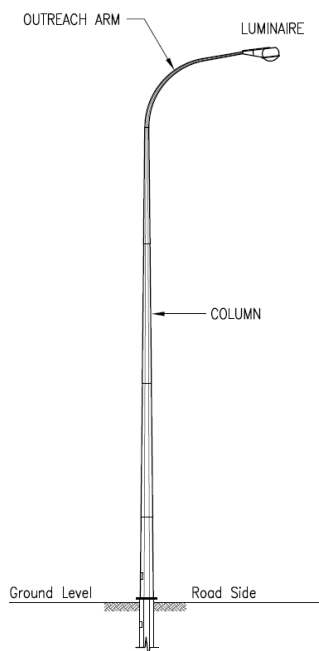


Figure 2-1: Typical street light

Figure 2-2 provides an overview of the street lighting network.

Street Lighting Asset Class Management Plan

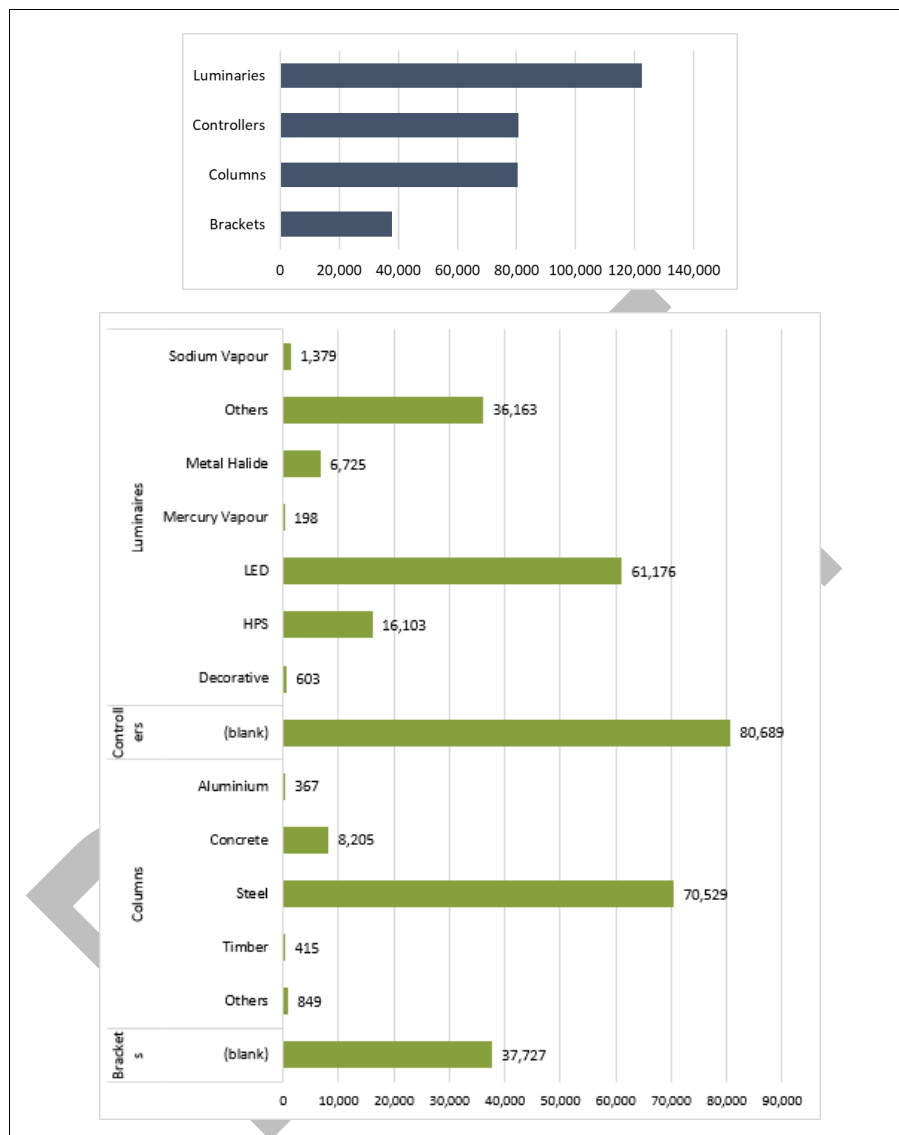


Figure 2-2: Street lighting network overview

Source: Auckland Transport RAMM database (March 2021)

Auckland Transport's RAMM database holds an inventory of our street lighting assets, including their location, model, type and management area, among other details. See Appendix A for a detailed breakdown of our street light assets by management area.

2.3 Current condition of assets

Asset condition is the key technical measure that Auckland Transport uses to indicate the quality of its street lighting assets, and to identify any maintenance or renewal requirements.

The condition of Auckland Transport's street lighting assets is surveyed as part of the 3-yearly visual inspections conducted by our street light maintenance contractors.

These condition rating surveys follow the New Zealand Institute of Highway Technology methodology, and take into account safety factors, structural defects, and the aesthetic and visual amenity of street lights.

This information from the surveys is captured in Auckland Transport's RAMM database, with each asset assigned a condition grade, ranging from 1 (being 'very good') to 5 (being 'very poor').

Figure 2-3 shows the condition profile of Auckland Transport's street lighting assets, by region. See Appendix A for a breakdown of these condition profiles, by component and management area.

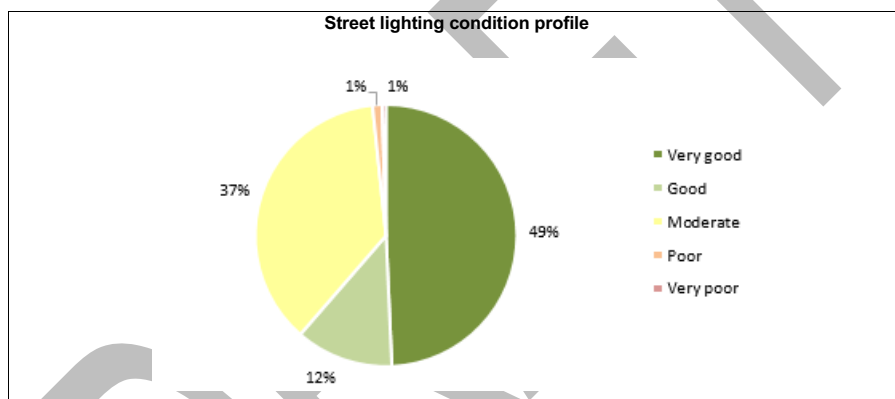


Figure 2-3: Street lighting condition profile

Source: Auckland Transport RAMM database (March 2021)

Figure 2-3 shows that:

- 99 per cent of street light assets are in average and above condition, and only 1 per cent are in poor and very poor condition
- 1 per cent of assets are in an unknown condition.

2.4 Age and expected lives of assets

Age is another factor that influences whether and when Auckland Transport's street lighting assets are renewed or replaced. We use information about the expected lives of assets and their current age, to project their remaining useful lives.

The average expected useful lives of our existing street lighting assets, regardless of their materials or types, are:

Street Lighting Asset Class Management Plan

- columns – 30 - 50 years
- brackets – 40 years
- luminaires – 15 years.

New street light columns are designed to have an expected life of 50 years, while new LED luminaires have an expected life of 20 years.

In the past, information about the age and build date of our street lighting assets has not been consistently or accurately recorded in RAMM. As a result, data about the age of columns and brackets is only 46 per cent complete in RAMM; and is more uncertain than the data we hold about the assets' condition.

Figure 2-4 shows the current (known) age profile of Auckland Transport's street lighting assets.

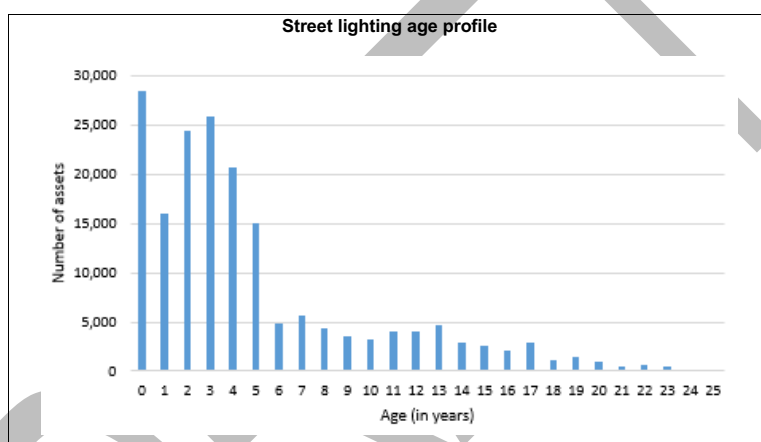


Figure 2-4: Street lighting age profile

Source: Auckland Transport RAMM database (March 2020)

2.5 Performance and standards of assets

2.5.1 Standards that apply to the assets

The design for street lighting in any new development must comply with AS/NZS 1158¹ and the Auckland Transport's Transport Design Manual, which provides guidance on the acceptable street lighting standards for different categories and types of road.

All new and replaced luminaires used in the network must be from the approved list of luminaires in the Transport Design Manual.

Auckland Transport uses an online tool called The RightLight to help select and manage its street lighting assets. The tool provides information on the optimal standards, designs and technical solutions to use to achieve cost-effective road lighting in New Zealand. It was developed by multiple agencies, including local authorities, the Waka Kotahi NZ, road lighting

¹ Australian/New Zealand Standard 1158.1.2:2010 Lighting for roads and public spaces - Vehicular traffic (Category V) lighting—Guide to design, installation, operation and maintenance (June 2010)

specialists, Local Government New Zealand and members of the AS/NZS 1158 standards committee. It covers efficient lighting solutions for existing street light networks, as well as for new installations.

Auckland Transport actively manages performance of its street lighting assets to ensure they are efficient and up to standard. In particular, it ensures that all new and renewed street lights comply with the levels of luminance required by the Transport Design Manual.

Factors that affect the street lighting network's performance include:

- lamps (bulbs) burning out
- diffusers (opaque lantern covers) losing their effectiveness due to dirt or cracking with age
- cleanliness of the lantern covers
- corrosion, especially in coastal areas
- mature trees causing shadows
- changes in technology and their impacts on the effectiveness of existing lighting
- commercial lighting standards.

Auckland Transport's corridor delivery team manages the delivery of maintenance activities to address these, and other issues, that affect performance.

2.5.2 Projects to improve performance

Auckland Transport has three current programmes designed to improve the performance of its street lighting network – the LED retrofit, infill lighting and amenity lighting programmes.

2.5.2.1 LED retrofitting

Auckland Transport's LED retrofitting programme is replacing high-pressure sodium lamps with light-emitting diode (LED) lamps, and utilising a tele-management system. The tele-management system uses innovative *Streetlight.Vision* central management system (CMS) software.

Figure 2-5 shows how the whole tele-management system works.

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Street Lighting Asset Class Management Plan

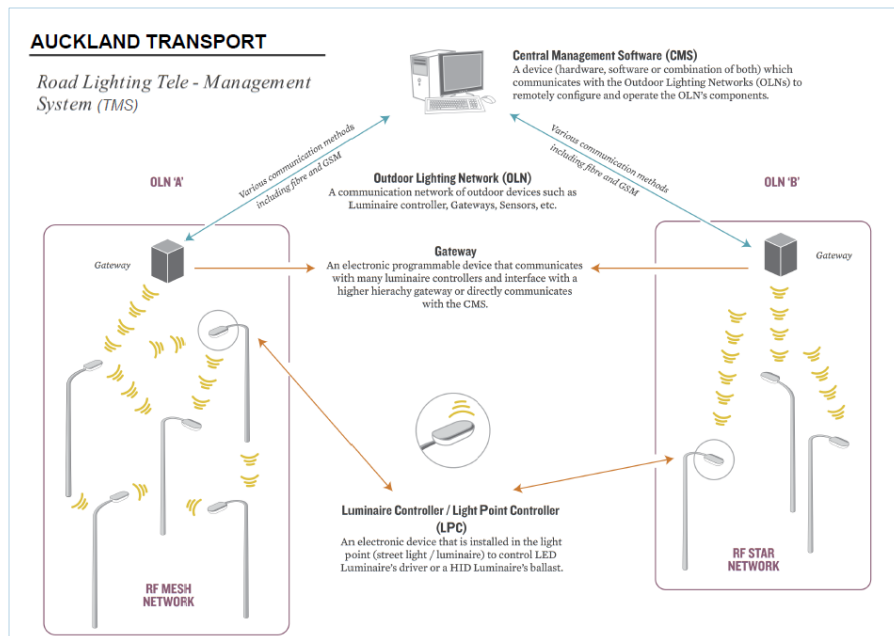


Figure 2-5: Auckland Transport tele-management system

Source: Auckland Street Light Network and Retrofit (presentation, 2016)

The LED retrofitting programme will provide cost, efficiency and performance benefits.

Electricity consumption is a major operational cost for Auckland Transport's street lighting network and has become a main driver for improving the network's energy efficiency.

Replacing high-energy-use luminaires with more energy-efficient LED luminaires will significantly reduce energy consumption. This reduction, after Stage 1 of the retrofit, was expected to be 11.2GWh per year, with a saving of about \$1.7 million per year, as shown in Figure 2-6.

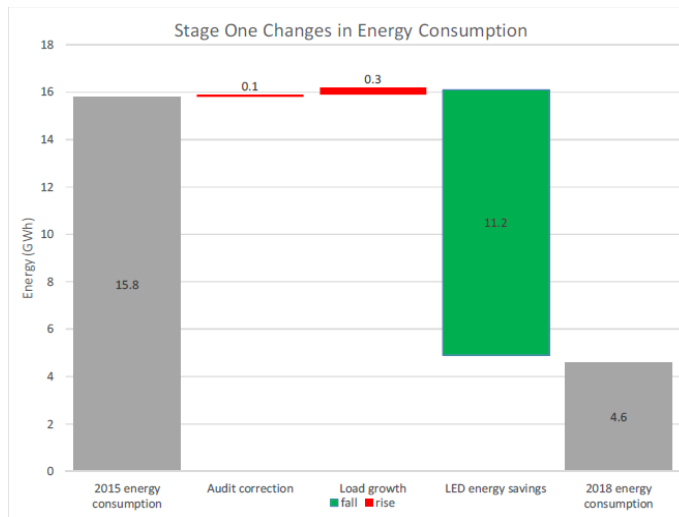


Figure 2-6: Changes in energy consumption from the LED retrofitting programme

Other benefits of using LEDs instead of high-pressure sodium lamps are:

- reduced maintenance, due to more reliable luminaires, with longer lives; at present, high-pressure sodium lamps are changed every 4 to 5 years, whereas the design life of an LED is 20 years, with an expected life of up to 25 years
- less light spill and road surface glare
- the white light produced by LEDs is internationally recognised as providing a safer environment for pedestrians and vehicles at lower electricity use.

Thirty thousand of the new LED lights have so far been connected to the tele-management system. The system provides robust management of street lighting assets and is expected to further reduce energy consumption by up to 20 per cent.

The benefits of the tele-management system are:

- controls individual lights within the network and better manages their luminance levels, by switching lights off and dimming them in off-peak times
- generates accurate records of actual energy use for each light and daily reports on lights that have not switched on or have remained on after sunrise (day burners), allowing real-time monitoring and control of the network
- removes the need for night patrols of the network and provides an enhanced customer service, as any lights that are out or on at the wrong time will be evident immediately. This should reduce the 750 street-light related calls received each month by our call centre.

2.5.2.2 Infill lighting

In the past, some residential areas, especially in north Auckland, were lit to 'country standard'. As a result, illumination levels in these areas do not meet the current standard.

Auckland Transport is improving lighting performance in these areas by installing infill lights, based on requests from residents and the police.

The capital cost to bring the network up to the standard is between \$1 million and \$2 million each year, for the next 10 years.

2.5.2.3 Amenity lighting

Amenity lighting improves pedestrian safety and an area's visual aesthetic appeal, and is installed mainly in town and suburban centres, including outdoor shopping precincts, malls, open arcades, town squares, civic centres and plazas.

In-ground luminaires are considered to be amenity lighting, as they are typically used to light trees, artistic or architectural features and pathways.

Auckland Transport currently owns around 2,500 amenity lights in the region. More are being installed as part of town centre developments. Depending on the type and features of these lights, their installation and maintenance costs can be quite expensive.

2.6 The street lighting asset data we collect and need

Auckland Transport needs good data about the core attributes of its street lighting assets. Having this data, enables us to manage these assets effectively and robustly.

Table 2-1 summarises the core asset data we collect.

Asset attribute	Description	Data requirements
Inventory	The intrinsic attributes of an asset	- Ownership - Age (installation date) - Location - Material - Dimensions
Unit cost	Cost of managing the asset over its full lifecycle	- Replacement cost - Maintenance cost history - Expected useful life - Expected deterioration profile
Condition	Physical condition of assets and their defects	- Based on recent inspections and asset condition rating surveys - Historical records of asset condition rating surveys
Performance	Measures the asset's safety and accessibility	- Customer satisfaction trends - Safety trends
Demand and loading	Measures demand and use of assets and services	- Monthly cycle counts - Network growth rates - Impact of growth

Table 2-1: Core asset data requirements

2.6.1 The quality of our inventory data

Good asset management planning requires good quality data. Auckland Transport iteratively reassesses its confidence in its asset data, and constantly works to improve it, through quality assurance regimes for data collection and entry, and by maintaining its asset information systems.

To this end, we have developed an asset data quality assessment tool, called Beagle, to validate the inventory data in our RAMM database.

Street Lighting Asset Class Management Plan

Auckland Transport's current confidence in its street lighting data is summarised in Table 2-2.

Asset component	Condition known	Age known	Ownership known	Condition updated in last 2 years
Columns	99%	46%	100%	93%
Brackets	100%	46%	99%	88%
Luminaires	99%	92%	95%	92%

■ High
 ■ Medium
 ■ Low

Table 2-2: Confidence levels for street lighting data

Source: Auckland Transport RAMM database (March 2017) (to be updated)

As Table 2-2 shows, there is a good level of confidence in most of the data attributes, except for the asset age data. This was because, historically, the installation date of street light columns and brackets was not recorded in RAMM.

Auckland Transport now ensures that this information is updated whenever assets are renewed or new assets installed.

2.6.2 Asset unit cost rates and valuation

Auckland Transport needs replacement unit cost rates for all key asset components. These rates are used to model asset performance and for investment planning. The rates are updated annually to capture fluctuations and market movements in asset construction costs.

The current unit costs and base lives for Auckland Transport's street lighting assets are shown in Table 2-3.

Asset class	Asset types	Base life (expected useful life)	Unit rate (per unit)
Street lighting	Columns	30 years (average of all types) 50 years (new types with improved specifications)	\$4860
	Brackets	40 years	\$342
	Luminaires	15 years (average) 20 years (for LED)	\$371
	Light point controllers	15 years	\$196

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Table 2-3: Base lives and unit cost rates for street lighting

Source: ROM; Auckland Transport Road Corridor Delivery group (to be updated)

Auckland Transport undertakes a full valuation of its infrastructure assets every 3 years. The valuations are updated annually, based on a fair value assessment.

A summary of the latest full valuation, completed in June 2017, for street lighting assets is provided in Table 2-4. This valuation shows that the total replacement value for street lighting assets is \$231.8 million, with a total depreciated value of \$124.4 million, and annual depreciation of \$9.3 million.

Street Lighting Asset Class Management Plan

Asset	Optimised replacement cost (\$M)	Optimised depreciated replacement cost (\$M)	Annual depreciation (\$M)
Poles	\$210.3	\$109.8	\$8.9
Controllers	\$12.1	\$10.9	\$0.5
Brackets	\$16.8	\$7.1	\$0.8
Luminaries	\$46.1	\$37.5	\$2.1
Total	\$285.3	\$165.3	\$12.2

Table 2-4: Valuations and depreciation of street lighting assets

Source: Auckland Transport Infrastructure Revaluation Report (June 2020)

3 Levels of service

This section describes the levels of services that Auckland Transport aims to provide from its street lighting assets. The levels of service stipulate how the assets are expected to perform in key areas.

Street lighting assets are an essential parts of Auckland's transport network. The services that these assets provide contribute to society's need for travel and accessibility, and help achieve social, economic and cultural well-being outcomes. It is vital that they, and their critical components, are maintained at an acceptable condition and have appropriate levels of risk associated with them.

3.1 Levels of service framework

Auckland Transport's levels of service framework demonstrates how the services that our assets provide align with our overall objectives and outcomes. It also shows how they satisfy the requirements of the national One Network Road Classification framework, in particular those requirements relating to safety, amenity, accessibility, travel time reliability and resilience.

The levels of service framework is available through [Sharepoint](#).

3.2 How we set levels of service

Auckland Transport's key stakeholders all have different expectations of the levels of service that the transport network will provide. We consult regularly with stakeholders in order to better understand these expectations and what is required to provide them with a better experience of the network.

Figure 3-1 provides a high-level overview of how Auckland Transport links the customer outcomes, network level of service, asset performance and financial requirements for its street lighting assets, in order to develop levels of service for them.

The starting point is customer outcomes, which provide a clear direction for how the overall network should be managed. This in turn indicates what standard each asset must perform to and the funding required to keep all of the assets in the network performing in line with customer requirements.

Street Lighting Asset Class Management Plan

CUSTOMER	NETWORK	ASSET	FINANCIAL
Outcomes are safe access for travel across the roading network	Level of service to provide safe access across the roading network	Assets perform their service to allow safe access across the roading network	Funding provided to pay for work programmes needed for assets to perform their required service
Customer outcome requirement is for: • safety • amenity • accessibility	Network service requirement is for: • street lighting to provide safe movement and amenity of road users Measured by: • accidents and injuries contributed by failure of street lighting • unavailability of the services	Asset requirement is for: • street lighting condition • street lighting performance These assets need to be sustained by work programmes of: • operations • maintenance • capital renewals • capital improvements	Funding work programmes: • operations • maintenance • capital renewals • capital improvements

Figure 3-1: Process for developing levels of service

Table 3-1 sets out our key stakeholders, their areas of specific interest, and how we consult or communicate with them.

Stakeholders	Areas of interest and expectations	Consultation or feedback method used
Transport customers (residential)	The main improvements suggested by: • residential road users: ◦ smooth roads Auckland-wide ◦ quality roads in local areas ◦ safety • footpath users: ◦ smooth footpaths ◦ more and continuous footpaths ◦ well-maintained footpaths • cyclists: ◦ more provision for cyclists ◦ wider cycle lanes ◦ improved safety • public transport users: ◦ more frequent services ◦ reduced fares ◦ improved punctuality and reliability (especially of trains).	• Auckland road user satisfaction survey – residential • Auckland Transport research panel findings
Transport customers (commercial)	The main improvements suggested by commercial road users: • improve traffic flow • improve public transport.	Auckland road user satisfaction survey – commercial
Auckland residents and ratepayers	Aucklanders want: • public transport, but it must be convenient, reliable and quicker • to walk and cycle, but it must be safe • better transport, but they have mixed views on how to raise the additional investment required • current funding to be reallocated more favourably towards public transport, walking and cycling.	Feedback on Auckland Council's Draft Long-Term Plan, as summarised in the Auckland Regional Land Transport Plan
Auckland Council	• Deliver the outcomes in the Auckland Plan and Unitary Plan. • Provide value for money.	• Auckland Transport's annual Statement of Intent • Elected member liaison team

Street Lighting Asset Class Management Plan

Stakeholders	Areas of interest and expectations	Consultation or feedback method used
Local boards	- Generally support Auckland Transport projects. - Central local boards favour more walking and cycling projects. - Outer (rural and semi-rural) local boards favour more sealing of unsealed roads.	Elected member liaison team
Other council-controlled organisations	Integrated planning, including: - for the CBD, with Waterfront Auckland and Auckland Council Property Ltd - for events, with Auckland Tourism, Events and Economic Development.	- Direct liaison - Joint working groups
Waka Kotahi NZ Road Efficiency Group	- One Network Road Classification requirements. - Deliver government policy statement outcomes. - Provide value for money. - Partnership projects, including the Auckland Transport Operations Centre.	- National One Network Road Classification levels of service requirements, as stipulated by the Road Efficiency Group - Direct liaison - Non-voting member on Auckland Transport's board
KiwiRail	Auckland Transport rolling stock and station assets are well maintained and meet appropriate safety standards.	Direct liaison
Ports of Auckland and Auckland International Airport Ltd	- Arterial road efficiency and reliability for carrying freight. - Integrated planning.	Liaison with industry groups
Mana whenua	Mana whenua want: - a good relationship with Auckland Transport - Auckland Transport to recognise te ao Māori (the Māori world view) - a set of overarching principles for te ao Māori - the Mauri Model method (Māori values) reflected in prioritisation.	- Independent Māori Statutory Board - Tamaki Regional Mana Whenua Forum - Tamaki (Treaty Negotiations) Collective - Auckland Transport Māori relationships team engagement with runanga, iwi and hapu authorities
Industry and customer groups (including the Road Users Forum, Business Forum, and walking and cycling advocates)	- Integrated planning. - Network efficiency and reliability. - Specific network improvements. - Access to properties.	Direct liaison and through industry groups
Utilities (including Watercare, Telecom and Vector)	- Corridor access. - Programming.	Direct liaison and through industry groups
Adjoining road corridor authorities	- Network services alignment. - Standards and protocols.	Direct liaison
Transport operators	- Customer service experiences. - Travel time reliability, and bus priority. - Public transport demand. - Network performance. - Scheduling, ticketing and information systems. - Service subsidies.	Through commercial franchising model.

Table 3-1: Stakeholder consultation, areas of interest and expectations

3.3 How we measure levels of service

In general, three types of levels of service are measured– each type focusses on different aspects of an asset's performance.

Governance key performance indicators:

Street Lighting Asset Class Management Plan

- are high-level indicators related to governance relationships, such as the statement of intent between Auckland Transport and Auckland Council
- are established through agreements with our key stakeholders, based on past performance and the impact on decision-making (i.e. alignment with government policies, and the need to achieve a sustainable balance between risk tolerance, available funds and standards of service).

Customer levels of service:

- describe what key stakeholders can expect when using the services
- are mainly related to the performance of assets
- are established from customer consultation and feedback, benchmarking among peer groups, the One Network Road Classification and industry best practice.

Technical levels of service:

- describe the standards of operation, maintenance and renewal activities that relate to an asset or group of assets
- relate mainly to the condition and operating environment of the assets
- ensure assets are preserved
- help deliver on customer expectations
- build data confidence
- are established using accepted thresholds of asset condition, operational standards, availability of funds and industry best practice.

3.4 Governance key performance indicators

Table 3-2 sets out the governance key performance indicators that Auckland Transport uses for its street lighting assets.

Asset management key result area	Asset management key service value	Asset management level of service	Performance or service measure	Current performance (at December 2019)	Target performance 2020–2024
Sustainable	Environmentally sustainable	Environmental sustainability priorities programmed	Reduction in CO ₂ e (emissions) generated annually by Auckland Transport corporate operations (from 2017/18 baseline)	7% increase	49% reduction
Safe	Road network safety	The road network is safer for all users	Deaths and serious injuries on Auckland local roads	430	Reduce

Table 3-2: Governance key performance indicators for street lighting

3.5 Customer levels of service

Table 3-3: sets out the customer levels of service that Auckland Transport uses for its street lighting assets.

These levels of services represent our customers' perceived performance of and satisfaction with Auckland Transport's street lighting assets.

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Asset management key result area	Asset management key service value	Asset management level of service	Performance or service measure	Current performance (at December 2019)	Target performance 2020–2024
Safe	Road network safety	The road network is safer for drivers and vehicle passengers	Deaths and serious injuries where loss of driver control at night was a contributing factor	29	0

Table 3-3: Customer levels of service measures for street lighting

3.6 Technical levels of service

Table 3-4: sets out the technical levels of service that Auckland Transport uses for its street lighting assets.

Technical levels of service aim to interpret customer levels of service into measurable indicators that reflect effective, efficient, safe and sustainable transport services.

Asset management key result area	Asset management key service value	Asset management level of service	Performance or service measure	Current performance (at March 2021)	Target performance 2021–2024
Sustainable	Environmentally sustainable	Environmental sustainability priorities programmed	Percentage of network installed with energy efficient street lighting (LED lamps)	62%	66%
Safe	Condition	Assets are well maintained	Percentage of street light brackets in acceptable condition	99.5%	81%
			Percentage of street light columns in acceptable condition	98.3%	88%
			Percentage of street light luminaires in acceptable condition	99.1%	93%
Safe	Road network safety	The road network is safer for all users	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 at commercial centres – 6 lux	>90%	100%
			Compliance with average level of illumination at major intersections – 7.5 lux	90%	100%
			Compliance with average level of illumination on residential streets – 2 lux	50%	100%
		The road network is safer for drivers and vehicle passengers	Deaths and serious injuries where loss of driver control at night was a contributing factor	29	0

Table 3-4: Technical levels of service measures for street lighting

Sources: Auckland Road User Satisfaction Report; Auckland Transport Statement of Intent; One Network Road Classification performance reporting tool; Auckland Transport RAMM database

4 Growth and demand

4.1 Growth of Auckland

Auckland is growing rapidly, and Auckland Transport must keep up with the growing demand for transport assets and services created by population growth and economic development.

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 paint an optimistic picture of population growth and economic development. Auckland's population is forecast to grow by over 260,000 people over the ten years of this plan, and there will be over 100,000 more jobs, as shown in Figure 4-1.

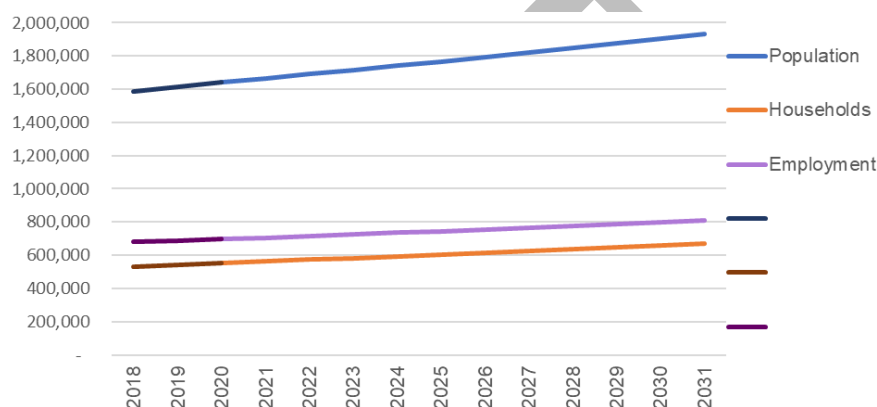


Figure 4-1: Auckland population growth 2018 to 2031

Sources: Statistics NZ; Auckland Council

There will be around 10,000 new households established each year. Figure 4-2 shows the distribution of this growth, and demonstrates that all areas of Auckland are growing. Although the rate of growth as a percentage is highest in the South Rural and North Rural areas (Franklin and Rodney local boards) the biggest growth in terms of absolute numbers of households will be on the Central isthmus.

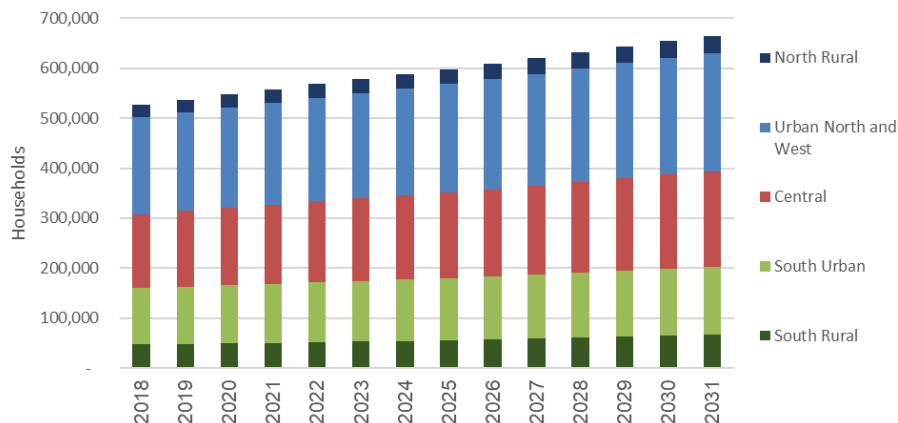


Figure 4-2: Household growth, from 2018 to 2031, by road management area

4.2 Overall response to 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 highway and local road improvements. However the plan recognises that there are few cost-effective options to add significant roading capacity within the Auckland urban area, and that any benefits from added capacity are likely to be short-lived.

To ensure that population growth does not translate into more congestion, reduced accessibility and a poorer quality city, Auckland Transport is investing in public and active transport, and optimising the existing transport network to improve safety and address traffic congestion.

As asset managers, we need to adapt our processes and priorities for a more diverse transport network. We cannot be customer focused if we assume that our customers are necessarily in cars. Over time the role for rail freight and public transport will expand, and more local trips will be made by walking and cycling. This shift is already underway, with more people travelling on key Auckland arterials by bus than by car, as shown in Figure 4-3.

Street Lighting Asset Class Management Plan

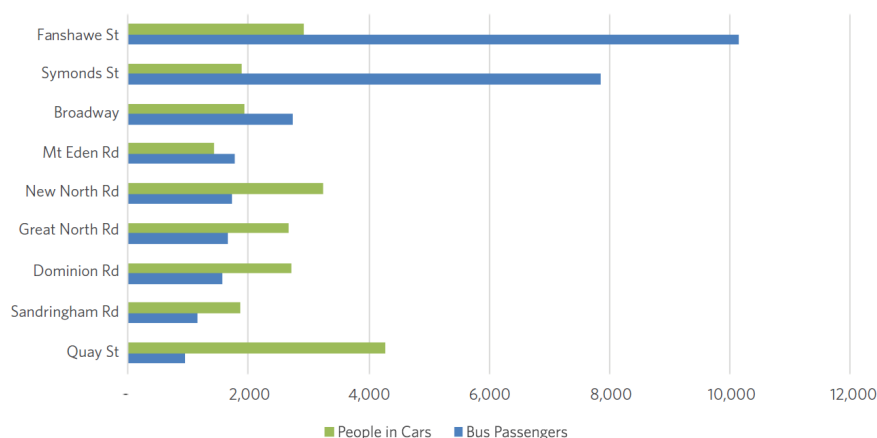


Figure 4-3 Inbound morning peak travel on key Auckland arterials

Source: Auckland Regional Public Transport Plan, Auckland Mode Shift Plan

4.3 Impacts of growth on streetlighting

Growth affects the maintenance and renewal of streetlighting in four main ways:

1. More assets are added to the transport network, leading to consequential maintenance and renewals costs.
2. Auckland Transport commits to reducing carbon emission and light pollution by installing energy efficient LED lights in the network.
3. The network urbanization identifies lighting improvement within the network. This involve installation of infill light in the network to meet the required standard.
4. Auckland's construction boom leads to a "seller's market", with higher prices for all of the components of installation and repair, from supply of products to engineering advice.

These pressures apply across the whole of Auckland, because the whole region is growing as shown in Figure 4-2.

4.3.1 Network expansion

The Auckland streetlighting network is expanding by around 2,300 lights per year, or 2.2%, as the sealed road network expands by around 75 km per year, or 1.1%, as shown in Figure 4-4. The streetlighting network expands due to:

- **Urban development** – Streetlights are installed on new local roads constructed in greenfields growth areas such as Whenuapai and Pinehill. Some new roads are also constructed as part of major "brownfields" developments within the urban area.
- **Auckland Transport capital programmes** – Streetlights are installed as part of new road pavements constructed by Auckland Transport. A new Eastern Busway from Panmure to Pakuranga is under construction, and the 2021 Regional Land Transport proposes new roads including Penlink and the Matakana Link Road.

Street Lighting Asset Class Management Plan

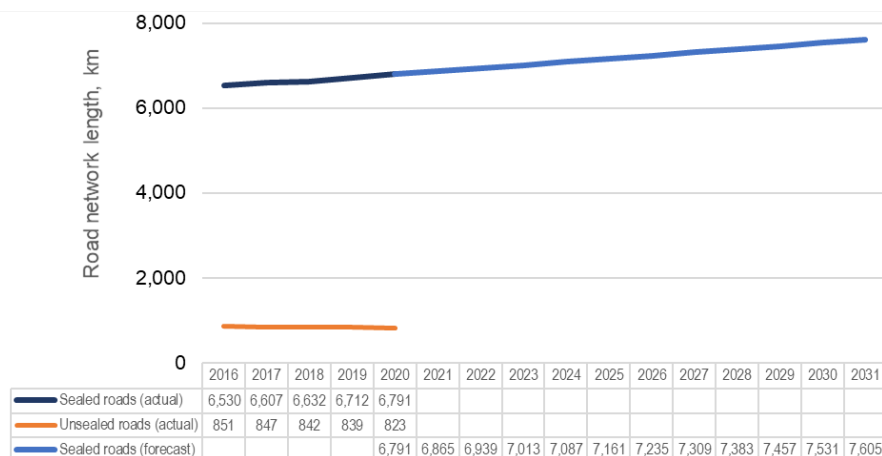


Figure 4-4: Growth in the sealed road network (to be replaced with SL growth)

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

4.3.2 Network efficiency and sustainability

Auckland Transport commenced the LED retrofit programme in 2015, to replace high-pressure sodium lamps with more energy efficient light-emitting diode (LED) lamps. This programme has been implemented into two stages over 8 years with a total capital cost of approx. \$67million. This initiative also involves the installation of a tele-management system for these lights added an additional capital cost of \$22 million.

4.3.3 Improving levels of service

In concurrence with the land use changes, Auckland Transport requires to carry out lighting improvement by installing infill lights where illumination levels do not meet the standards. The capital cost to bring the network up to the standard is anticipated to be between \$1 million and \$2 million each year, for the next 10 years.

4.3.4 Higher unit prices

Prior to Covid-19, Auckland was experiencing a major construction boom, with the value of building consents issued climbing above \$1 billion for the first time, with [more cranes on the Auckland skyline](#) than in any US city.

AT's three key contracts for maintenance and renewals of streetlighting were procured in 2019 and the overall management fees and costs per unit of work have been increased as labor rate rises, traffic management costs and new specification changes in the new contracts.

Street Lighting Asset Class Management Plan

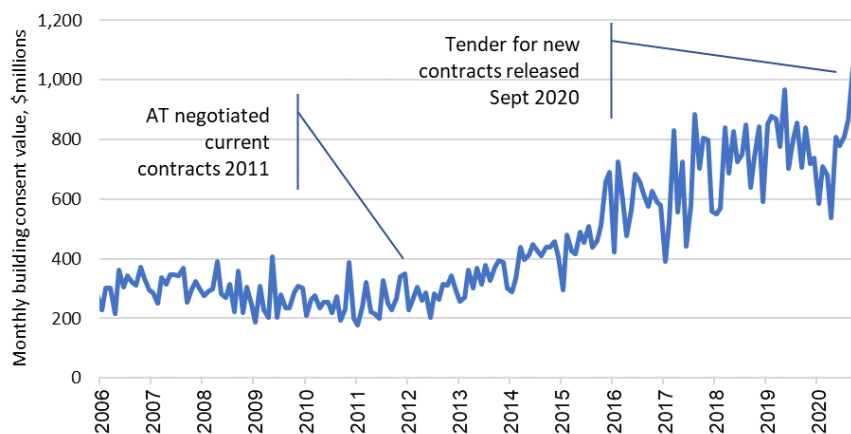


Figure 4-5: Auckland monthly building consent value, 2006 to 2020

Source: Statistics NZ

Although the impact of Covid-19 is clearly visible in the data for Quarter 1 2020, recovery has been swift. In September 2020, the monthly value of building consents issued in Auckland exceeded \$1 billion for the first time.

5 Risk management

5.1 Why we manage risk

Risk can be defined as the “Effect of uncertainty on objectives” – ISO 55000:2018(E), Section 3.1.

Risk events are “events which may compromise the delivery of the organisation’s strategic objectives” – International Infrastructure Management Manual, 2015.

Auckland Transport manages risks across all of its functions so it can achieve its objective of ‘easy journeys’ for all transport users.

Risk management is crucial for achieving the right balance between the costs of delivering services and the levels of service provided. This inter-relationship, and the trade-off involved, is illustrated in Figure 5-1.

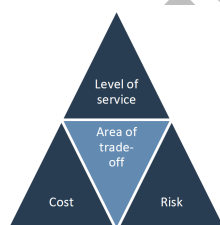


Figure 5-1: Trade-offs between levels of service, risk and cost

Auckland Transport’s Enterprise Business Plan has two key outcomes related to risk:

- undertake a risk-based approach to delivering safe transport initiatives in to the community
- increase resilience of the current transport network to support response to disruption and provide for continuity.

Asset management is one of 15 key risks that Auckland Transport has recognised in its Organisational Risk Management Framework. The organisation’s risk appetite with respect to asset management is defined in Table 5-1: .

Key risk	Appetite Low – Mod – High	Risk appetite statement
Asset management		We have a low appetite for events which may adversely affect our critical assets.
		We have a moderate risk appetite for events which may adversely affect how we maintain our assets at a good operating level.

Table 5-1: Auckland Transport risk appetite for asset management

Source: Organisational Risk Management Framework (Section 2.3: Risk appetite and tolerance)

5.2 How we manage risks

Auckland Transport divides its risk management activities into three groups:

Street Lighting Asset Class Management Plan

- planning risks
- service delivery risks
- management risks.

The key areas of risk within these groups are shown in Figure 5-2, together with the avenues we use to identify risks.

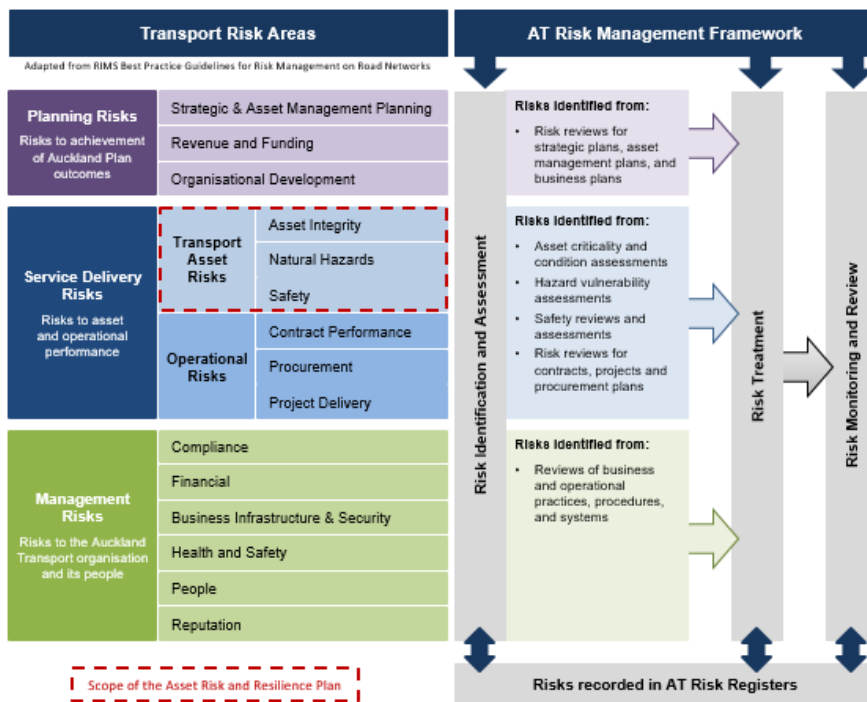


Figure 5-2: Auckland Transport's risk management process

Auckland Transport's Organisational Risk Management Framework defines the overarching policies and procedures we use to identify, assess, treat and monitor risk, at an appropriate level. The process encapsulated in the framework adopts *AS/NZS ISO 31000:2018 Risk Management – Principles and Guidelines*, enabling a structured risk management approach.

Auckland Transport uses the framework to manage organisational risks across the major functional areas, including safety, business continuity, reputation, customer and asset management.

Through formal risk assessments, we analyse and review key organisational risks and their associated mitigation measures, and report on these to management, with the information used to support risk management initiatives.

Auckland Transport uses Active Risk Manager (ARM) to document, manage and monitor risk information in the organisational risk register. The register provides a central repository for information about transport risks, with details of the risk owners, mitigation plans, and

monitoring and reporting requirements. Our organisational risk management plans are regularly reviewed by the Executive Leadership Team and the Finance, Capital and Risk Committee of Auckland Transport Board.

5.3 Criticality framework and assessments

Auckland Transport has adopted a Criticality Framework for Transport Infrastructure.

The framework defines criticality as 'a measure of the severity of an outcome'; while critical assets are those that are likely to result in a more significant financial, environment and social costs, in terms of their impact on organisational objectives (International Infrastructure Management Manual, 2015).

The criticality framework provides a systematic and structured approach for carrying out criticality assessments on transport infrastructure assets, in both the road and public transport networks. The approach is a two stage one, looking at an asset's:

- network-level criticality
- asset-level criticality.

The combined results from the network-level and asset-level assessments provide the overall criticality of transport infrastructure assets and are used to support day-to-day decision-making around lifecycle management, including planning, programming and prioritising maintenance and renewal works, risk management and investments.

5.3.1 Network-level criticality assessments

For network-level criticality, assessments take into account different factors, depending on the location of the asset.

For assets located in the road corridor, these include:

- One Network Road Classification – provides an established functional classification for roads, covering traffic volumes, economic criteria, accessibility, connectivity and the like
- lifeline routes – provide access to lifeline utilities (such as water, wastewater, power and telecoms) or a lifeline evacuation route that enables Auckland to respond and recover from hazard events
- essential services – provides access to facilities and services that are essential to the social wellbeing of the community.

For assets that are part of public transport and parking facilities, these include patronage, as the number of people using the facility reflects its importance in facilitating access and connectivity to transport.

The result of the network-level assessment is summarised on a scale of 1 (being 'vital') to 5 (being 'minor'). The numbers of critical street lighting assets coming within criticality level is shown in Table 5-2.

SL Assets	Level 1	Level 2	Level 3	Level 4	Level 5	TBD	Total
Columns	8,789	7,644	10,370	8,810	37,346	7,406	80,365
Brackets	2,213	2,788	7,023	6,921	18,338	444	37,727
Luminaires	11,817	10,962	18,481	16,369	56,367	8,351	122,347
Controllers	6,009	5,964	10,275	11,674	42,848	3,919	80,689

Table 5-2: Critical street lighting assets

5.3.2 Asset-level criticality assessments

For asset-level criticality, Auckland Transport adopts a qualitative approach to assessment that considers three key factors:

- impact of an asset failure on safety outcomes
- impact on levels of service and efficiency of operation
- impact on cost to repair or replace – i.e. whole-of-life cost.

5.3.3 Current condition of critical assets

Auckland Transport inspects street lighting assets, and records the severity of defects of their major components using a condition rating scale ranging from 1 (very good) to 5 (very poor).

The current condition these assets based on their network criticality is shown in Table 5-3. Assets that are located on highly critical corridors and that are in poor or very poor condition are given priority when managing the street lighting network.

Count		Asset Condition												Total
		Very good		Good		Moderate		Poor		Very poor		Unknown		
		Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	Qty	%	
Criticality Level	Vital	8,753	30.4%	3,034	10.5%	10,400	36.1%	361	1.3%	137	0.5%	6,143	21.3%	28,828
	Major	9,053	33.1%	2,425	8.9%	9,241	33.8%	381	1.4%	123	0.4%	6,135	22.4%	27,558
	Significant	16,043	34.8%	4,992	10.8%	13,603	29.5%	675	1.5%	354	0.8%	10,482	22.7%	46,149
	Minor	16,490	37.7%	3,638	8.3%	11,270	25.7%	322	0.7%	165	0.4%	11,889	27.2%	43,774
	Local	56,862	36.7%	13,132	8.5%	40,342	26.0%	940	0.6%	304	0.2%	43,319	28.0%	154,899
	TBD	10,574	52.6%	1,686	8.4%	3,438	17.1%	128	0.6%	65	0.3%	4,229	21.0%	20,120
Total		117,775	36.7%	28,907	9.0%	88,294	27.5%	2,807	0.9%	1,148	0.4%	82,197	25.6%	321,128

Table 5-3: Network criticality versus condition for street lighting assets

Sources: Network criticality assessment; Auckland Transport's RAMM database

5.4 Asset management risks

Auckland Transport groups asset management risks into three broad categories:

- asset integrity – risks associated with the physical status of assets (their condition), design standards and construction quality
- natural hazards – risks arising from exposure to natural hazards and the vulnerability of assets
- safety – safety issues arising from the use of assets.

5.4.1 Asset integrity risks

Asset integrity risks include the risk of assets physically failing, having their function disrupted or providing reduced levels of service, due to their deterioration, issues with their design or construction, or exposure to various types of hazards. These risks are managed through operational activities throughout the asset's lifecycle.

Table 5-4: summarises the risks and mitigation controls Auckland Transport has identified with respect to asset integrity.

Asset integrity risks	Mitigation controls
Assets are designed inappropriately	Design and construct assets in compliance with Transport Design Manual requirements, Road and Streets Framework and the asset management policies
Assets are not maintained in good condition	- Inspect and monitor condition of the asset network - Prepare maintenance and renewal plans and programmes to ensure assets are maintained at the correct level of condition to provide the agreed levels of service
Assets do not provide value for money over their lifespan	- Ensure whole-of-life approach is implemented through planning, design, construction and maintenance phases of assets - Evaluate customer's expectations versus the delivery outcomes, and implement network improvements
Assets are not fit for purpose for the long-term sustainability of the network	- Understand changes within and surrounding the network to address them pro-actively - Plan pro-actively and implement network improvements through emergency management plans and resilience improvement plans

Table 5-4: Asset integrity risks and mitigation controls

5.4.2 Natural hazards risks

Transport infrastructure and services are prone to damage and disruption from natural hazards, such as earthquakes and liquefaction, coastal inundation, floods and tsunami. Proactive planning and mitigation controls to address these hazards will improve the resilience of the transport network and help future proof it and make it more sustainable.

Table 5-5 summarises the risks and mitigation controls Auckland Transport has identified with respect to natural hazards.

Natural hazard risk	Mitigation controls
Assets are damaged or services are disrupted due to unexpected natural hazard events	- Identify hazard types and assess the level of exposure and vulnerability to natural hazards - Identify areas at high risk and implement prioritised resilience improvement activities in these areas - Prepare emergency response plans for natural hazards - Secure emergency funds in response to natural hazard events

Table 5-5: Natural hazard risks and mitigation controls

Auckland Transport has assessed how exposed the transport network is to the following natural hazards:

- earthquake and liquefaction
- coastal inundation and sea-level rise
- flooding
- tsunami
- volcanic activity.

The assessment utilises available published datasets for the hazard info and identify the road segments interest the hazard extents.

The interim result of this assessment is summarised in

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

Table 5-6. The results will be used to develop a risk and resilience plan for critical infrastructure assets.

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
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Coastal inundation (2m sea-level rise 100 year)	3.20%	242km

Table 5-6: Road network exposed to natural hazards

5.4.2.1 Natural Hazard Risk Management Framework

Auckland Transport is developing a Natural Hazard Risk Management Framework for its transport network. The framework will assess the risks related to natural hazards, and will be used to prioritise risk mitigation measures and network resilience improvements.

Under the framework, natural hazard risks are assessed based on their:

- likelihood – the chance of a natural hazard event happening (hazard likelihood)

- vulnerability – the level of potential damage that could be caused if assets are exposed to the hazard (asset integrity)
- consequence – what effect a hazard event would have on transport objectives (criticality).

This approach is illustrated in Figure 5-3.

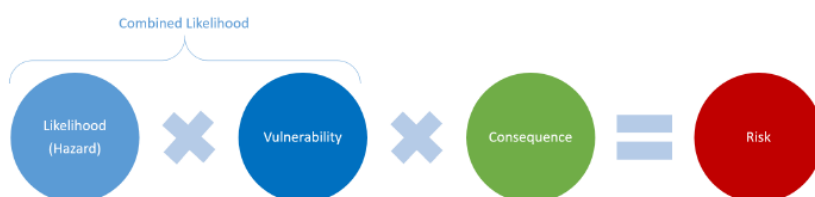


Figure 5-3: Asset risk management framework assessment approach

This natural hazard risk assessment will allow Auckland Transport to identify key risk areas and any assets that are likely to be exposed to natural hazard events, and give them a risk profile ranking from very low to very high.

The information will help decision-makers prioritise risk-mitigation initiatives in the highest ranked risk areas.

Once we have identified the priority risks, we will develop options to improve network resilience. Options will balance the cost and effort of their implementation against the benefits to be gained.

5.4.3 Safety risks

Safety risks relate to the death and injury of transport users, where asset failure or the inadequate provision of assets or services has been a key contributor.

The safety of the transport network depends on a number of factors, including:

- road condition (visibility, traffic volumes, road alignment, materials, design defects, maintenance defects, etc)
- road user behaviour (speed, fatigue, age, etc)
- vehicle condition (technical faults and defects).

Safety issues tend to manifest as incidents or crashes, and are likely to involve one or more of the factors listed above.

Table 5-7 summarises the risks and mitigation controls Auckland Transport has identified with respect to safety.

Safety risks	Mitigation controls
Assets create safety hazards	• Review and improve design, construction practices and methodologies • Review and improve asset maintenance and management strategies • Identify critical assets in the network, and maintain and improve asset integrity through operational activities • Identify locations of high crashes or incidents and implement network safety improvements

Street Lighting Asset Class Management Plan

	Ensure all works comply with health and safety standards and regulations
Assets cause adverse environmental impacts	- Ensure environmentally friendly and non-toxic materials are used in construction - Review and improve procedures and disposable methods when handling hazardous substances on sites

Table 5-7: Safety risks and mitigation controls

5.5 Street lighting risk register

Auckland Transport has identified key risks for its street lighting assets and developed mitigation plans to address these risks. This information is recorded in a risk register and is summarised in Table 5-8.

Code	Asset type	Consequence category	Risk detail	Net risk factor	Mitigation options
RI SL FI 1	Street lighting	Finance	Increased costs due to technology change	Medium	Stay abreast of technology changes. A revolution in street lighting technology is taking place across New Zealand, as high-pressure sodium lamps are being replaced with LEDs. This technology change allows for other system changes, such as smart controls. It is important that the pros and cons of the changes are well understood and the benefits are constantly monitored.
RI SL HS 3	Street lighting	Health and safety	Hazards from fallen street light columns	Medium	- Review current maintenance plans and improve inspection approaches. - Streamline remedial actions and responses to customer complaints.
RI SL HS 1	Street lighting	Health and safety	Electrocution from street lighting power supply	Medium	Ensure that works are undertaken only by contracting companies and staff who have the necessary electrical safety certification from the power and electrical network companies.
RI SL HS 2	Street lighting	Health and safety; service delivery	Unsafe conditions for customers, due to outages or inadequate street lighting illumination in the road reserve, walkways and cycleways	Medium	- Ensure all new lamps comply with the lighting standards (AS/NZS 1158). - Undertake minor safety works to identify areas for improvements and implement illumination improvement works. - Put in place an emergency plan for power outages
RI SL RE 1	Street lighting	Reputation	Change in public's perception of street lighting	Medium	- Review urban street lighting design and internationally recognised standards and approaches. - Provide adequate illumination in residential areas and public spaces

Low Medium High Very high

Table 5-8: Street lighting asset risks

Street Lighting Asset Class Management Plan

Source: Asset management team (February 2020)

In addition to the risks set out in Table 5-8, specific types and locations of assets that have a history of issues are monitored and maintained, as summarised in Table 5-9.

Asset types	Issues
Street lighting assets attached to non-council columns	These include luminaires on brackets attached to Vector and Telecom columns for power and support (approximately 35,000). These assets are considered critical as the management of associated columns is unknown.
Multi-function columns	These are standard specification in the higher profile commercial and retail parts of the city, and are designed to accommodate street lights, traffic signals, CCTV cameras, red-light cameras, radio equipment and advertising banners. They help reduce the total number of columns needed, by hosting multiple services. These assets are considered critical due to their high lifecycle costs, as they need to be visited more often for maintenance and are costly to replace (replacement cost = \$7,000 to \$15,000 per pole set).
Asset components that commonly lead to street lighting outages	These include lamps, fuses, wiring, wiring cover plates and controller failures. These assets are considered critical as they may compromise safety.
Older street light columns unable to carry additional loading, such as banners	Older street light columns are generally not designed for carrying the additional loads of attached banners. Auckland Transport is managing these by adding extra strength in the column base. These columns are considered critical due to potential safety concerns.
Bermeka columns in the north area	There are a number of subdivisions in the north area where Bermeka columns were installed. They are non-galvanised steel poles and have a short design life of 10-15 years and are now failing due to corrosion. The estimated replacement cost of those is estimated to be \$3.8 million over the next 3 years.
Fibreglass and reinforced spun concrete poles	There are issues with old fibreglass and spun concrete columns in the network. They are not at adequate standard and are brittle and have poor resistance to stress. Auckland Transport has a programme to replace those problematic ones.
HUB columns	There are approximately 330 multi-function columns in the central area, which were manufactured in China and purchased from the HUB Group in Australia. These columns have sub-standard welding. Columns in the most vulnerable positions have already been remediated. A monitoring programme is being set up to manage the potential risk of column failure due to fatigue. This involves regular testing of the columns and data analysis from the columns in service. The estimated cost of pole maintenance including monitoring is \$540,000 over 10 years, with an average of \$54,000 per year.

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Table 5-9: Asset and location specific street lighting issues

Source: Auckland Transport Street Lighting team

5.6 How risk underpins decision-making

The various risk mitigation measures, identified and required under the risk management framework, also need to align with Auckland Transport's capital improvements, maintenance and operational programmes.

The risk management information gathered will be used to inform a risk-based decision-making process, including to prioritise and justify programmes and projects, and most importantly, to mitigate the various risks identified.

The information is also be useful for developing an evidence-base for funding applications and for assessing benefits of projects for users.

This process is highlighted in Figure 5-4.



Figure 5-4: Risk-based decision-making process

6 How we manage assets throughout their lifecycle

Auckland Transport actively manages its assets throughout their lifecycles, using lifecycle management plans. Lifecycle management plans contain several important components, including:

- an operational plan – detailing how we will ensure assets remain fit for purpose, and how we respond to customer service requests and emergency events
- a maintenance plan – setting out how we will identify and repair asset faults
- a renewals plan – explaining our approach for replacing assets as they deteriorate
- a capital improvements programme – detailing our plans to create new assets or improve existing assets
- a disposal plan – explaining when and how we will dispose of assets, once they have reached the end of their lives.

In this section we explain our approach to lifecycle management, and outline the operational, maintenance, renewal and disposal plans, and the capital improvement programme that we have developed for the street lighting assets in the Auckland transport network.

6.1 Lifecycle management objectives

The objectives of our asset lifecycle management activities align with Auckland Transport's overall asset management performance measures, outlined in Section 3 of this plan. These objectives include:

- serviceability – delivering agreed fit-for-purpose levels of service for assets, that are focussed on safety, condition, amenity and customer requirements, to ensure the asset network satisfies the needs for all road users
- prudent risk management – providing a safe network, by ensuring that there are no road incidents where lighting is a major contributing factor and continuous availability of critical street lights
- perpetuity of assets – addressing loss of service potential due to asset deterioration, and ensuring the network remains available for future generations by implementing appropriate operational, maintenance and renewal activities
- value-for-money – optimising and prioritising investments to achieve best whole-of-life costs, while meeting agreed levels of service.

Strategies we use to deliver these objectives are:

Street Lighting Asset Class Management Plan

- using competent and capable people – resourcing a team of asset engineers, contractors, and customer services staff, with specified roles and responsibilities, who have suitable skills and experience to deliver our network operations, maintenance and renewals services
- establishing asset management systems – establishing the processes, information management systems, governance and management structures needed to develop, deliver and monitor our asset management activities
- optimising service delivery mechanisms – outsourcing service delivery contracts, using competitive bidding in the open market and industry accepted procurement processes, to effectively and efficiently deliver our programmes
- lifecycle management plans.

6.2 Operational plan for street lighting

Auckland Transport's operational plan for its street lighting assets includes:

- operational activities – the activities involved in managing these assets, including frequencies and response times
- historical performance and costs – how these assets have performed in the past and what it cost
- future operational requirements – what assets will be required for the future and the associated costs.

6.2.1 Operational activities

Operational activities (also known as operations) are the day-to-day network management activities required to keep the street lighting network in a safe and operable state, and to prevent interruptions to the agreed levels of service. They are different from the maintenance and renewal activities associated with the network.

Key operational activities for street lighting assets include:

- asset inspections and monitoring
- customer service and emergency responses.

In developing and delivering these activities, Auckland Transport takes into account:

- the risk of critical assets failing
- the baseline levels of service required, and any changes to the agreed levels of service.

Auckland Transport's street lighting operations and maintenance activities are delivered under the road corridor maintenance contracts. All works delivered under those contracts must comply with the specifications and standards detailed in the Transport Design Manual. All contracting companies and staff carrying out the works must have electrical safety certification from the power and electrical network companies.

The main operational activities for street lighting assets are summarised in Table 6-1. These planned activities help control the common causes of street lighting assets failing, such as power outages, which affect the overall levels of service provided by the street lighting network.

Street Lighting Asset Class Management Plan

Activity	Description	Requirements	Work carried out by
Asset inspections and monitoring	Detailed inspections – inspections and condition rating of assets required for asset management planning, programming, asset monitoring and reporting	Annually or as required	Auckland Transport maintenance contractors or consultants
	Routine inspections – routine, ongoing and repetitive activities, needed to ensure the network remains safe and accessible. Includes patrols and night-time inspections of the entire network	Regular weekly and monthly inspections for the network	Auckland Transport maintenance contractors
Power supply	Testing and checking the electricity supply to all Auckland Transport street lights	Daily	Power supply companies
Customer service and emergency response	- Responding to requests for services through Auckland Transport's customer relationship management system - Responding to unexpected events and incidents that effect network safety and integrity, or public safety - Cleaning up after accidents (car vs pole) and providing temporary services - Undertaking minor safety works to address issues caused by telecommunication services work within the road corridor	As required within specific timeframes	Auckland Council's call center Auckland Transport Maintenance Contractors

Table 6-1: Operational activities for street lighting

Source: Auckland Transport road corridor maintenance contracts

6.2.1.1 Asset inspections and monitoring

Auckland Transport inspects its street lighting assets to identify defects that could cause assets to fail or affect their performance. Defects are recorded, so that maintenance and renewal activities can be programmed to address them.

Table 6-2 summarises the nature and frequency of the inspections carried out for street lighting assets.

Type of inspection	Description	Inspection frequency
Pedestrian crossings	Lighting for dedicated pedestrian crossings that are marked with alternative parallel bands of black and white, and which may have reflectors, and for defined pedestrian crossing routes at traffic signal-controlled intersections. Includes Belisha Beacons.	3 months
Stairs, subways footbridges and ramps	Lighting for connecting elements that are used only by pedestrians.	6 months
Local and residential roads, pathways and cycleways	Lighting for local and residential areas, pathways and cycleways.	6 months
Auckland Transport car parks	Lighting for outdoor car parks.	3 months
Transport interchanges	Lighting for transport terminals, interchanges and service areas.	1 month

Street Lighting Asset Class Management Plan

Type of inspection	Description	Inspection frequency
Town centres, shopping precincts and civic centres	Lighting installed on lighting columns in areas used primarily by pedestrians and where lighting is essential for public safety, e.g. town and suburban centres, including outdoor shopping precincts, malls, open arcades, town squares and civic centres.	1 month
Arterial roads	Street lighting on roads in central and regional activity centres of capital and major provincial cities, and other areas with major abutting traffic generators.	3 months
Collector roads	Street lighting on roads that predominantly carry through traffic from one region to another, forming principal avenues of communication for traffic movements.	3 months
Rural areas	Street lighting on roads within areas located outside of the Auckland Council metropolitan urban limit.	12 months
Amenity lighting		12 months
Clocks		1 month
Navigation aid beacons		6 months

Table 6-2: Inspection frequencies for street lighting

Source: Auckland Transport road corridor maintenance contracts

The condition of the assets inspected is graded on a 1 to 5 rating scale, based on the criteria in Table 6-3.

Condition grading	Description
Very good (excellent)	Assets are in as-new condition, with no identifiable faults.
Good	Most of the asset is still in excellent condition, but there are some isolated components that require minor repair.
Moderate (average)	There are some parts of the asset still in excellent condition, but there are a significant number of components that require maintenance – some faults are affecting performance.
Poor	There are several faults that are affecting performance. Lack of significant maintenance or renewal will lead to rapid deterioration or compromise safety.
Very poor	There are many faults that prevent the asset performing at the desired level. Safety is compromised, and urgent replacement or significant remedial work is required.

Table 6-3: Condition grading for street lighting

Source: Auckland Transport road corridor maintenance contracts

6.2.2 Historical operational costs

Historically, the operational costs for Auckland Transport's street lighting assets averaged \$14.1 million per year.

This level of historical investment delivered the agreed:

- levels of service for street lighting
- asset inspections and monitoring – of columns, brackets and luminaires
- customer service and emergency responses through Auckland Transport's customer relationship management system.

Auckland Transport uses these historical costs to calculate what the future operational needs for these assets are likely to be, including the financial investment required.

Street Lighting Asset Class Management Plan

Figure 6-1 and Table 6-4 show the historical operational costs for street lighting assets for the past 8 years.

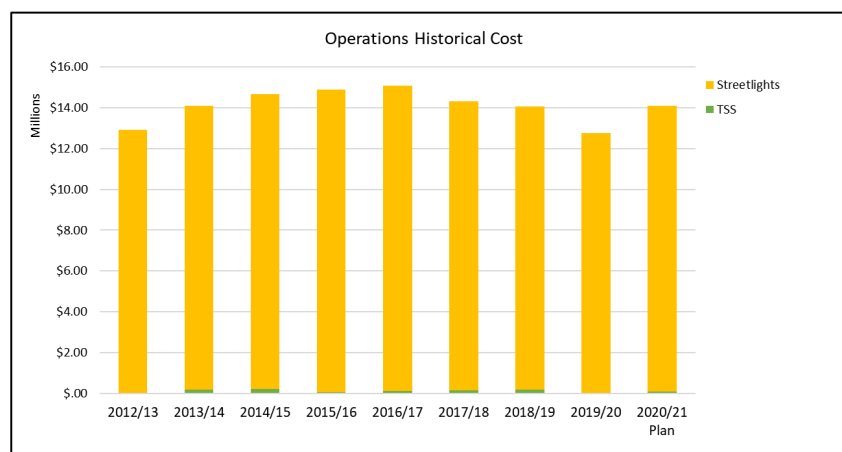


Figure 6-1: Historical operational costs for street lighting

Source: Auckland Transport SAP database (2020)

Asset type \$M	2012/1 3	2013/1 4	2014/1 5	2015/1 6	2016/1 7	2017/1 8	2018/1 9	2019/2 0	2020/2 1 Plan
Streetlights (electricity)	\$12.9	\$13.9	\$14.5	\$14.9	\$15.0	\$14.2	\$13.9	\$12.8	\$14.0
Technical support services	\$0.0	\$0.2	\$0.2	\$0.0	\$0.1	\$0.1	\$0.2	\$0.0	\$0.1
Grand Total	\$12.9	\$14.1	\$14.7	\$14.9	\$15.1	\$14.3	\$14.1	\$12.8	\$14.1

Table 6-4: Historical operational costs for street lighting

Source: Auckland Transport SAP database (2020)

The above figures include electricity costs and technical support services relating to street light assets. Other historical operational costs related to inspections are included with the maintenance expenditure (see section 6.3.2).

In the past, electricity costs have accounted for up to 76 per cent of total operational and maintenance expenditure for street lighting. This proportion has been reducing over time, through the programmes to retrofit more energy-efficient LED luminaires and to control light levels during off-peak hours through a tele-management system.

6.2.3 Future operational requirements

The future operational investment required for operational activities for street lighting is \$15.2 million per year. This figure is a yearly average over 10 years and will cover:

- the current baseline level of service for operational activities
- any consequential operational needs arising from the growth of the network
- any other operational needs identified for the network, such as changes to the current levels of service.

Street Lighting Asset Class Management Plan

Note that future operational costs are based on current 2019/2020 contract rates, exclude escalation, and are expressed in present-day dollars, as of July 2019, and include.

6.2.3.1 Future baseline operational needs

Figure 6-2 and Table 6-5 summarise the future baseline operational needs for street lighting assets. These needs have been calculated on the assumption that:

- Auckland Transport will continue to deliver the current baseline operational levels of service in the future for the existing network
- the current level of operational activities will continue in the future
- operational costs incurred during the 2019/2020 financial year will remain the basis for assessing future costs.

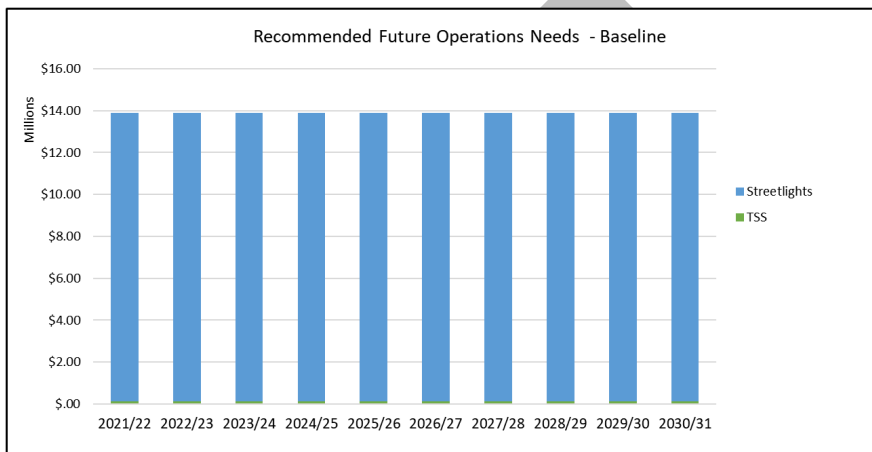


Figure 6-2: Recommended baseline operational needs for street lighting

Source: Asset management financial model (2020)

Asset type \$M	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	10-year total
Street lights (electricity)	\$13.8	\$13.8	\$13.8	\$13.8	\$13.8	\$13.8	\$13.8	\$13.8	\$13.8	\$13.8	\$137.6
Technical support services	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$1.2
Total	\$13.9	\$13.9	\$13.9	\$13.9	\$13.9	\$13.9	\$13.9	\$13.9	\$13.9	\$13.9	\$138.8

Table 6-5: Baseline operational needs for street lighting

Source: Asset management financial model (2020)

This level of investment will enable Auckland Transport to deliver future operational activities related to electricity supply and technical support.

6.2.3.2 Future consequential operational needs

Consequential operational activities, that are extra to the baseline needs activities, may arise if the street lighting network expands through capital improvement projects, new subdivisions and development, city centre or town-centre upgrades, the overhead-to-underground (OHUG) programme of lighting in-fill, cycleway projects, road corridor improvement projects and other streetscape projects.

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Street Lighting Asset Class Management Plan

Auckland Transport establishes the future consequential operational needs for street lighting by modelling the likely network growth, based on historical and future capital projects and projected vested assets.

Major assumptions in the model include

- all components in an asset will deteriorate in the same fashion – no allowance has been made for early or sudden failure of the asset
- growth in the number of vested assets will be the same as the average growth per year for the past 3 years
- where projects are not split into phases, the construction cost of the project is assumed to be its full cost
- operational costs will be consistent year on year, and start in the year immediately following the asset's completion
- no allowance has been made to inflate historical costs to current dollar values.

The average historical growth of street lighting assets over the past 5 years has been approximately 2,318 lights (2.2 per cent) and 2,539 columns (2.9 per cent) per year. This growth has been largely due to subdivisions and developments across the region.

Using these figures, modelling shows that the average growth of street lighting assets over the next 10 years network will be 1335 new assets each year.

The predicted future consequential operational and maintenance needs for street lighting, due to this growth, are given in Figure 6-3 and Table 6-6.



Figure 6-3: Future consequential operational needs for street lighting

Source: Asset management financial model (2020)

Asset type	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	10-year total
Street lights	\$0.5	\$0.7	\$0.8	\$1.0	\$1.2	\$1.4	\$1.6	\$1.7	\$1.9	\$1.9	\$12.8
Total	\$0.5	\$0.7	\$0.8	\$1.0	\$1.2	\$1.4	\$1.6	\$1.7	\$1.9	\$1.9	\$12.8

Table 6-6: Future consequential operational needs for street lighting

Street Lighting Asset Class Management Plan

Source: Asset management financial model (2020)

This level of investment will deliver operational services for street lighting related to network growth.

6.2.3.3 Future additional operational needs

Additional operational needs may arise due to local requirements, committed activities, increased levels of service or factors such as climate change.

At present, we have not identified any future additional operational needs for the street lighting network.

6.2.3.4 Future operational investment required

The future operational investment required for Auckland Transport's street lighting assets takes into account all of the above operational needs.

The total recommended future operational investment required for the street lighting network for the next 10 years is \$138.8 million. This equates to an average of \$15.2 million per year, and is made up of:

- baseline operational needs – \$13.9 million
- consequential operational needs (due to network growth) – \$1.3 million.

Figure 6-4 and Table 6-7 show how this investment will be allocated over the next 10 years.

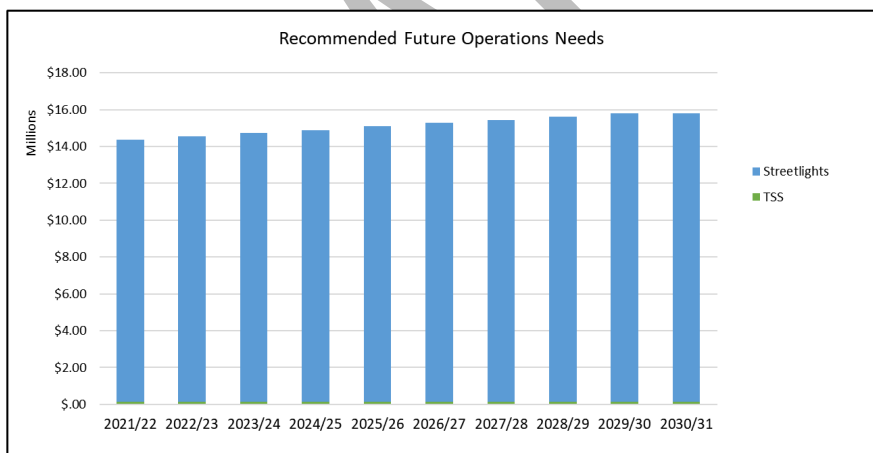


Figure 6-4: Recommended future operational investment for street lighting

Source: Asset management financial model (2020)

Asset type \$M	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	10-year total
Street lights (electricity)	\$14.3	\$14.4	\$14.6	\$14.8	\$15.0	\$15.2	\$15.3	\$15.5	\$15.7	\$15.7	\$150.4
Technical support services	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$1.2
Total	\$14.4	\$14.6	\$14.7	\$14.9	\$15.1	\$15.3	\$15.4	\$15.6	\$15.8	\$15.8	\$151.6

Table 6-7: Recommended future operational investment for street lighting

Source: Asset management financial model (2020)

Note that the above figures include electricity costs and technical support services for providing street light assets. Other future operational costs related to inspections and other operational services are summarised under maintenance expenditure (refer section 6.3.3).

6.2.3.5 Future electricity needs

The future cost of providing electricity for the street lighting network, over the next 10 years, is estimated to be \$110 - \$126 million.

Electricity consumption is calculated by evaluating the total electrical load and applying the current average cost of electricity. Electricity cost is based on a fixed cost, the charge for maintenance and daily line charges of the network, of \$0.15 per light and a variable cost of \$0.16 per kwh, with a luminaire running time of 4,340 hours per annum.

Table 6-8 shows the breakdown of this total 10-year cost by asset management region.

Region	10-year budget requirement for electricity	Adjusted for increase in network load	Adjusted for increase in network load and dimming
Central	\$27,091,056	\$30,285,850	\$26,788,575
North	\$28,445,312	\$31,510,426	\$27,381,502
South	\$37,095,893	\$41,027,356	\$35,908,802
Haurakj Gulf islands	\$8,980,002	\$10,392,152	\$9,022,785
West	\$11,224,751	\$12,875,827	\$11,275,027
Total	\$112,837,015	\$126,091,613	\$110,376,690

Table 6-8: 10-year electricity cost estimates for each region

Source: Auckland Transport Road Lighting 10-year Forward Works Plan (2018-draft)

From Table 6-8, it was assumed that the road lighting network will increase by 2.7 per cent per annum over the 10 year period and that LED luminaries will be dimmed to 50 per cent output for 7 hours per night.

6.3 Maintenance plan for street lighting

Maintenance is the work carried out to maintain assets and ensure they continue to deliver the agreed levels of service, without any interruption.

Maintenance activities enable the street lighting network to be used as planned and ensure it fulfils its purpose throughout its expected life span. Without these activities, the network would rapidly deteriorate and become unsafe for users, and would require costly pre-mature renewal works in the future.

Auckland Transport's maintenance plan for its street lighting assets includes:

- maintenance activities – to describe the maintenance activities needed to upkeep the street lighting network
- historical maintenance costs – to understand how the network performed in the past and the associated costs
- future maintenance requirements – to forecast and propose future maintenance programmes and the associated costs.

6.3.1 Maintenance activities

Maintenance activities for the street lighting network include routine (or cyclic), planned (or programmed) and unplanned (or reactive) maintenance, and emergency reinstatement.

In planning and developing these activities, Auckland Transport takes into account:

- the risk of critical assets failing
- the agreed baseline levels of service required, and any changes to these.

Auckland Transport's maintenance activities aim to use consistent products, material types and quality among its street lighting assets. These activities include repairs for faults and defects.

Maintenance activities for street lighting assets are summarised in Table 6-9.

Activity	Description	Requirements	Service carried out by
Planned maintenance			
Routine maintenance	Ongoing, repetitive activities necessary to ensure the safety of the network and respond to customer service requests	Regular weekly activities for maintenance of the network	Auckland Transport maintenance contractors
Planned maintenance	Planned or programmed repair or replacement to address asset faults and defects and reinstate assets following telecommunication works.	As required	Auckland Transport maintenance contractors
Reactive maintenance			
Unplanned maintenance and fault management	Responding to requests for services through the customer relationship management system. Restoring failed power supplies. Reporting observed faults and updating records in RAMM.	As required within specific timeframes	Auckland Council's call centre Auckland Transport maintenance contractors
Emergency work	Responding to unexpected events that effect public health and safety.	As required by contract	Auckland Transport maintenance contractors

Table 6-9: Maintenance activities for street lighting

Source: Auckland Transport road corridor maintenance contracts

6.3.1.1 Routine and planned maintenance

Planned maintenance includes regular, routine and predictable maintenance activities that can be organised, programmed and scheduled in advance. Planned maintenance covers most maintenance needs.

Planned maintenance activities are identified through network inspections, and from non-urgent requests from customers.

Routine (or cyclic) maintenance works involve:

- repairing all damaged, defective and faulty equipment and components
- straightening street light columns and brackets

Street Lighting Asset Class Management Plan

- replacing obsolete or failed fittings and lamps, with equivalent modern components
- responding to customer service requests within the response times.

Planned (or programmed) maintenance works involve:

- repair or replacing asset components that are damaged or in a very poor condition
- repairing assets that have known performance issues
- replacing, in bulk, lamps (on a 3 to 5-year cycle)
- updating the asset inventory in the RAMM database, as required.

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.

Auckland Transport also maintains the internal and external lighting for 16 clocks located in public places. Maintenance activities for these assets includes repairing and maintaining the clocks' mechanical and electrical mechanisms, adjusting their accuracy, general cleaning and general maintenance of the structure, as well as repairing the lighting.

6.3.1.2 Unplanned and emergency maintenance

Auckland Transport carries out unplanned maintenance to respond to irregular, unpredicted events that require maintenance action. Emergency works respond to unexpected events that affect public health and safety.

Auckland Transport receives requests for unplanned and emergency maintenance services for the street lighting network through its customer relationship management system. Maintenance activities in response to these requests include repairing defects and testing lights.

Auckland Transport categorises and allocates response times for both its routine and emergency maintenance based the service levels required in the maintenance contracts for that area of the network. The various service levels are explained in Appendix B.

Table 6-10 summarises the response times required for street lighting maintenance works.

Asset issue	Repair time for works			
	SL1*	SL2	SL3	SL4
Asset hanging	4 hours	4 hours	4 hours	4 hours
Lighting column leaning	1 month	1 month	1 month	1 month
Lighting column gear door open, missing or unsecure	1 day	1 day	1 day	1 day
Three or more consecutive lights out – all areas	3 days	3 days	3 days	1 month
Lamp out	3 days	3 days	1 week	1 week
Asset alignment	1 week	1 week	1 week	1 week
Day burner(s)	3 days	3 days	3 days	3 days
Glare and obtrusive light control	3 days	3 days	3 days	3 days
Miscellaneous faults	1 day	3 days	1 week	1 week
Pole and luminaire has been damaged	1 week	1 week	1 week	1 week

Commented [MO(7)]: to identify most cost-effective repair

Street Lighting Asset Class Management Plan

Table 6-10: Maintenance response times for routine and emergency works

Source: Auckland Transport street lighting maintenance contracts

Note: *SL = service level.

All emergencies that result in damage to the road lighting network shall be carried out in accordance with the contract Emergency Management requirements.

6.3.2 Historical maintenance costs

Historically, the cost of maintenance activities for street lighting assets has been \$3.9 million per year (yearly average).

This level of historical investment delivered the agreed:

- levels of service for maintaining street lights, including maintenance of columns, brackets and luminaires
- customer service and emergency responses.

Auckland Transport uses these historical costs to calculate what future maintenance requirements for **pathways** assets are likely to be – both for the maintenance programme and the financial investment required.

The historical maintenance costs for street lighting assets over past 8 years are given in Figure 6-5 and

Asset type	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21 Plan
Streetlights	\$5.3	\$3.7	\$4.1	\$4.5	\$3.8	\$3.7	\$3.3	\$3.1	\$3.6
Grand Total	\$5.3	\$3.7	\$4.1	\$4.5	\$3.8	\$3.7	\$3.3	\$3.1	\$3.6

Table 6-11. These figures include both maintenance costs (for physical asset repairs) and operational costs for asset inspections and emergency responses.

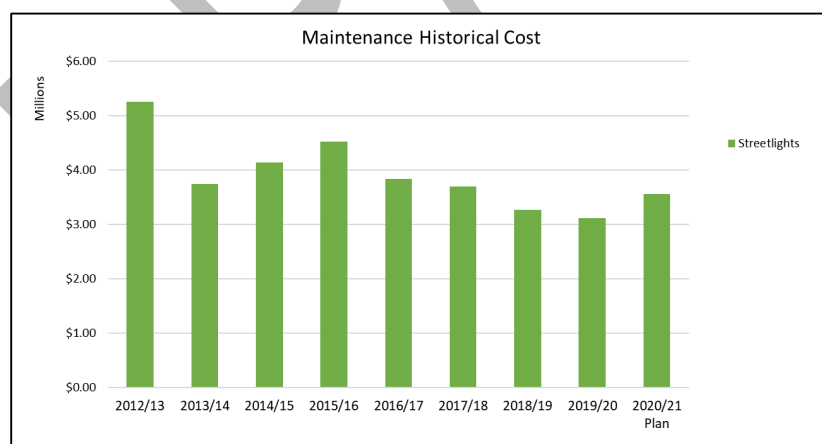


Figure 6-5: Historical maintenance costs for street lighting

Source: Auckland Transport SAP database (2020)

Asset type	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21 Plan
Streetlights	\$5.3	\$3.7	\$4.1	\$4.5	\$3.8	\$3.7	\$3.3	\$3.1	\$3.6

Commented [AP(8)]: streetlight

Street Lighting Asset Class Management Plan

Streetlights	\$5.3	\$3.7	\$4.1	\$4.5	\$3.8	\$3.7	\$3.3	\$3.1	\$3.6
Grand Total	\$5.3	\$3.7	\$4.1	\$4.5	\$3.8	\$3.7	\$3.3	\$3.1	\$3.6

Table 6-11: Historical maintenance costs for street lighting

Source: Auckland Transport SAP database (2020)

6.3.3 Future maintenance requirements

Note that for reporting purposes, costs for some operational activities are included in this section.

The future investment required for maintenance activities for street lighting assets is \$5.6 million per year. This figure is a yearly average over 10 years, and will cover:

- the agreed levels of service for baseline operational activities
- any consequential maintenance needs arising from the growth of the network
- any other maintenance needs identified, such as changes to the current levels of service.

Future maintenance requirements are based on current contract rates, as of 2019/2020 (excluding escalation), and are expressed in present-day dollars, as of July 2019.

6.3.3.1 Baseline maintenance needs

To establish the future baseline maintenance needs for street lighting, it has been assumed that:

- Auckland Transport will continue to deliver the current baseline operational levels of service in the future, for the existing street lighting network
- the current level of maintenance programmes will continue into the future
- maintenance costs incurred during 2019/2020 will be the basis for assessing future costs.

Based on this approach, Figure 6-6 and Table 6-12 summarise the future baseline maintenance needs for street lighting assets. These figures include the costs of asset inspections and other operational costs, but exclude electricity and technical support services costs.

Street Lighting Asset Class Management Plan

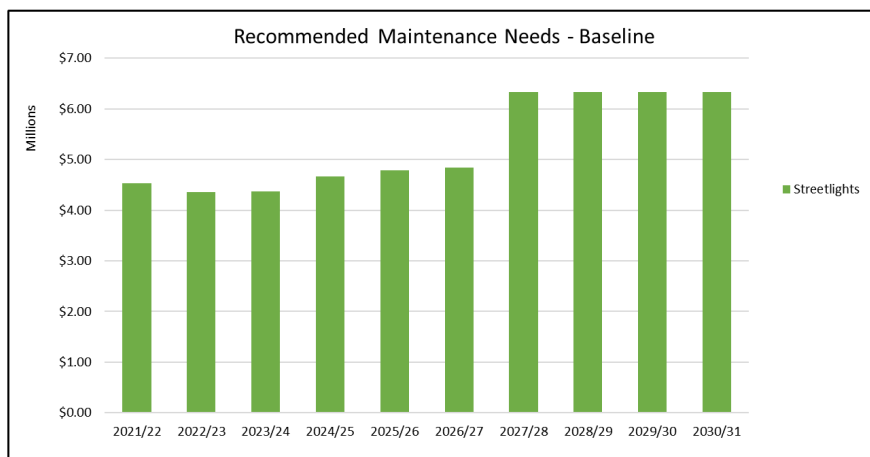


Figure 6-6: Future baseline maintenance needs for street lighting

Source: AM Financial Model 2020

Asset type \$M	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	10-year total
Street lights	\$4.5	\$4.4	\$4.4	\$4.7	\$4.8	\$4.8	\$6.3	\$6.3	\$6.3	\$6.3	\$52.9
Total	\$4.5	\$4.4	\$4.4	\$4.7	\$4.8	\$4.8	\$6.3	\$6.3	\$6.3	\$6.3	\$52.9

Table 6-12: Future baseline maintenance needs for street lighting

Source: Asset management financial model (2020)

The budget increase in 2027/28 onwards reflect the maintenance needs for luminaire cleaning based on dirt exposure, once every six to twelve years after the installation. Auckland Transport identifies that the HUB multi-function columns that have sub-standard welding need to be monitored closely through a programme. The cost of maintenance of those are assumed to be increased in 2027/28.

This level of investment will deliver the:

- agreed levels of service, as set out in the current maintenance contracts
- asset repairs and replacements, as required.

6.3.3.2 Future consequential maintenance needs

Consequential operational and maintenance needs, in addition to the baseline operational and maintenance needs, may be required if the street lighting network expands, due to capital improvement projects, new subdivisions and development, city centre or town-centre upgrades, the OHUG in-fill lighting programme, cycleway projects, and road corridor improvement and other streetscape projects.

Streetscape and town centre upgrades, in particular, tend to yield significant consequential maintenance needs, due to their requirement for high-value amenity lighting.

Auckland Transport establishes the consequential operational and maintenance needs for street lighting by modelling the likely network growth, based on historical and future capital projects and the projected amount of vested assets.

Major assumptions used in the model include:

Street Lighting Asset Class Management Plan

- all components in an asset type will deteriorate in the same fashion – no allowance has been made for early or sudden failure of the asset
- growth in the number of vested assets will be the same as the average growth per year for the past 3 years
- where projects are not split into phases, the construction cost of the project is assumed to be its full cost
- maintenance costs follow a set pattern, based on the age of each type of asset; these costs are assumed to remain at zero for a number of years initially, before increasing to a maximum cost per year at the end of the asset's life
- no allowance has been made to inflate historical costs to current dollar values.

The average historical growth of street lighting assets over the past 5 years has been approximately 2.5 per cent (an estimated 3,000 lights per year, due to subdivisions and developments across the region).

The modelling shows that the average annual growth of the street lighting network will be lower than this in the future, at 1,335 additional street lights per year for the next 10 years.

Figure 6-7 and Table 6-13: Future consequential maintenance needs for street lighting show the predicted consequential operational and maintenance needs for the street lighting network.

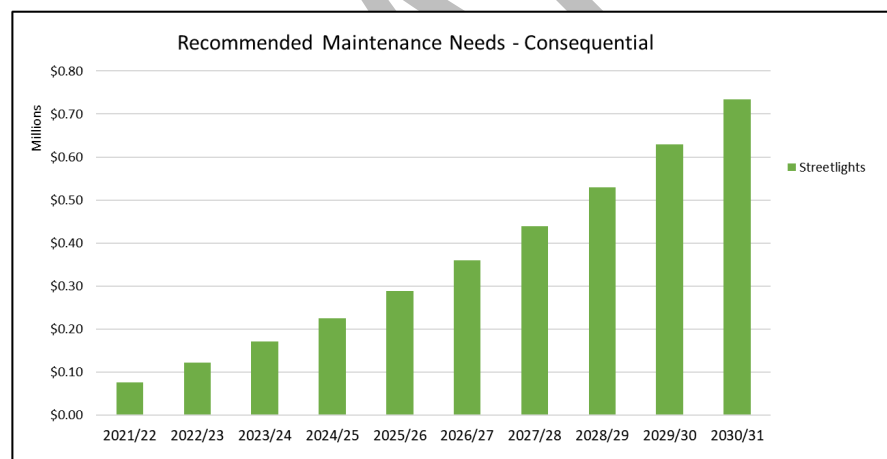


Figure 6-7: Future consequential maintenance needs for street lighting

Source: Asset management financial model (2020)

Asset type	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	10-year total
Street lights	\$0.08	\$0.12	\$0.17	\$0.23	\$0.29	\$0.36	\$0.44	\$0.53	\$0.63	\$0.73	\$3.58
Total	\$0.08	\$0.12	\$0.17	\$0.23	\$0.29	\$0.36	\$0.44	\$0.53	\$0.63	\$0.73	\$3.58

Table 6-13: Future consequential maintenance needs for street lighting

Source: Asset management financial model (2020)

Commented [MO(9)]: Actual growth (asset register) 2,318 lights (2.2 per cent) and 2,539 poles (2.9 per cent) per year
Check – contradicting statements
Modelling vs area mgt team
Over the past few years, Auckland Transport's street lighting network has grown by approximately 2.5 per cent each year (an estimated 2,700 new lights a year) and is expected to continue at the same rate for the next five years.

Street Lighting Asset Class Management Plan

This level of investment will enable Auckland Transport to deliver the agreed levels of service for maintaining 1,335 additional street lights each year, for the next 10 years.

6.3.3.3 Additional maintenance needs

Additional maintenance needs can arise from local requirements, committed activities, increased levels of service and other factors, such as climate change.

At present, we have not identified any additional maintenance needs for the street lighting network.

6.3.3.4 Future maintenance investment required

The future maintenance investment required for the street lighting network takes into account all the above types of maintenance needs. It also includes the costs of asset inspections and other operational costs, but excludes electricity and technical support services costs.

The total recommended maintenance investment forecast for the street lighting network for the next 10 years is \$56.5 million, which equates to an average of \$5.6 million per year. This is made up of:

- baseline maintenance needs – \$5.3 million (10-year average)
- consequential maintenance needs (from new assets due to network growth) – \$0.36 million (10-year average).

Figure 6-8 and Table 6-14 show how this investment will be used over the next 10 years.

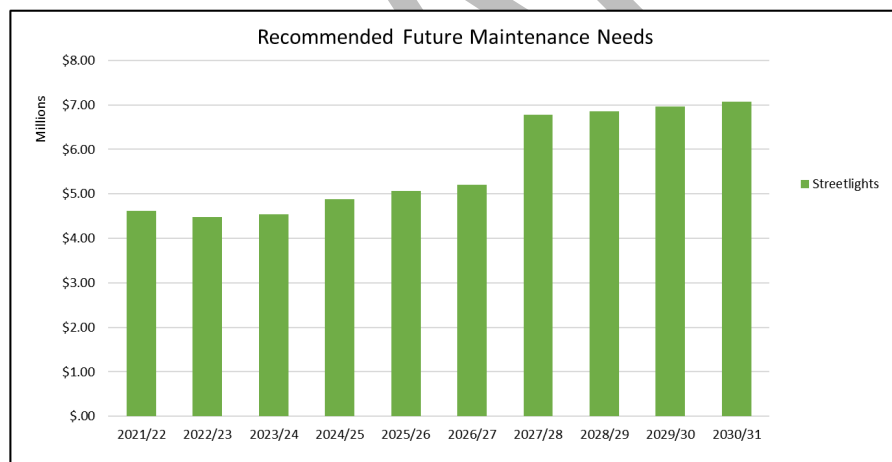


Figure 6-8: Future maintenance investment required for street lighting

Source: Asset management financial model (2020)

Street lights \$M	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	10-year total
Street lights	\$4.6	\$4.5	\$4.5	\$4.9	\$5.1	\$5.2	\$6.8	\$6.9	\$7.0	\$7.1	\$56.5
Total	\$4.6	\$4.5	\$4.5	\$4.9	\$5.1	\$5.2	\$6.8	\$6.9	\$7.0	\$7.1	\$56.5

Table 6-14: Future maintenance investment required for street lighting

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Source: Asset management financial model (2020)

This level of investment will deliver:

- agreed levels of service for maintenance of the growing street lighting network
- repairs to the street lighting assets in the future network
- customer service and emergency responses.

These overall future maintenance requirements for the street lighting network have been split further into the 11 contract areas: details are given in Appendix B.

The costs for each area have been allocated based on historical expenditure trends, contractual requirements and an assessment of each area's maintenance needs.

6.3.4 Maintenance forward works programme

Auckland Transport takes into account the criticality of street lighting assets and the severity of any faults when developing and prioritising its maintenance forward works programme.

Table 6-10 summarises the 10-year maintenance forward works programme budget requirements (physical works only), by asset type and maintenance area. It shows that the total costs over the next 10 years are estimated to be \$38 million: the 10-year totals can be divided evenly across each of the 10 years.

Work activity	Central	North	South	HGI	West	10-year total
LED luminaire cleaning	\$556,440	\$534,160	\$734,480	\$178,040	\$222,560	\$2,225,680
Lamp replacement	\$39,600	\$37,800	\$46,800	\$54,000	\$1,800	\$180,000
HUB poles maintenance or replacement	\$570,609	\$0	\$0	\$0	\$0	\$570,609
Clock maintenance	\$30,000	\$30,000	\$30,000	\$0	\$10,000	\$100,000
Pole testing and maintenance	\$2,280,000	\$3,000,000	\$4,800,000	\$840,000	\$1,080,000	\$12,000,000
Pole maintenance	\$1,126,482	\$1,627,140	\$2,440,710	\$438,076	\$625,823	\$6,258,231
Bracket maintenance	\$698,985	\$435,645	\$1,320,165	\$232,312	\$994,613	\$3,681,720
Luminaire maintenance	\$794,679	\$754,899	\$1,020,656	\$247,845	\$321,137	\$3,139,216
Amenity lighting maintenance	\$1,732,000	\$109,000	\$113,000	\$0	\$0	\$1,954,000
LPC replacements	\$183,311	\$175,978	\$241,970	\$58,659	\$73,324	\$733,242
Storm damage	\$5,985	\$20,416	\$57,171	\$4,200	\$8,288	\$96,060
Patrols	\$262,500	\$252,000	\$346,500	\$84,000	\$105,000	\$1,050,000
software licence	\$422,620	\$422,620	\$422,620	\$422,620	\$422,620	\$2,113,100
Base stations	\$25,000	\$24,000	\$33,000	\$8,000	\$10,000	\$100,000
CATS	\$781,946	\$781,946	\$781,946	\$781,946	\$781,946	\$3,909,730
Total	\$9,510,157	\$8,205,604	\$12,389,018	\$3,349,698	\$4,657,111	\$38,111,588

Commented [MO(10): Unit rate update, lump sum commitments and other planned maintenance RCD (TBC – 10yr plan)

Table 6-15: 10-year maintenance forward works plan for street lighting, by region

Source: Auckland Transport Road Lighting 10-year Forward Works Plan (2018-draft)

Auckland Transport has now changed its contractual arrangements for street lighting forward works to streamline processes and ensure consistency in how maintenance and renewal activities are delivered.

Table A 1 in Appendix B summarises the current street lighting maintenance contracts.

6.4 Renewal plan for street lighting

Renewals are planned work activities that respond to asset degradation, where the risk of the asset failing and the consequential disruption to service has become unacceptable to road users. This may include the effects of both direct disruption if the asset fails and any subsequent disruption while the asset is being reinstated.

The decline of an asset's condition or performance can be assessed using:

- level of service criteria – the asset no longer achieves the required condition or performance expected at an acceptable risk tolerance level
- economic criteria – it is more cost effective to replace the asset, rather than continue to maintain or repair it².

6.4.1 Our renewals planning approach

Figure 6-9 illustrates a typical ongoing deterioration pattern for an asset, from its 'as new' state through to its eventual 'end of life state and failure'.

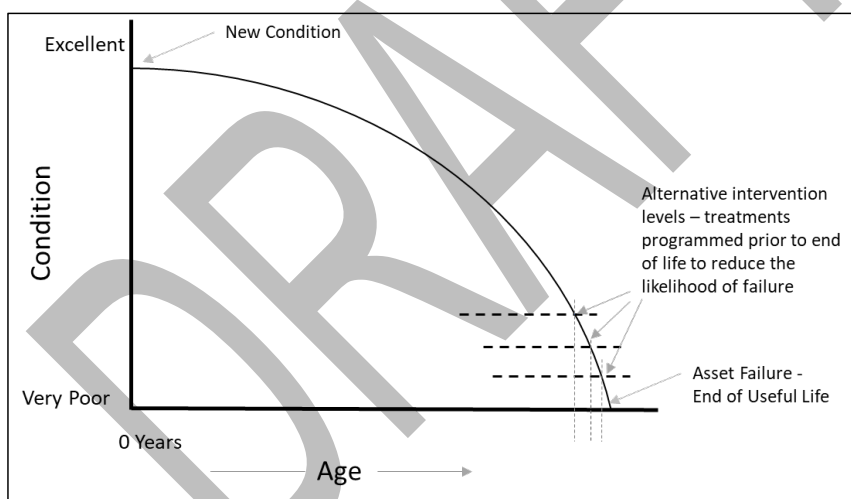


Figure 6-9: Typical deterioration curve for an asset

The decision to intervene and replace an asset, before it fails, might be taken if the risk of disruption from that failure is too great. This means considering progressively earlier interventions, and not allowing the asset to fall below a set condition or performance level that will affect customers' safety.

Typically, this approach considers assets on busier and more important roads to present higher levels of risk, while assets on quieter local roads can be allowed to deteriorate a little more, but not to the point of failure.

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² The net present value of the treatment rises above zero, thus balancing future discounted maintenance costs against the cost of the treatment.

Renewals planning can also be viewed from the perspective of exposure to financial risk. This approach involves mapping the asset's replacement cost (from the asset valuation) against risk, taking into account likelihood and consequence of an asset failure.

While the likelihood of an asset failing can be difficult to assess, its condition and age provide an indication of this likelihood. The worse the asset's condition, the more likely it is to fail. Assets that are both very important and more likely to fail should have a higher priority, and be replaced or rehabilitated earlier in their lifecycle, than others. For less important assets, a lower renewals priority is suitable.

By mapping the replacement cost of the asset and its known condition data, by One Network Road Classification category, a picture can be formed of the potential financial exposure or renewal liability for the asset, using its criticality (or importance) and condition as guides.

6.4.1.1 Approach used to analyse 10-year asset renewal needs

Auckland Transport determines its 10-year asset renewal needs for street lighting by following a comprehensive process using a range of inputs, as shown in Figure 6-10.

This is the common approach adopted for all the assets we manage, although not all inputs are appropriate for all asset classes (e.g. dTIMS does not apply for street lighting).

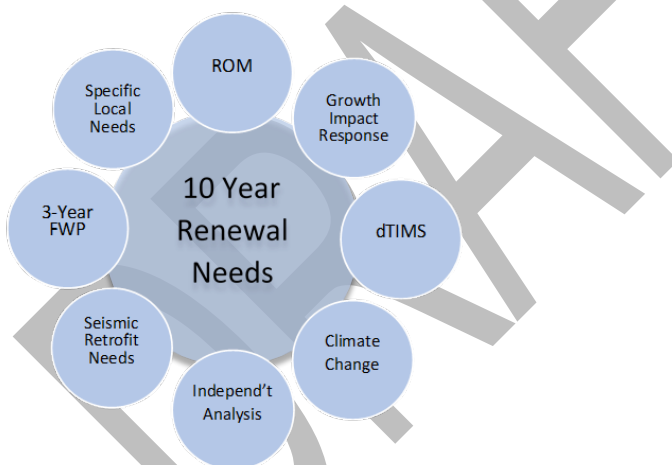


Figure 6-10: Inputs used to determine 10-year asset renewal needs

The process uses modelling tools and considers significant trends that are or will affect the road network in the future. It also integrates both 'top-down' and 'bottom-up' considerations, enabling any incremental programme changes derived from these inputs to be compared.

The process starts with the ROM model and follows the steps shown in Figure 6-11.

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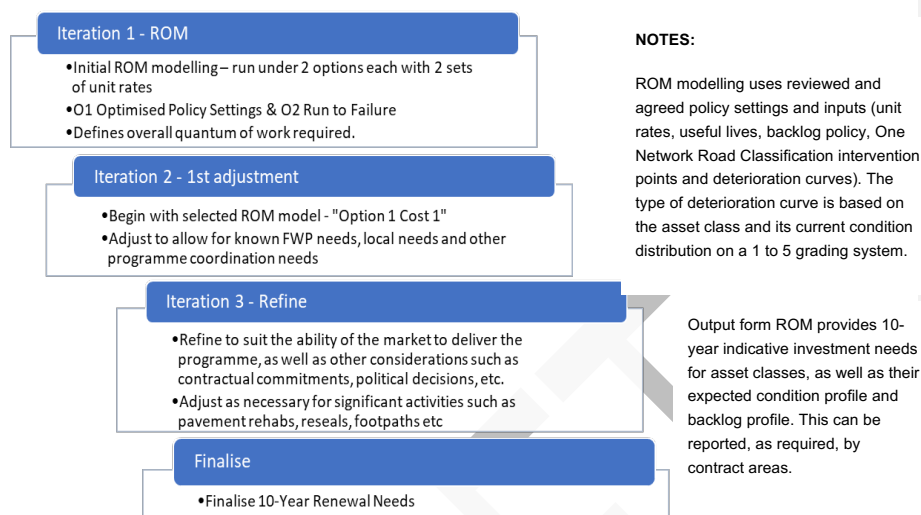


Figure 6-11: Steps taken to determine 10-year asset renewal needs

6.4.2 Renewal activities

Renewal activities generally involve the planned, like-for-like replacement of components of street lighting assets. Replacement occurs when the condition of the structure has deteriorated to the point where it is neither economically efficient nor prudent to continue to maintain it. These requirements are identified through asset inspections, condition surveys and customer feedback.

Significant renewal activities for street lighting include replacing old or poor condition columns, and replacing high-pressure sodium lamps with energy-efficient LEDs. Even though the high-pressure lamps still have life left in them, they have now become obsolete, due to technology changes and Auckland Transport's objective of ensuring the environmental sustainability of the asset network.

The different types of renewal activities for street lighting are summarised in Table 6-16: .

Activity	Description	Waka Kotahi NZ work categories
Street light renewals	Programmed renewals – to replace deteriorated street lighting assets, and address risks and level of service requirements	222: Traffic services renewals
	Reactive renewals – unplanned replacement of assets that are damaged by severe weather events or road incidents	
	Other renewals – renewal of street lighting assets in conjunction with OHUG projects, town-centre upgrades and local board projects	

Table 6-16: Street light renewal activities

Table 6-17 summarises the key intervention points for programmed street lighting renewals and the target time-frames.

Street Lighting Asset Class Management Plan

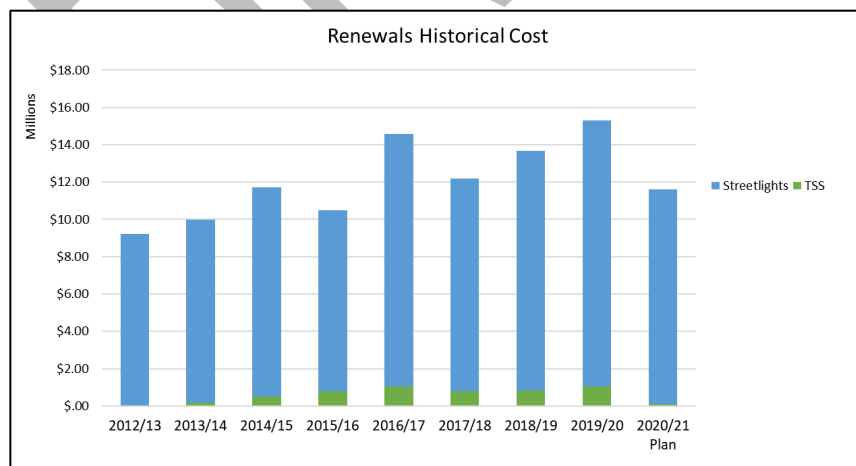
Key intervention points for programmed renewals	Renewals approach
Asset in 'very poor' condition Serious faults or defects that are affecting performance and road safety. Lack of significant maintenance or renewal will lead to rapid deterioration and compromise safety. Examples include: - luminaires with serious water ingress, dirt ingress, corrosion on housing or faded diffuser - columns with serious corrosion, damaged and bent columns - broken or bent outreach arms.	- Replacement is required within 1 year. - Include in the forward works programme for urgent renewals. - Urgent maintenance or repairs are to be completed within the specific time scale, as described in the contract.
Asset in 'poor' condition Faults or defects that prevent the asset performing at the desired level. Safety is compromised and replacement or remedial work is required. Examples include: - luminaires with visible water ingress, dirt ingress, corrosion on housing or faded diffuser - columns with some visible corrosion.	- Replacement is required within 2 to 5 years, depending on the level of impact or risks to the public. - Include in the forward works programme and prioritise for required actions.
Assets that have known performance issues (e.g. problematic Bermeka columns in the north area)	Replacement with modern equivalent is required to comply with the required standards and specifications.
Columns that are not suitable to host the required services such as traffic signals, CCTVs, etc.	Replacement with the appropriate model or type is required.
Luminaires that are not sustainable long term or are high-energy users	Replacement with the approved energy-efficient luminaires is required.
Assets that are below standard, or the required illumination level or new urban design requirements	Assessment is required to identify safety issues and to be programmed for levels of service improvements.

Table 6-17: Key intervention points for programmed renewals

6.4.3 Renewals history

On average over the past 3 years Auckland Transport has invested on average \$13.7 million per year in street lighting renewals.

Figure 6 10 compares historical asset renewals costs with current budgets to 2020/21.



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Figure 6-12: Historical and planned renewal costs

Source: Auckland Transport SAP database (2020)

Asset type \$M	2012/1 3	2013/1 4	2014/1 5	2015/1 6	2016/1 7	2017/1 8	2018/1 9	2019/2 0	2020/2 1 Plan
Streetlights	\$9.2	\$9.8	\$11.2	\$9.7	\$13.5	\$11.4	\$12.9	\$14.2	\$11.5
TSS	\$0	\$2	\$5	\$8	\$1.0	\$8	\$8	\$1.0	\$1
Grand Total	\$9.2	\$10.0	\$11.7	\$10.5	\$14.6	\$12.2	\$13.7	\$15.3	\$11.6

Table 6-18: Historical renewal costs for street lighting

Source: Auckland Transport SAP database (2020)

6.4.4 Renewal issues

This section describes the main issues affecting Auckland Transport's renewals programme.

6.4.4.1 Condition, performance and risk

Figure 6-13 shows the current distribution of the replacement cost of street lighting assets, by asset condition and likelihood of failure.

The top-right corner represents an unacceptable financial risk exposure justifying early intervention. A run-to-failure strategy for renewals would result in more street lights moving towards the right or into the top-right quadrant. However, such a strategy is not appropriate, for safety reasons.

Road hierarchy	Replacement cost by condition and failure risk				
	As new condition	Good condition	Average condition	Poor condition	Very poor condition
	Failure risk: very rare	Failure risk: rare	Failure risk: seldom	Failure risk: common	Failure risk: frequent
Regional					
Arterial					
Primary collector					
Secondary collector					
Access / low volume					

Figure 6-13: Street lighting replacement cost, by condition and failure risk

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6.4.4.2 Lifecycle economics

Lifecycle economics are considered at a network level in the dTIMS model, using the maintenance cost function, and are implicit in the ROM model.

Net present value analysis is conducted at a project level when making programming decisions for the 3-year forward works plan, allowing for adjustments to forecasts on an economics basis, if required.

6.4.4.3 Growth impacts

Growth issues affecting the road network, including street lights, include:

- overall network growth due to population growth, land use changes and safety requirements

- new subdivisions and urban development, which add to the size of the street lighting portfolio.

More information about growth can be found in Section 4.

6.4.4.4 Construction cost trends

Unit rates for street lighting have increased, following changes to the contractual agreements for renewals works region-wide. A variety of factors have contributed to the increased rates, including, but are not limited to:

- increased traffic management costs, due to improvements in safety standards and regulations
- rates negotiated for contract extensions taking into account the increased input costs
- changes in the product unit cost
- changes in the cost of delivery due to inflation.

6.4.5 Renewals programme development

Auckland Transport develops its renewals programme for its street lighting assets using ROM modelling.

The modelling takes into account the current condition of assets, the risks associated with the condition profile, and the levels of service to be delivered. It runs various iterations of the model.

6.4.5.1 Iteration 1

The first iteration involves testing two alternative renewals strategies – run to failure and optimised – against two sets of unit rates and the intervention settings listed in Table 6-19.

Scenario	Unit rates input	Renewal intervention level input
O1-C1	Cost 1 – unit rates based on a 3-year rolling average (2017/18 to 2019/20)	Optimised policy settings – intervention level ranges from 12 to 14, based on One Network Road Classification categories
O1-C2	Cost 2 – unit rates based on 2018 asset management plan rates	Optimised policy settings – intervention level ranges from 12 to 14, based on One Network Road Classification categories
O2-C1	Cost 1 – unit rates based on a 3-year rolling average (2017/18 to 2019/20)	Run to failure – intervention level 15 for all assets
O2-C2	Cost 2 – unit rates based on 2018 asset management plan rates	Run to failure – intervention level 15 for all assets

Table 6-19: Intervention settings used in ROM modelling for renewals

The modelling process produced the forecast costs for the renewals programme shown in Table 6-20. These figures include all street lighting renewals costs.

Scenario	Year 1 \$M	10-year total \$M	Comment
O1-C1	\$12.3	\$165.2	Preferred – this is the base case for further iterations of programme needs

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A clear explanation of what it is about. Are we describing the process used to develop the renewals programme of works? Or to forecast what renewals will be needed? If so, we need a clear statement to this effect, followed by an explanation of how all the subsections fit in the process.

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What is the purpose of the iterations and what do they show?

Street Lighting Asset Class Management Plan

O1-C2	\$11.9	\$149.9	Demonstrates the impact of lower unit rates
O2-C1	\$12.2	\$162.9	Run to failure – purpose is to benchmark the preferred option
O2-C2	\$11.8	\$147.8	Run to failure – purpose is to benchmark the preferred option

Table 6-20: Street lighting renewal costs

6.4.5.2 Iterations 2 and 3

These iterations allow for the issues described in section 6.4.3 to be incorporated in the renewals programme forecast, as shown in Table 6-21.

Iteration	Factors and impacts included
Iteration 2 – Local needs	Adjustments to scenario O1-C1 base programmes to match the 10-year street lighting plan from service delivery Street light renewal works coordinated with other programmes, in particular with major pavement rehabilitation works

Table 6-21: Iteration to align with the 10 year street lighting plan

The allocations in this iteration are based on local experience and will be refined when more details become available, including an assessment of the effect of the Covid-19 pandemic. There are changes in the programme needs between iterations 2 and 3 for street lights, as shown in Table 6-22.

Scenario O1-C1 cost element	Iteration 1 - ROM		Iteration 2		Iteration 3	
	Year 1 \$M	10-years \$M	Year 1 \$M	10-years \$M	Year 1 \$M	10-years \$M
Street light renewals	\$12.3	\$165.2	\$13.6	\$93	\$13.6	\$93
Local needs			\$0.5	\$5.3	\$0.5	\$5.3
Other costs ²	\$1.8	\$17.6	\$1.8	\$17.6	\$1.8	\$17.6
Total renewals	\$14.1	\$182.8	\$15.8	\$115.8	\$15.8	\$115.8

Table 6-22: Iterations considering financial impacts from events

6.4.5.3 Comparative analysis

Figure 6-14 compares the renewal forecast and depreciation.

<needs to be updated with new valuation and information and actual renewal profile>

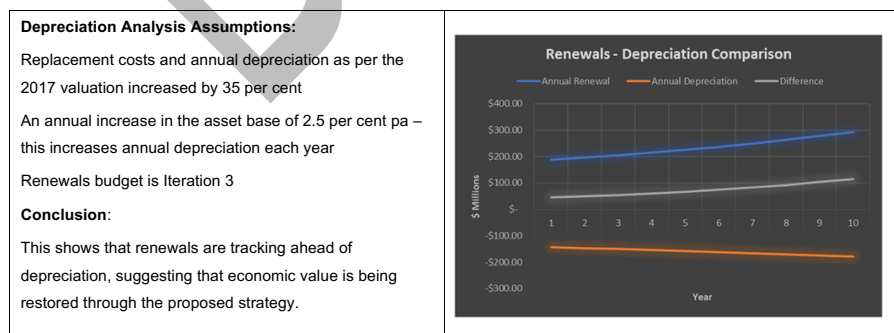


Figure 6-14: Comparison of renewals and depreciation of the assets

6.4.5.4 Refine programme

The draft 10-year street lighting plan has been used to refine the street lighting renewals programme, following consultation with Auckland Transport's operations team, as summarised in Section 6.4.6

6.4.6 Renewals programme recommendation

Auckland Transport recommends that there is a 10-year renewals programme for street lighting with a total cost of \$115.9 million, an average of over \$11.6 million per year, with \$15.9 million allocated in the first year.

This is an increase over the current 3-year average renewals programme cost of \$1.8 million per year.

The increased figures allow for the increase in unit cost rates, assumed in the ROM modelling. They exclude escalation, and are expressed in present-day dollars.

Table 6-23 and Figure 6-15 summarise how the recommended future renewals costs will be spread over future years.

Asset type	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	10-year total
Street light renewals	\$14.1	\$13.6	\$13.6	\$8.1	\$8.1	\$8.1	\$8.1	\$8.1	\$8.1	\$8.1	\$98.2
Technical support services	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$1.1	\$11.3
Staff overheads (renewals)	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6	\$6.3
Total	\$15.8	\$15.4	\$15.4	\$9.9	\$9.9	\$9.9	\$9.9	\$9.9	\$9.9	\$9.9	\$115.8

Table 6-23: Future renewal costs for street lighting

Source: Asset Management financial database

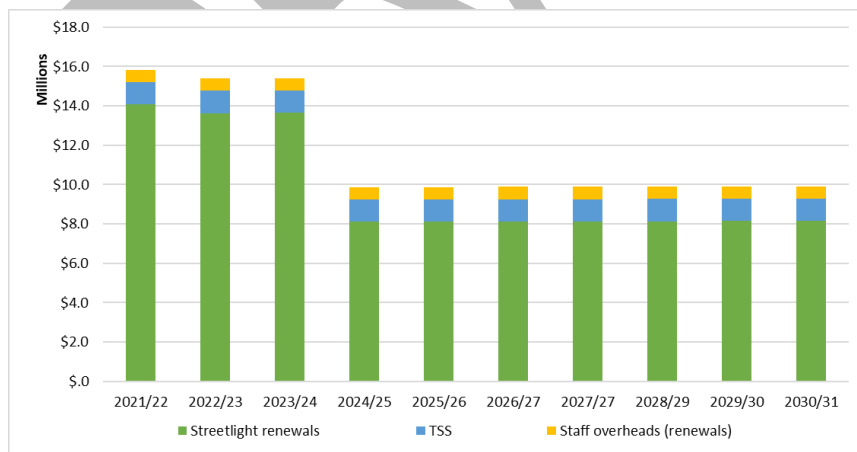


Figure 6-15: Future renewal costs for street lighting

6.4.7 Comparison with long-term plan

Figure 6-16 compares the recommended renewals for street lighting with those forecast in Auckland Council's Long-Term Plan 2018.

Overall, the recommended renewals align with the approved renewals budget in the long-term plan.

Recommendation to increase the first 2 years is to address the rapid deterioration of the pavements due to growth related construction traffic and heavy commercial vehicle usage.

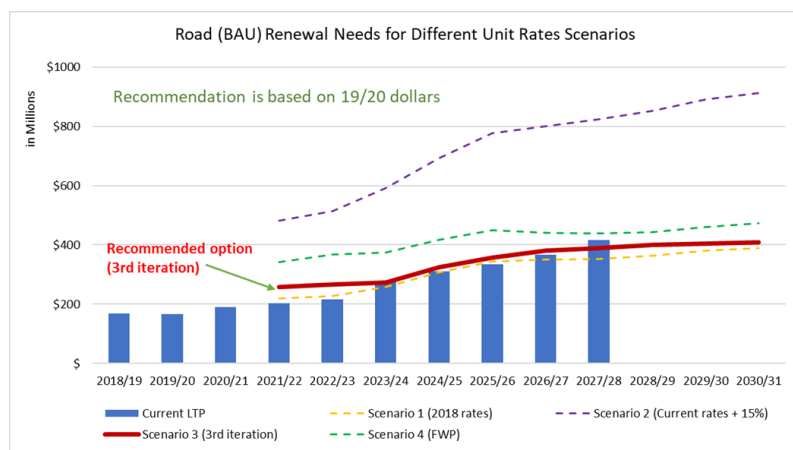


Figure 6-16: Renewal cost comparison with the long-term plan (road)

6.4.8 Future condition profile

The future condition profile of street lights, under the recommended renewal programme, is predicted to behave as shown in Figure 6-17.

There is a trend of assets moving from moderate and good condition, to very good condition. Also, poor and very poor performing assets will stabilise over next 10 years.

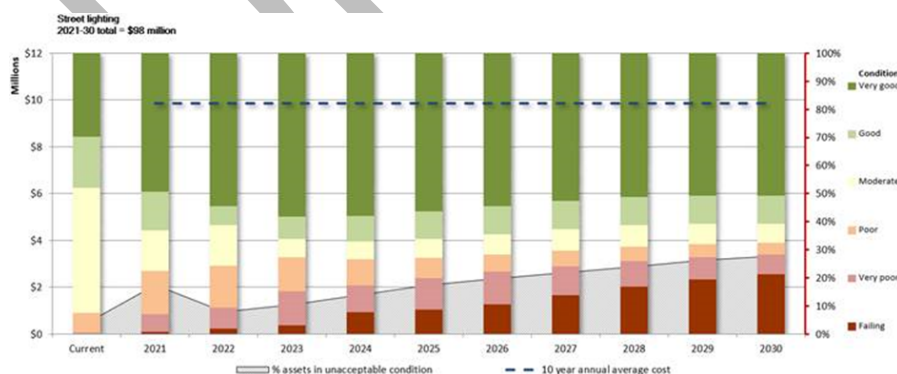


Figure 6-17: Future condition profile for street lighting

Commented [MO(15)]: Is this relevant for street lighting? Need to make this explicit if street lighting is part of the roading costs.

Commented [MO(16)]: AP: 20% of the streetlights have failed by the end of ten years, looks like the reduction in poor and very poor condition is because the lights have failed altogether which does not sound like good news. Also – across all asset classes – ROM is showing this huge difference between current and 2021 condition. The shift from moderate to very good condition is entirely within this “hidden” year. It undermines the confidence in what ROM has to say about the following ten years

6.4.9 Street lighting renewals forward works programme

The process that Auckland Transport uses to develop its renewals forward works programme involves:

- identification – identifying sites for renewal based on their condition, and local knowledge and requirements
- prioritisation – assigning a condition-based ranking to assets needing renewal, assuming no budget constraints
- optimisation – making a risk-based selection of assets for renewal, to fit a constrained budget
- integration – validating the scope of the renewals works required, and integrating these works with other projects.

Auckland Transport's 10-year Street Lighting Plan sets budgets for renewing street lighting assets so they achieve the required levels of service. It provides a long-term view of the network management required, based on asset knowledge.

Table 6-24 summarises Auckland Transport's current renewals forwards work programme for street lighting, excluding the LED replacement programme.

Work activity	Central	North	South	HGI	West	10-year total
Pole renewals	\$7,509,877	\$10,847,600	\$16,271,400	\$2,920,508	\$4,172,154	\$41,721,539
Bermeka/Non-galvanised pole replacement	\$13,904	\$3,179,425			\$676,671	\$3,870,000
Car vs pole renewals	\$900,000	\$1,300,000	\$1,950,000	\$350,000	\$500,000	\$5,000,000
Bracket renewals	\$1,553,300	\$968,100	\$2,933,700	\$516,250	\$2,210,250	\$8,181,600
Luminaire renewals	\$1,258,166	\$535,228	\$1,324,466	\$413,074	\$1,701,094	\$5,232,028
Amenity lighting renewals	\$3,848,500	\$243,000	\$251,500			\$4,343,000
OHUG related renewals	\$5,100,000		\$9,900,000			\$15,000,000
CATS renewal	\$317,005	\$317,005	\$317,005	\$317,005	\$317,005	\$1,585,025
Grand total	\$20,500,752	\$17,390,358	\$32,948,071	\$4,516,837	\$9,577,174	\$84,933,192

Table 6-24: Street lighting renewals forward work plan

Source: Auckland Transport Road Lighting 10-year Forward Works Plan (2018-draft)

Note: Includes an element of over/under programming and details are to be reviewed.

6.4.10 Process to develop a fundable renewals plan

Unlike 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 Auckland Transport revenue, Auckland Transport has developed a set of adjustments to its asset needs renewals programmes.

Commented [MO(17)]: How does this section now fit with the recommended investment in section 6.4.5? Explain how they fit together.

Commented [MO(18)]: Check – to introduce it earlier and explain how it fits with this plan

Street Lighting Asset Class Management Plan

An overview of the costs of the scenarios considered is shown in Figure 6-18.

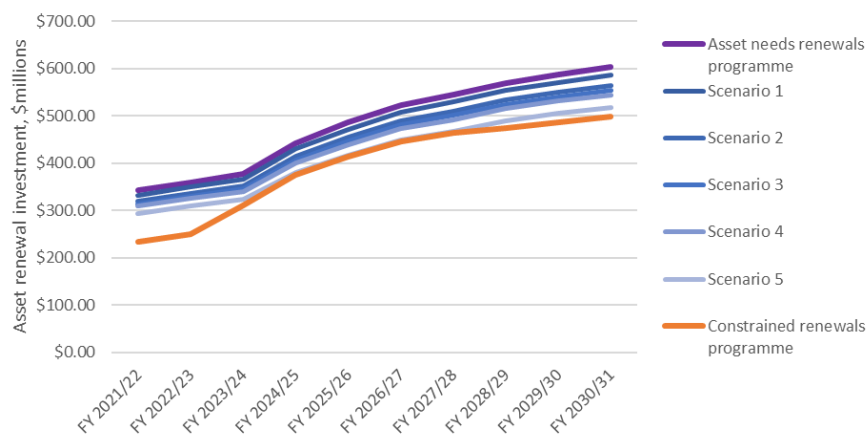


Figure 6-18: Asset investment programmes considered

6.4.10.1 Asset needs renewals programme

The asset needs renewals programme has a total cost of \$4.832 billion over 10 years. It includes the street lighting programme which has been the focus of this Asset Class Management Plan. The process by which the asset needs renewals programme was developed is described in detail in Section 6.4.9 of this ACMP, and in Section 6.2 of the Asset Management Plan. Renewals are prioritised based only on asset needs and delivery constraints. This programme did not consider affordability.

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 Auckland Transport 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 Auckland Transport 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.

6.4.10.2 Scenarios in response to funding constraints

In response to current funding constraints, Auckland Transport has developed a set of scenarios that postpone some renewals activities in order to arrive at a more affordable option. These scenarios are:

Scenario 1 – \$4.694 billion

This option addresses the backlog of assets that are below Auckland Transport'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 Auckland Transport 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.

6.4.10.3 The constrained renewal programme

This represents a sixth scenario, with a total cost over ten years of **\$3,951 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 will be included in AT's draft 2021 RLTP.

6.5 Capital improvements for street lighting

6.5.1 Auckland Regional Land Transport Programme

The Auckland Regional Land Transport Programme takes a strategic approach to the transport challenges faced by the Auckland region.

The programme summarises these challenges under key areas:

- safety
- congestion
- freight
- accessibility
- environment
- growth
- value for money.

The long-term capital investment programme set out in the Regional Land Transport Programme will enable Auckland to address its current challenges and take advantage of future growth, while at the same time enabling the creation of an accessible, well-connected, safe and sustainable region.

The Regional Land Transport Programme will also support the move away from a city where the dominant mode of travel is by single-occupant private vehicles, to a city where public transport, walking and cycling play a more important role. Significant investment in transport infrastructure such as light rail, mass transit, bus priority measures and cycleways, supported by improvements to bus, rail and ferry services, will support Auckland to achieve these goals. This will be supported by a much greater focus on customer needs and improving customer experience.

Street Lighting Asset Class Management Plan

Investment in walking and cycling facilities will be supported by the provision of more shared spaces, amenity improvements, cycleways and footpaths, better network connections, end-of-journey facilities, more and improved pedestrian crossings, signal phasing that prioritises pedestrians, and safer traffic speeds.

Addressing the negative impacts of the transport system is a core element of the programme, in particular to reduce deaths and serious injuries. This will be achieved through a comprehensive programme of safety improvements, including targeted initiatives such as improvements to high-risk intersections and corridors, and speed management.

Minimising the impacts of transport on the environment is also a core focus of the programme, and will be achieved through better design, greater use of more sustainable travel options, the rollout of LED lighting, the installation of pollutant traps to minimise the impacts of road stormwater damage and promotion of electric vehicles.

Improving network capacity and performance by making the most of the existing transport system will also be key. For example, optimising the network through targeted changes such as improving the coordination of traffic lights, using dynamic lanes at peak times, and removing bottlenecks to mitigate congestion. Maximising the benefits from new technology and taking opportunities to influence travel demand by encouraging car sharing and mobility as a service (MaaS) are also important. In the longer term, we will also consider introducing pricing to address congestion.

While the primary focus of the Regional Land Transport Programme is to reduce people's reliance on private cars, there is still a need to invest in roads. In this respect, the programme addresses congestion on the arterial road network, supports the movement of freight including access to key freight locations, the port and Auckland Airport, and enables public transport to support housing and development.

6.5.2 LED retrofitting programme

One Auckland Transport's key capital improvements for street lighting is its current LED retrofitting programme.

The programme is an accelerated renewals programme, which will retrofit energy-efficient LED luminaires in place of high-energy-use luminaires, in street lights across the Auckland region with more.

The programme is part of Auckland Transport's focus on providing low-emission transport facilities and services, and on using new technologies to reduce the environmental impacts of the transport network. It is also one of our key activities that contribute to the government's and Auckland Council's objective of reducing energy use and carbon emissions by 40 per cent by 2040.

Further details of the energy efficiency improvements that will result from this programme and other recent Auckland Transport initiatives are discussed in Appendix D.

The planned capital investment for street lighting improvements in the current Auckland Regional Land Transport Programme (2018-2028) is shown in Table 6-25.

Project name and description \$M	Priority	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25 to 2027/28
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Street lighting improvements Programme to deliver improved street lighting throughout the Auckland region where it has been identified as deficient, such as where there are safety concerns. This programme also includes rollout of LED street lighting on the local road network.	2	5.5	5.5	8.1	7.9	8.0	10.7	12.5
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Table 6-25: Auckland Transport capital programme (funded) for street lights

Source: Auckland Regional Land Transport Programme (2018–2028)

The LED retrofit programme is mainly funded as a capital improvement, although some replacement with LED lights are funded under renewals budgets.

The initial rate of this subsidy was 85 per cent, which applies through to June 2021. For 2021/2022 and 2022/2023, the subsidy will revert to 51 per cent. For this reason, the programme is aiming to retrofit as many lights as possible before the end of June 2021.

6.5.2.1 Progress to date

The LED retrofitting programme began in May 2015, and is being implemented into two stages.

Stage 1 targeted predominately residential streets ('P' category roads), replacing 49,000 70-watt high-pressure sodium lamps at a total cost of \$25.59 million. The installation of a tele-management system for these lights added an additional capital cost of \$22 million. The system manages light levels by switching off and dimming lights during times of low usage, and monitors light performance

Stage 1 was completed in 2018/2019. We estimate this stage of the programme will deliver net savings of around \$32 million over the 20-year design life of the installed LEDs. The tele-management system will add a further 15 to 20 per cent energy savings for the network.

Stage 2 began in 2018/2019 and will complete the replacement of the remaining old lights in the network. This involves replacing 49,000 100-watt high-pressure sodium lamps with LED lamps, over 5 years, on vehicle predominant roads ('V' category roads) and connecting them to the tele-management system.

The total capital cost of stage 2 is \$43.1 million. We anticipated it will achieve net savings in energy and maintenance of \$73.1 million over 20 years.

Figure 6-19 shows the lifecycle costs for retrofitting on V category roads over the asset life of 20 years.

View the following link for further details: <https://at.govt.nz/media/1976503/item-111-street-lighting-procurement-stage-2-april-2018.pdf>.

Commented [MO(19)]: Check:
Figure to show the net savings as stated
Figure t show the capital costs of \$42.1m
Check \$73.1m saving - \$1.7m next paragraph

Street Lighting Asset Class Management Plan

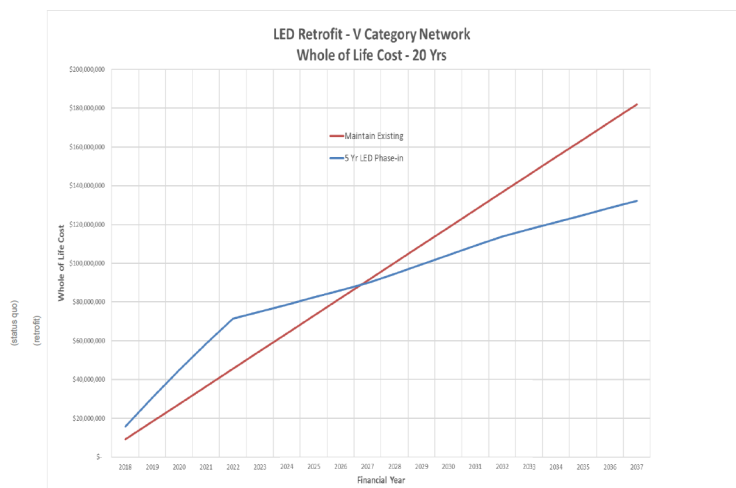


Figure 6-19: Whole-of-life costs for LED retrofitting on V category roads

Source: Comparison of total cost (energy, maintenance, renewals) for proposed retrofit and status quo

The expenditure for stage 2 of the programme is set out in Table 6-26.

2018/19	2020	2021	2022	2023	Total
\$M					
\$7.89	\$14.58	\$20.63	\$6.37	\$6.36	\$55.83

Table 6-26: Expenditure for LED retrofitting programme, stage 2

This expenditure with the administration costs added is set out in Table 6-27.

2018/19	2020	2021	2022	2023	Total
\$M					
\$8.41	\$15.78	\$21.46	\$6.73	\$6.73	\$59.11

Table 6-27: Expenditure for LED retrofitting programme, stage 2, with administration costs

By the end of February 2020, 60,904 lights in total had been retrofitted and connected to the tele-management system, under stage 1 and 2 of the programme.

A further 11,630 LED lights have been installed in the network through other projects and subdivisions. These LED lights represent more than \$2 million per year in electricity cost savings and a reduction of 1,400 tonnes in CO₂ emissions. There is a further direct savings of \$1.7 million per year in maintenance costs.

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Auckland Transport is planning on having 90,000 lights retrofitted and connected to the tele-management system by June 2021. This target now depends on there being a sufficient supply of luminaires and the effect of any Covid 19-related restrictions.

The remaining lights on the network to be retrofitted are higher power (larger) lights. The reductions in energy usage and costs savings achieved by replacing these lights will be higher.

6.6 Disposal plan for street lighting

Street lighting assets are generally disposed of when they are damaged, become redundant or have reached the end of their useful lives. Disposal has financial and environmental impacts.

Auckland Transport encourages its contractors to reuse or recycle assets where possible. Where this is not practical, assets must be disposed of responsibly.

Some products are designed to be reused at the end of their life span. For example, aluminium lighting columns are 100 per cent recyclable, lightweight, maintenance free and impact-safe. When designing the aluminium lighting column, all non-aluminium components are designed to be easily separated at the end of its useful life. Aluminium can be profitably recycled, providing some financial return.

Contractors are responsible for identifying, obtaining consents for and cleaning up after any disposal activities, as part of their contract agreement. Any surplus materials and broken items are disposed of at contractors' off-site dumps. Special care is taken when disposing of gas-filled lamps, which contain hazardous substances.

7 Improvement initiatives

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.

Table 7-1: Enterprise Business Plan key deliverables and Asset Management goal

A comprehensive asset management improvement programme is currently underway which has been developed over the last three years by taking into account the feedback received from a number of assessments and audits. These include improvements sourced from:

- Waka Kotahi NZ Audits (2018 & 2019)
- AECOM 2018 Business Review
- 2020 Infrastructure Management Assessment
- 2020 Road Efficiency Group Excellence Programme
- Integration with Auckland Transport systems and policies, including Enterprise Asset Management (EAM), Active Risk Manager (ARM) and Central Management System for street lighting.

Street Lighting Asset Class Management Plan

There are 102 improvement tasks altogether and they will be implemented over a period of time as highlighted in **Error! Reference source not found..**

The progress highlights achieved so far is summarised below:

- AM Risk Deep Dive Review
- Working with Risk & Assurance Team
- Seeking to retender AM Prof Services year early
- Statement of Intents for AM, AM Data, SLAs and Comms plan progressing well
- Asset Management Centre of Excellence Knowledge Hub to be revamped
- Transport for NSW collaboration.

Street Lighting Asset Class Management Plan

IIMM Cat	Improvement Required	Source	Priority	Improvement Owner	Gen 1 Outcome	Gen 1 End Date	Gen 1 Status
AM Policy and Strategy	1.1 Draft / Complete the AT Asset Management Strategy. The AM Strategy forms a major component of the AT Asset Management System and should describe AT's strategy for the management of physical assets over their life cycle and demonstrate the organisational approach to the coordination of asset management outcomes across the various asset portfolios and the organisation as a whole. The AM Strategy should establish the asset management objectives, set out how AT will achieve these objectives and provide direction for downstream activities that are documented in the AT Asset Management Plans.	DHCL IIMM AMMA Apr 20	1	Myles Lind	AM Strategy based on ISO55000 AM Policy reviewed and approved to ensure alignment with Strategy	Dec-20	Underway
	1.2 Develop an integrated ISO 55001 Asset Management System (for either alignment or certification purposes).	AECOM BIP - Roads Apr 18			AM Document Hierarchy (Legislation → Supporting Elements)	Oct-20	Underway
	1.3 Develop AM policy and strategy using ISO55000	Group Future Work Plan			2020 AM Policy	Jun-20	Underway
	1.4 Strengthen key strategic themes and KPIs to drive "sustaining and maintaining the resilience and integrity of existing infrastructure".	AECOM BIP - Roads Apr 18			Document key strategic themes / principles as they apply to AM. Identify KPIs for AM Identify AM feedback loops (where appropriate)	Dec-20	Underway
	1.5 Develop and review asset related guidelines, policies and strategies	Group Future Work Plan			Document catalogue of guidelines and supporting elements (Sharepoint)	Aug-20	Complete
	1.6 Update the AM Policy to include assets that are currently not included i.e. harbour master and airfield assets.	DHCL IIMM AMMA Apr 20			Confirm asset classes not covered in legacy AM Policy and ensure included within AM Strategy.	Aug-20	Complete
	1.7 Develop a graphic for inclusion in the AM Strategy and AMP that clearly depicts the separate components of the AT Asset Management System. This system can be defined as a set of interrelated or interacting elements of the organisation that establish the asset management policies and objectives, as well as the processes and procedures that support the system.	DHCL IIMM AMMA Apr 20			Graphical representation of the AT AM System	Jul-20	Underway
	1.8 Once AM Policy has been updated have it independently reviewed prior to final approval.	DHCL IIMM AMMA Apr 20	3	Myles Lind	AM Policy External Review	Sep-20	Assigned

Street Lighting Asset Class Management Plan

Levels of Service and Performance Management	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.	DHCL IIMM AMMA Apr 20	2	Siri Rangamuwa	Identify Level of Service gaps and where Levels of Service may no longer be appropriate	Dec-20	Assigned
	2.2	Establish a process for engagement both internally and externally to secure acceptance of agreed levels of service.	DHCL IIMM AMMA Apr 20		Siri Rangamuwa	Engagement process designed and documented. (Part of 2.1 above)	Dec-20	Assigned
	2.3	Agree Stormwater levels of service with Auckland Council and introduce governance overview of performance to agreed levels.	DHCL IIMM AMMA Apr 20	2	Cathy Bebelman	Process of agreement and governance developed and documented. (Part of 2.1 above)	Dec-20	Assigned
	2.4	Develop a trade-off model to assess options for increasing or decreasing levels of service, which considers risk, costs and benefits across the portfolios.	DHCL IIMM AMMA Apr 20	2	Siri Rangamuwa	Identify Levels of Service that could benefit from being included in a trade off model (may be all or just some - link to investment drivers, legislation and operational context)	Dec-20	Assigned
Forecasting Demand	3.1	Consider additional resources to increase traffic, pedestrian and cycle counting capabilities.	DHCL IIMM AMMA Apr 20	3	Delia Sahinovic	Following item 3.1a below. Develop position descriptions / Prof Services scope / training requirements for additional resource requirements (Capacity / capability).	Jun-21	Assigned
	3.1a	R.11.2 Develop and implement an effective, network-wide, activity counting programme, that provides accurate multi-modal volumes and trends.	Waka Kotahi - Investment Audit Report 2019	2	Delia Sahinovic	Complete strategic case for traffic/mode counting (identify benefits to inform investment / SSBC)	Jun-21	Assigned
	3.2	Incorporate the roles of other AT teams in the demand forecasting process in subsequent maturity reviews.	DHCL IIMM AMMA Apr 20	2	Siri Rangamuwa	Identify roles/responsibilities to be included in demand forecasting process for next AMM Assessment.	Nov-20	
	3.3	Monitor and respond to the impacts of rapid heavy vehicle growth on roads and structures	AECOM BIP - Roads Apr 18	2	Delia Sahinovic	Review / GAP on existing AT approaches to understanding HV impacts on AT assets.	Sep-20	On Hold
Asset Register Data	4.1	Develop a data management guideline or policy that provides rules and procedures around data ownership, transfer, management and maintenance of asset data. Ensure the guideline aligns to requirements of EAM Project.	DHCL IIMM AMMA Apr 20	1	Myles Lind	Draft AM Data Policy	May-20	Complete
	4.1a	R.11.1 Ensure appropriate process controls are created to assure all data entering the system complies with the data quality dimensions of timeliness, accuracy and completeness.	Waka Kotahi - Investment Audit Report 2019		Charmaine Okros	Review RAMM reports on data quality and associated socialising and decision making based on these reports.	Jun-20	Complete

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4.2	General asset data improvements	Group Future Work Plan	1	Brett Elston	Prioritised programme of data improvements across asset classes. Asset data scope/specifications provided to Maintenance contract retender. Asset management data scope reviewed ahead of professional services retender.	Nov-20	Complete
4.3	Make improvements to data across a range of areas – including asset inventory, criticality, condition and maintenance history.	AECOM BIP - Roads Apr 18		Siri Rangamuwa	Part of 4.2 above - Measurable reduction in data quality issues (timeliness, accuracy, completeness)	Dec-20	Underway
4.4	Review the quality of the data that should be used to make tactical and operational decisions and develop improvement actions (including reporting) to improve the quality where required	DHCL IIMM AMMA Apr 20		Myles Lind	Investigate existing sector solutions for data decision making frameworks - expressly with data requirements for operational and tactical decision making.	Sep-20	Underway
4.5	Complete asset ownership review and ensure this is widely understood by key stakeholders.	DHCL IIMM AMMA Apr 20	1	Siri Rangamuwa	Part of 4.6 below - Data Ownership Issues & Options Paper	Dec-20	Underway
4.6	Provide input to improve the AT Guidelines for asset ownership and maintenance responsibilities, including system/database update.	Group Future Work Plan		Siri Rangamuwa	SLAs between CEAM, P&I and RCD teams / (ownership / inputs / deliverables)	Oct-20	Underway
4.7	Review vested assets process to ensure that quality information is secured during the transfer process	DHCL IIMM AMMA Apr 20	3	Delia Sahinovic	Review current vested asset process, identify gaps and information requirements for process update	Jun-21	Underway
4.8	Revise/update the process for check/validation of the As-built Information, AOMs and Data Quality Assurance for PT new Assets	Group Future Work Plan		Delia Sahinovic	Review current as-built validation process, identify gaps and information requirements for	Apr-21	Underway
4.9	Develop an Improvement Plan to review and update the process for the as-built information management associated with the vested assets - AC	Group Future Work Plan	2	Charmaine Okros	Strategic Case for As-Built Information Management (BIM & ISO 19650 Adoption)	Mar-21	Assigned
4.9a	R.11.3 Establishes a control point where the vesting of the asset to Auckland Transport is reliant on the developer providing the as-built data.	Waka Kotahi - Investment Audit Report 2019		Delia Sahinovic	Part of 4.7 above - Programme BC for As-Built Control point.	Jun-21	Assigned
4.10	Review the AT as-building process for renewal works - RCD	AECOM BIP - Roads Apr 18		Charmaine Okros	Strategic Case for As-Built Information Management (BIM & ISO 19650 Adoption)	Mar-21	Underway
4.11	Check and validate as required As-built Information, AOMs and Data Quality Assurance for new and upgraded PT assets (consultant input required) - SPM	Group Future Work Plan		Delia Sahinovic	Part of 4.7 above - Programme BC for As-Built Control point.	Jun-21	Assigned

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	4.12	Check and validate as required As-built Information and Data Quality Assurance for new Rooding and Structures Assets (AT Capital and AC/DE projects) - RAMM	Group Future Work Plan		Delia Sahinovic	Part of 4.7 above - Programme BC for As-Built Control point.	Jun-21	Underway
Asset Performance and Condition	5.1	Review requirements for reporting and consider development of automated dashboard of performance measures to provide more timely indicators.	DHCL IIMM AMMA Apr 20	2	Myles Lind	Develop ELT / Board Level dashboards through Bridges Pilot / EAM	Jul-20	Underway
	5.2	Review and increase transparency on the use of condition and performance data in decision making throughout the organisation	DHCL IIMM AMMA Apr 20	1	Charmaine Okros	Data Quality Reporting (quarterly) Accuracy, completeness, timeliness (from RAMM) Mike Alford	Jun-20	Complete
	5.3	Rooding Structures - Improve condition inspection/assessment reporting	Group Future Work Plan	1	Myles Lind	EAM Report of AMP FWP Programme vs Completed FWP	Dec-20	Assigned
	5.4	PT Metro Assets - Improve condition inspection/assessment reporting	Group Future Work Plan		Myles Lind	EAM Report of PT Facilities Inspection Programme vs Completed	Dec-20	Assigned
	5.6	Stormwater Assets - Improve condition inspection/assessment reporting	Group Future Work Plan		Myles Lind	EAM Report of Stormwater Inspections Programme vs Completed	Mar-21	Assigned
Decision Making	6.1	Review and document the decision-making process. AT is a large and complex organisation with a large budget. This environment makes it more important to have a robust coordinated decision-making process.	DHCL IIMM AMMA Apr 20	1	Myles Lind	Review and document core AT decision making process for AM	May-21	Assigned
	6.2	Establish a formal decision-making process in line with existing processes for stormwater.	DHCL IIMM AMMA Apr 20		Myles Lind	Document the stormwater decision making business process for AM.	May-21	Underway
Managing Risk	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.	DHCL IIMM AMMA Apr 20	1	Myles Lind	Review and transfer strategic AM risks into corporate ARM System	Jun-20	Complete
	7.2	In line with the improvement above improve reporting of major asset risks to enable the appropriate level of visibility at senior level.	DHCL IIMM AMMA Apr 20		Myles Lind	Develop AM risk reporting protocols / dashboards.	Sep-20	Complete
	7.3	Elevate risk management and reporting processes to Board level: (1) Convey understanding of broad nature of risks (e.g. slope failure, retaining walls) – “no surprises”.	AECOM BIP - Roads Apr 18		Murray Burt	Reporting protocols to be designed / tested through AM.IPSG.	Dec-20	Complete
	7.4	Improve risk management processes: (1) Identification of critical assets – what assets can't be allowed to fail? (2) Develop from current corporate risk management processes, tools and reporting, more granular.	AECOM BIP - Roads Apr 18	1	Siri Rangamuwa	Document existing asset criticality approaches.	Dec-20	Underway

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	7.5	Identify assets at high risk and develop suitable management strategies	Group Future Work Plan		Siri Rangamuwa	High risk / criticality assets identified and reported to FCR.	Jun-20	Complete
	7.6	Develop Resilience scorecards and assessments – test current vs desired (e.g. routes, key sites).	AECOM BIP - Roads Apr 18	2	Siri Rangamuwa	Resilience Scorecards designed.	Dec-20	On Hold
	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.	Group Future Work Plan		Siri Rangamuwa	First pass resilience assessment completed for priority factors	Apr-21	Underway
	7.8	Create Emergency Preparedness Procedure/Resilience Plan for key assets	Group Future Work Plan		Siri Rangamuwa	Emergency preparedness plans designed (template)	May-21	
	7.9	Develop and Implement a Climate change adaptation plan	Group Future Work Plan	2	Cathy Bebelman	Investigate / research good practice CCA Plans.	Dec-20	
	7.10	Strengthen the AM culture around long term risk and service outcomes – a “stewardship” focus.	AECOM BIP - Roads Apr 18	2	Myles Lind	Ensure stewardship key theme in AM COP ToR	Jun-20	Complete
Operational Planning	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.	DHCL IIMM AMMA Apr 20	1	Siri Rangamuwa	Criticality Framework gaps identified, workplan to review, update and/or develop critical asset strategies established	Dec-20	Underway
	8.2	Where budgets do not align with asset requirement ensure this is escalated as a priority risk and the consequences fully detailed and communicated.	DHCL IIMM AMMA Apr 20	1	Myles Lind	Industry research to benchmark AT budgets with sector peers.	Dec-20	Underway
	8.3	Review the process for building maintenance budgets to ensure input from all areas of the business (such as technical input) is considered.	DHCL IIMM AMMA Apr 20	1	Siri Rangamuwa	Maintenance budget development gaps identified (including external review of consequential Opex and unit	Dec-20	Underway
	8.4	Ensure that project work is classified correctly and funded from the relevant Activity Class and Work category.	Waka Kotahi - Technical Audit 2018	1	Matiul Khan	Provide evidence to NZTA that recommendation has been resolved.	Jul-20	Complete
	8.5	Review the consultant's role to improve the development of the structures renewal and improvement programmes.	Waka Kotahi - Technical Audit 2018	1	Matiul Khan	Provide evidence to NZTA that recommendation has been resolved.	Jul-20	Complete
	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	AECOM BIP - Roads Apr 18	2	Siri Rangamuwa	Sector research on peers use of RCA and IoT etc	May-21	
Capital Works Planning	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.	DHCL IIMM AMMA Apr 20	1	Siri Rangamuwa	SLAs between CEAM, P&I and RCD teams / (inputs / deliverables)	Sep-20	Underway

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	9.2	Improve the project closeout processes to ensure accurate and timely information is passed to AT and captured in appropriate systems.	DHCL IIMM AMMA Apr 20	2	Delia Sahinovic	Review and update the legacy Asset Handover Completion Handbook (2015 version)	Sep-21	Underway
	9.3	Develop more integrated planning process that work across AT to optimise the opportunities to renew, improve level of service or increase capacity for growth	DHCL IIMM AMMA Apr 20	2	Myles Lind	Establish AM COP with ToR	Jun-20	Complete
	9.4	Escalate the vested asset risk within the risk management system and aim to mitigate the issues.	DHCL IIMM AMMA Apr 20	2	Delia Sahinovic	Review current vested asset process, identify gaps and information requirements for process update (TDM)	Nov-20	Complete
Financial Planning	10.1	Complete a review of the renewals model to determine its accuracy.	DHCL IIMM AMMA Apr 20	1	Siri Rangamuwa	External review requirements scoped	Oct-20	Underway
	10.2	Implement ROM improvements- Stable software platform for ROM system, Improved ROM condition profile and cross asset optimisation	Group Future Work Plan		Myles Lind	Investigate pros / cons of including ROM Model within EAM project	Dec-20	Underway
	10.3	Continue to develop scenario planning tools (e.g. Renewals Optimisation Model (ROM)) – to enable strategic use of risk, service and cost levers to test alternative AM investment scenarios.	AECOM BIP - Roads Apr 18		Siri Rangamuwa	Documentation of ROM model and design of maintenance and improvement plan for ROM model.	Mar-21	Underway
	10.4	Review the consequential Opex model to determine its accuracy. Complete a review of the renewals model to determine its accuracy.	DHCL IIMM AMMA Apr 20	2	Siri Rangamuwa	External review requirements for Opex Model scoped	Apr-21	
	10.5	Programme to document and review unit rates model (IIFMM? Watercare approach?)	Group Future Work Plan		Siri Rangamuwa	External review requirements for unit rates scoped	Jul-21	
	10.6	Strengthen the linkage between new Capex and consequential Opex in budgets: (1) Ensure that a standardised whole-of-asset life cost approach is adopted on all projects Options Analysis and Design phases. Ensure the costs of mitigating residual safety-in design risks are include	AECOM BIP - Roads Apr 18		Siri Rangamuwa	Links to Item 8.3. Whole of Life / AT approach designed into Consequential Opex Model	Dec-20	Underway
	10.7	Improve the capture of maintenance expenditure by asset.	DHCL IIMM AMMA Apr 20	2	Myles Lind	Asset data scope provided to Maintenance contract retender. Asset management data scope reviewed ahead of professional services retender.	Nov-20	Complete
	10.8	Review the Transport Agency's Lifecycle Management Plan against the Bridges, Structures and Walls ACMP.	Waka Kotahi - Technical Audit 2018	1	Matiul Khan	Provide evidence to NZTA that recommendation has been resolved.	Jul-20	Complete
Asset Management Leadership and Teams	11.1	Develop a communication strategy and plan that enable leaders at all levels to deliver a consistent asset management message across the organisation. The plan and messaging should be approved at ELT level to ensure it has the appropriate level of support.	DHCL IIMM AMMA Apr 20	2	Siri Rangamuwa	Sector research on existing AT, peers use of communication strategy. Design communication strategy ToC.	Dec-20	

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	11.2	Ensure roles, accountabilities and responsibilities are well defined for the end to end (Structures AM) process	Waka Kotahi - Technical Audit 2018	1	Matiul Khan	Provide evidence to NZTA that recommendation has been resolved.	Jul-20	Complete
	11.3	Review current FTE numbers. Determine what is missing (by number and function) to enable the level of asset management capability required.	DHCL IIMM AMMA Apr 20	1	Myles Lind	GAP Analysis of AM resourcing to support 2024 AMP Development	Dec-20	Underway
	11.4	Review the role of AM in the organisation and develop an AM competences framework. In addition: (1) Implement a comprehensive succession planning process (2) Strengthen internal geotechnical engineering capability. (3) Strengthen internal Bridges and Structures capability	AECOM BIP - Roads Apr 18	1	Myles Lind	Investigate sector solutions for possible competency frameworks. REG? IPWEA? Other	Nov-20	Underway
	11.5	Strengthen in-house capabilities to update the asset inventories	Group Future Work Plan	2	Myles Lind	Complete Strategic Case for AM Capability Investment	Jul-21	
	11.6	Benchmark against like organisation in terms of asset team size.	DHCL IIMM AMMA Apr 20	2	Myles Lind	Identify sector benchmarking initiatives (performance and funding) and/or identify benchmarking peers.	Sep-21	Underway
Asset Management Plans	12.1	Develop the asset management planning processes to more effectively engage other teams within AT such as RCD, Finance and Planning and Investment.	DHCL IIMM AMMA Apr 20	1	Siri Rangamuwa	Establish AMP Development Committee	Jun-20	Complete
	12.2	Develop ways to summarise / aggregate customer information for interpretation in AMPs / AM strategies.	AECOM BIP - Roads Apr 18		Siri Rangamuwa	Investigate sector approaches regarding customer information and AMPs.	Nov-20	Assigned
	12.3	Foster more collaboration across the AM business cycle.	AECOM BIP - Roads Apr 18		Myles Lind	Establish AM COP with ToR	Jun-20	Complete
	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.	DHCL IIMM AMMA Apr 20	2	Siri Rangamuwa	Investigate sector solutions to AMP format and structures. Implement / pilot sector acceptable format / template	Sep-20	Complete
	12.5	Strengthen the main AMP as a roll-up of all transport Asset Class Management Plans (AcMPs) (also known as Lifecycle Management Plans) and align with new Capex.	AECOM BIP - Roads Apr 18		Siri Rangamuwa	Investigate sector solutions to AMP format and structures. Implement / pilot sector acceptable format / template	Sep-20	Underway
	12.6	Document specific asset management business processes (i.e. development and prioritisation of FWPs.)	Group Future Work Plan	1	Myles Lind	Identify business process mapping tools available to AT.	Sep-21	Assigned
	12.7	Improve alignment between AMP and FWP	Group Future Work Plan		Siri Rangamuwa	Report AMP FWP Programme vs Completed FWP	May-21	Underway
Management Systems	13.1	Ensure relevant AM practices are included within the AT Quality Assurance Framework.	DHCL IIMM AMMA Apr 20	1	Siri Rangamuwa	AT Quality Assurance Framework updated	Sep-20	Assigned
	13.2	A number of processes are being reviewed as part of the EAM project. Identify the processes that are not being reviewed through the EAM project and review and update where required.	DHCL IIMM AMMA Apr 20	2	Siri Rangamuwa	Catalogue of non-EAM business processes captured.	Jun-21	



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	13.3	Develop and implement asset management business processes	Group Future Work Plan		Siri Rangamuwa	Identify and prioritise missing business processes for mapping / documenting and maintaining.	Jun-21	
	13.4	EAM Project Transition	Group Future Work Plan	1	Myles Lind	Identify EAM System owners and include duties into JDs. (BIRST, IPS, & dPEM Modules)	Dec-20	Underway
	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 ISO5500 terms and abbreviations.	DHCL IIMM AMMA Apr 20	2	Myles Lind	Engagement with AT COP and National Data Standards team to align data structure / dictionary efforts for AM	Sep-20	Complete
Asset Management Information Systems	14.1	Investigate the benefits of a data standard. Develop in line with EAM requirements.	DHCL IIMM AMMA Apr 20	1	Myles Lind	Engagement with NZTA and National Data Standards team to align data structure / dictionary	Sep-20	Underway
	14.2	Develop an Asset Information Strategy and provide clarity around the implementation of EAM vs the future of RAMM.			Charmaine Okros	Identify AIS used by peers that could be applicable to AT. All AM	Nov-20	Complete
	14.3	Complete the pilot for EAM for bridge assets and agree the next steps forward.	DHCL IIMM AMMA Apr 20	1	Myles Lind	Statement of Work One Review. Inform SOW 2.	Jun-20	Complete
	14.4	Develop more timely ways of providing information and graphical analysis to the organisation (potentially through EAM or through better use of business intelligence tools).	DHCL IIMM AMMA Apr 20	2	Siri Rangamuwa	Develop key (ELT / Board Level) dashboard reporting as part of Bridge EAM pilot project / UAT	Jul-20	Underway
	14.5	Complete the update of the data base information manual.	DHCL IIMM AMMA Apr 20	2	Delia Sahinovic	AT DOM Review for Rooding.	Apr-21	Underway
	14.6	Transfer and maintain the CEAM risks in legacy systems and spreadsheets into the AT Corporate ARM Risk System	AT Business Plan	1	Myles Lind	ARM Training completed. Gain access to ARM System.	May-20	Complete
	14.7	Review and maintain resource consent compliance status and supporting evidence within the AT Corporate CRM System	AT Business Plan	1	Myles Lind	CMS Training completed. Gain access to CMS System. Develop core compliance status reports. Review assignment of consents in CMS.	Jun-20	Complete
Service Delivery Mechanisms	15.1	Develop an internal Service Delivery responsibility and accountability matrix. Identify where key interdependencies and decision points are to ensure successful programme delivery.	DHCL IIMM AMMA Apr 20	1	Siri Rangamuwa	SLAs between CEAM, P&I and RCD teams / (ownership / inputs / deliverables)	Sep-20	Underway
	15.2	Develop a more robust contract performance management framework. This will need to be done prior to contract renewal in order for it to be ready a contract renewal time.	DHCL IIMM AMMA Apr 20	1	Myles Lind	Industry / peer sweep to identify good practice in contract performance management.	Oct-20	Underway

Table 7-2: Asset Management improvement activities

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Other key improvement initiatives relating to street lighting include those shown in Table 7-3.

Asset area	Key result area	Actions	Priority	Status
Streetlighting	Finance	Complete valuations of the street light assets in the old Franklin district that are currently owned by Counties Power, as part of due diligence.	Medium	On-going
Streetlighting	Finance	Tracking of historical expenditure trends for street lighting operation and maintenance, and renewal expenditure by asset type and expenditure type.	High	On-going
Streetlighting	Service delivery Asset management	Install a formal feedback loop so the operation team is informed about changes in traffic volume data to enable the lighting registers to remain current.	Medium	On-going
Streetlighting	Service delivery Asset management	Undertake testing programme to identify old columns that are at risk when any unplanned additional loading, such as banners, is added to them, particularly in the old central areas.	High	Yet to start

Low Medium High Very high

Table 7-3: Street lighting improvement initiatives (TBC)

8 Sustainability (TBC)

Auckland Transport aims to ensure the environmental and economic sustainability of its transport network, so that it remains available for and does not compromise the wellbeing of future generations.

For the street lighting network, this will be achieved through:

- Emissions Trading Scheme responsibilities – minimise the network’s carbon footprint, and maximise the economic value of its recycled materials
- pollution control – minimise light pollution
- economic sustainability – provide assets and services at least whole-of-life cost.

Table 8-1 details the specific management processes, approaches and activities that Auckland Transport will use to achieve these goals.

Impact	Sustainability initiatives
Environmental	
Carbon footprint and light pollution	Improve the transport network’s energy efficiency by using new technology, with LED street light lamps and control gear that can vary lighting levels during specific times of the day. Improve lighting standards through better light distribution and lower light pollution from new lighting technologies, reducing spill light and sky glow. Reduce light output at times of low traffic volumes by using pre-programmed photocells and a central management system that allows light profiles to be changed to match weather and traffic conditions. Comply with the requirements in Auckland Transport’s Transport Design Manual for Street Lighting.
Social	
Personal well-being and amenity	Acknowledge that lighting environments have a direct influence on the motivation and alertness of people living and moving in them. Improve urban design and amenity value when revitalising areas. Consider urban design principles in all Auckland Transport’s projects. Create shared spaces and high-quality pedestrian-focused streets with well-designed street lighting. This will improve amenity and safety value, as well as encouraging pedestrian activity rather than the use of private vehicles.
Economic	
Whole-of-life costs	Consider sustainable solutions for reusing and recycling street lighting components, e.g. select aluminium lantern bodies, which are highly recyclable when compared to glass reinforced plastic units. Treat street lighting equipment as special waste and take it to specialised recycling facilities where the materials (sodium, mercury, etc.) are removed for reuse. Analyse the current age and condition of street lighting assets for renewal planning, while meeting service levels and managing risks. Use energy-efficient luminaires with longer life spans and reduce general and consequential operation and maintenance costs.

Table 8-1: Street lighting sustainability initiatives

9 Key issues (TBC)

Table 9-1 summarises the key issues that impact Auckland Transport's street lighting assets and the actions we plan to take to resolve those issues.

Code	Consequence category	Issue	Ranking	Mitigation	Outcome
IR SL FI 1	Finance	Maintenance budgets for street lighting have been reduced in the past few years, although the amount of work required increases relative to network growth (around 2.5% per year). The impact of budget reductions, and the consequences in terms of achieving levels of service, are not well understood.	Medium	- Collaborate work with city planners, local boards and developers to understand the upcoming land use development within the network. - Complete consequential OPEX analysis in future planning. - Use a whole-of-life approach in planning, designing and implementing works.	Whole-of-life costs are considered in decision-making
IR SL FI 3	Finance	Coordination is required to integrate street lighting renewals forward works with other programmes, including road and kerb realignments, urban streetscape projects that require new or upgraded lighting, and utilities programmes such as OHUG power and telephone services.	Medium	- Ensure there is more information sharing and coordination between Auckland Transport divisions and departments relating to their proposed forward works programmes. - Apply the National Code of Practice for Utilities Access to the transport corridors, in order to improve coordination between stakeholders, improve project delivery and maximise the use of staff time.	Whole-of-life costs are considered in decision-making
IR SL SD 1	Service delivery Asset management	The data in RAMM has been improved during the year. However, there are areas that need further works for improvement, eg ownership and age, condition and general data completeness	High	Collect and complete data about the age and condition of .asset components	Increased data confidence; effective asset management
IR SL SD 2	Service delivery Asset management	Currently there is no schedule cleaning regime for LED luminaires	Low	Schedule and implement work for LED cleaning (10% of the network per year to start with) from 2017-18	Improved services; effective asset management

Commented [MO(21)]: Check and confirm

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Code	Consequence category	Issue	Ranking	Mitigation	Outcome
IR SL SD 3	Service delivery Asset management	Approximately 1,500 car versus pole crashes have occurred in the region since 2000 (Road Crash Statistic Report), costing an average of \$230,000 per annum to replace.	Medium	Implement a cost-recovery process for car and pole crashes.	Effective asset management
IR SL SD 4	Service delivery Asset management	Better street lighting will be required to create more pedestrian-friendly environments that encourage walking as a transport choice and to revitalise urban areas.	Low	- Investigate good urban design features for street lighting and implement them within redevelopment projects. - Ensure street lighting specifications and levels of service consider safety for all transport users, and not just vehicle needs.	Improved services
IR SL SD 6	Service delivery Asset management	Effectiveness of street lighting reduced by overhanging trees.	Low	Ensure that new street lighting is positioned to avoid existing trees. Keep existing trees clear from lights.	Improved services
IR SL SD 7	Service delivery Asset management	Vandalism and other damage to street light assets.	High	Set up regular condition inspections for street-lighting assets.	Improved services; effective asset management
IR SL SD 8	Service delivery Asset management	Outages due to reliance on third-party power supply.	High	Streamline procedures for rectifying outages on the lines companies' networks.	Effective asset management
IR SL SD 9	Service delivery Asset management	Overseas and local studies indicate reductions in night-time crashes of around 30% where lighting has been improved. This should be taken into account when selecting the appropriate category for design levels.	High	- Better target road safety lighting, and consider crash types rather than crash numbers alone. - Ensure illumination levels in the region are up to the standard. - Upgrade existing yellow light with white light LED luminaires (in progress).	Improved services; effective asset management

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Code	Consequence category	Issue	Ranking	Mitigation	Outcome
IR SL SD 13	Service delivery Asset management	Electricity use accounts for \$14.7 million per year (for 2015/2016) and is 76% of Auckland Transport's street lighting maintenance costs.	Medium	LED retrofit programme is in place to replace high-pressure sodium with LED. The first 30,000 lights have been installed in the region, with electricity savings of approximately 70%. By using the tele-management system to switch off and dim those new lights we will save up to 20% further on electricity.	Effective asset management
IR SL SD 14	Service delivery Asset management	Significant areas of the region are below the AS/NZS 1158 standard for illumination (lux) levels.	High	- Use accident investigation studies and police reports to highlight street lighting deficiencies that contribute to accidents and antisocial behaviour. - Undertake illumination improvement works through capital programmes. - Adopt lighting levels to comply with the AS/NZS 1158 standard. - Identify areas to be prioritised using public feedback and police requests.	Improved services
IR SL SD 15	Service delivery Asset management	Infill street lighting (additional lights) is required in under-lit areas.	High	Undertake a desktop study to calculate light quality, light spread and lumens level in the region.	Improved services

Low
 Medium
 High
 Very high

Table 9-1: Key issues affecting street lighting assets

Source: Feedback from various stakeholders (to be updated)

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Appendix A: Asset information

Network overview by asset management area

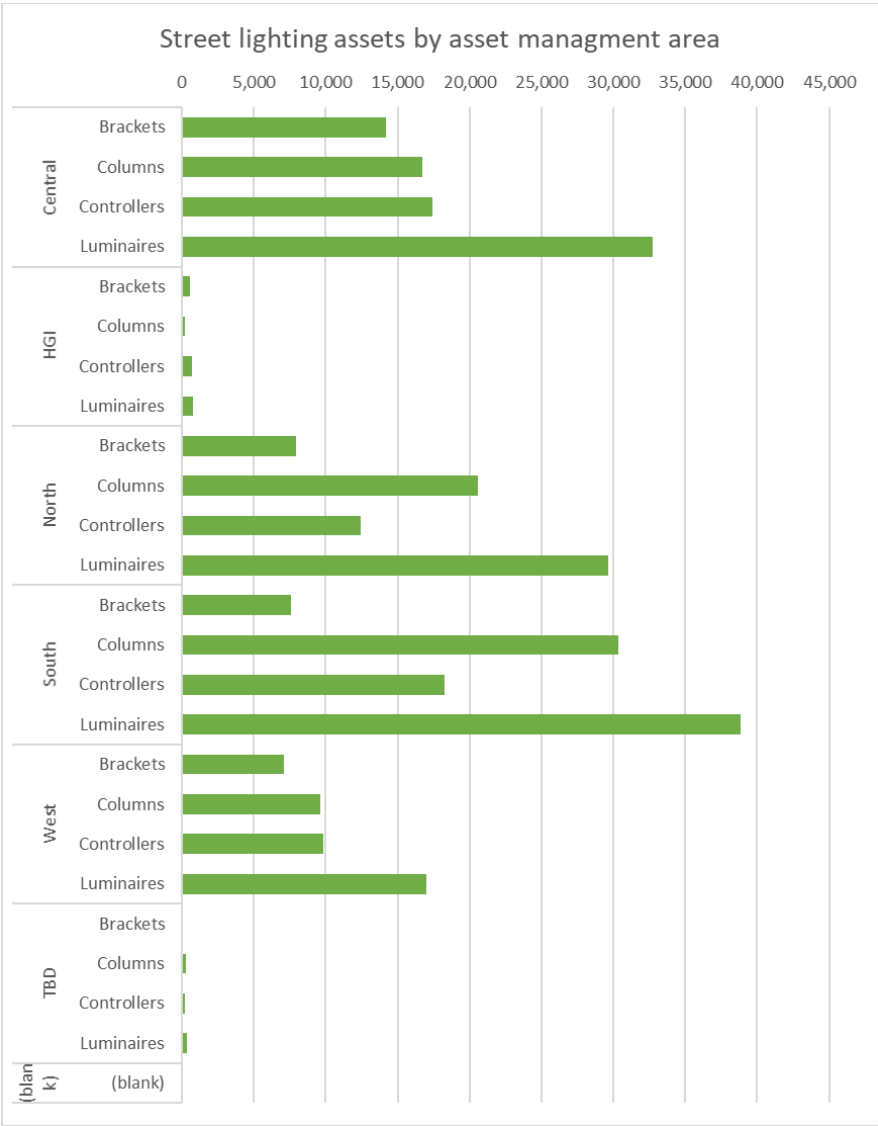


Figure A 1: Columns, brackets and luminaire breakdown by management area

Asset condition by asset management area

Condition profiles show that 94 per cent of columns are in 'moderate' to 'very good' condition, as are 98 per cent of brackets and 97 per cent of luminaires.

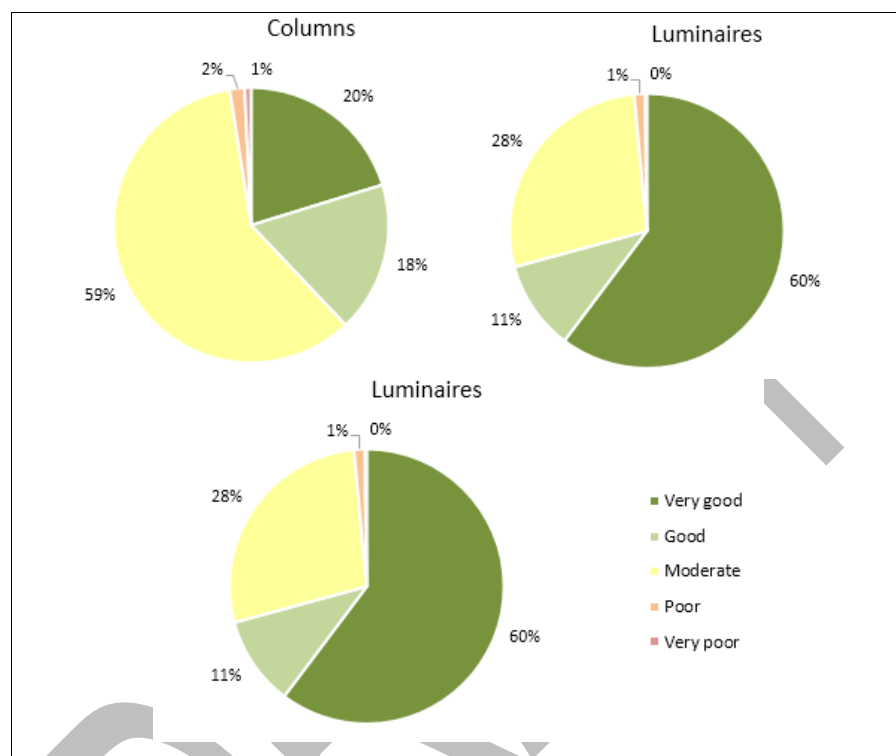


Figure A 2: Condition of street lights by components

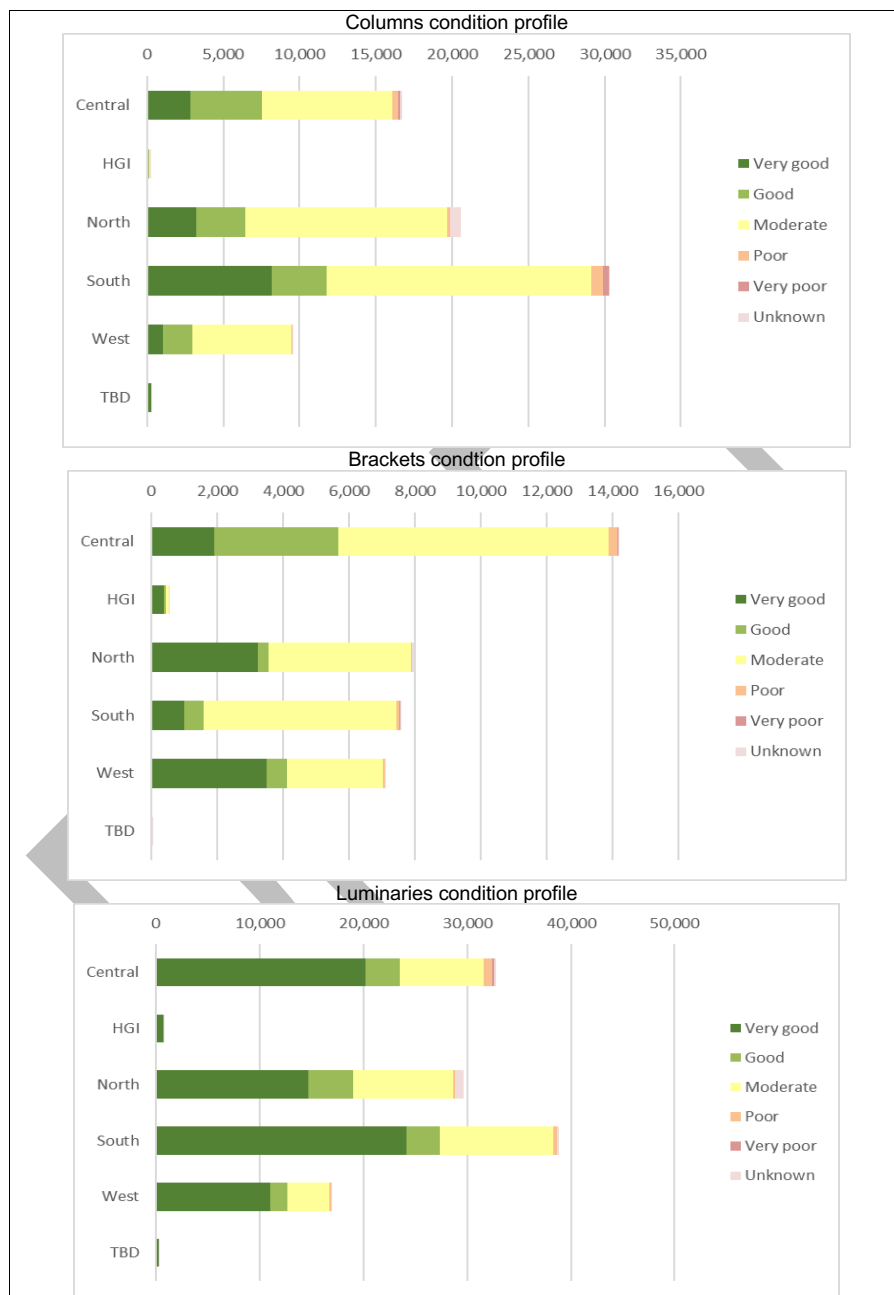


Figure A 3: Condition of street light components by management area

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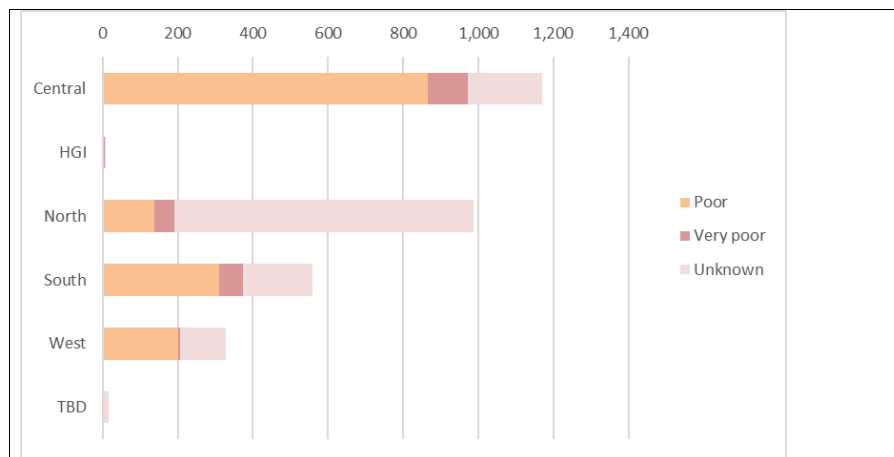


Figure A 4: Poor, very poor and unknown condition street light assets by area

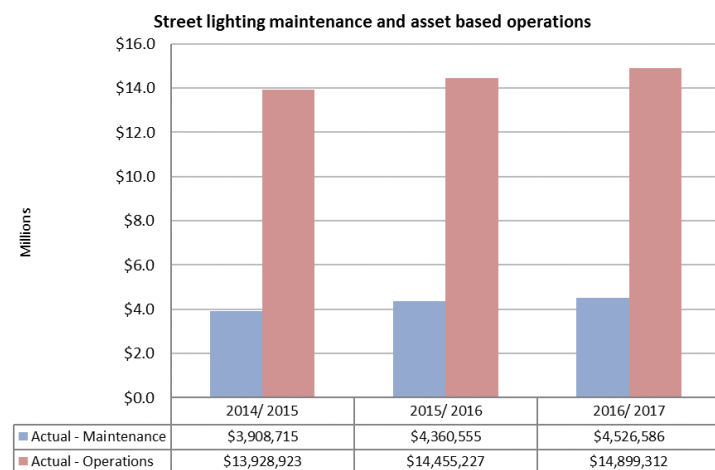
Appendix B: Supporting maintenance and renewal analysis

Historical trends

The key historical operational trends for the street light asset group are:

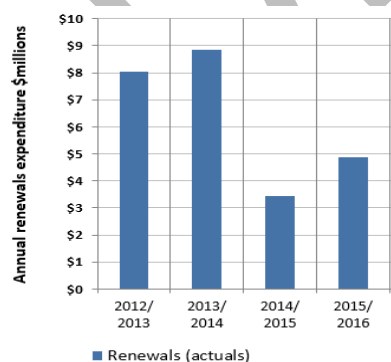
- New technology has been introduced to street lighting and more energy efficient lights have been used where possible for an upgrade
- The condition information of street light assets has been collected in a more planned and regional manner
- Changes in urban design demand for efficient, attractive and well-designed lighting requirements
- Street lights are becoming more important to improve the amenity value around safety

The figures below illustrate the 3 years' actual spent on the street lighting operation and maintenance by work types.



Source: SAP, ATAP Updated: 13 September 2016

Figure A 5: The 3-years OPEX spent



Source: SAP April 2016, ATAP September 2016 ()

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Figure A 6: The 3-years renewals spent

Note that \$427,000 worth of OHUG Street Lighting works (2012/13) are categorised as renewals, and not "New Works".

Street lighting maintenance contracts

Contract Area	Contract Number	Contract Name	Contractor	Activity	Start Date	Approx. Finish Date	Original Tendered \$ value
North	410-19-467-AC	Street light maintenance and Renewals and Capital Work	Electrix	Street light operations	1-Sep-19	30-Jun-23	\$30,572,429+gst
Central	410-19-468-AC	Street light maintenance and Renewals and Capital Work	McKay Electrical	Street light operations	1-Sep-19	30-Jun-23	\$27,587,106+gst
South	410-19-469-AC	Street light maintenance and Renewals and Capital Work	Downer Lighting	Street light operations	1-Sep-19	30-Jun-23	\$27,955,106+gst
HGI Waiheke	412-16-080-RM	Street light maintenance and Renewals and Capital work	Northpower	Street light operations	1-Jul-16	30-Jun-21	\$3,244,124+gst
BroadSpectrum Regional	412-18-242-AC	Street light Renewals and Capital Work	BroadSpectrum	Street light operations	1-Sep-18	30-Jun-21	\$3,166,163+gst
Northpower Mainland	412-16-080-RM	Street light Renewals and Capital Work	Northpower	Street light operations	1-Sep-18	30-Jun-21	\$888,000+gst
Vector OHUG	412-15-336-RM	Street light Capital Work - OHUG	Electrix & Northpower, Downer and BroadSpectrum	Street light operations	1-Jul-15	30-Jun-21	\$7,822,104+gst
Counties Power Lower South	412-18-272-AC	Street light Renewal & Capital Work - OHUG	Counties Power	Street light operations	1-Jul-18	30-Jun-21	\$2,922,061+gst
Central management system – region-wide		Central management system	Pioneer Generation Limited	Street light operations	1-Oct-15	1-Sept-2020 (extended to April-2021)	\$540,300 + \$250,000

Table A 1: Auckland Transport street light contracts summary

Source: Auckland Transport street lighting team (Road Corridor Delivery, May 2020)

Street lighting maintenance contract service levels

Service Level (SL)	Item	Description
SL1	Pedestrian Crossings	Lighting for dedicated pedestrian crossings that are marked with alternative parallel bands of black and white, which may be reflectorized or the defined pedestrian crossing route only at traffic light controlled intersections.
	Stairs, Subways Footbridges and Ramps	Lighting for connecting elements that are used by pedestrians only.
	Local/Residential Roads, Pathways & Cycleways	Lighting for local/residential areas, pathways and cycleways.
	Auckland Transport Car Parks	Lighting for the outdoor car parks.
SL2	Transport Interchanges	Lighting for transport terminals, interchanges and service areas.
	Town Centres/Shopping Precincts/Civic Centres	Lighting installed only on lighting columns in areas primarily for pedestrian use and essential for public safety eg town/suburban centres, including outdoor shopping precincts, malls, open arcades, town squares and civic centres.
SL3	Arterial Roads	Roads in central and regional activity centres of capital and major provincial cities, and other areas with major abutting traffic generators.
	Collector Roads	Roads that predominantly carry through traffic from one region to another, forming principal avenues of communication for traffic movements.
	Rural Roads	Roads within areas located outside the Auckland Council Metropolitan Urban Limit
SL4	Amenity Lighting	Any lighting (including illuminated bollards) not installed on lighting columns in areas primarily for pedestrian use and not essential for public safety eg town/suburban centres, including outdoor shopping precincts, malls, open arcades, town squares, civic centres and plazas.

Table A 2: Maintenance contract service levels

Source: Auckland Transport street lighting maintenance contracts

Poor condition street light components

Figure A 7 shows examples of poor condition street lighting components that require replacing.





Figure A 7: Examples of street lights requiring replacement

Source: Auckland Transport Road Lighting 10-year FWP (19/12/2016 ISSUE 1)

Renewal optimisation

A key aspect of portfolio asset management is obtaining an appropriate and sustainable balance between funding, levels of service and risk. Renewals expenditure must be optimised and prioritised across the asset portfolio to ensure that the transport networks do not deteriorate and that they will continue to provide agreed levels of service into the future.

The criteria for optimising the asset renewals for street light asset group are as follows:

- Based on condition grades only for simplicity and recognising that there are other drivers for street light renewals such as new technology (i.e. LED lamps and smart controls)
- Maintaining the current condition profile within the optimum profile
- Identifying future liabilities where large amounts will move to condition grades 4 and 5 within the short to medium term
- Acceptable level for condition grades 4 and 5 is <10 per cent.

The criteria for prioritising the renewal works for street light asset group are as follows:

- Addresses safety risk (the most important criterion)
- Strategic importance and location. Street lights located in the CBD and commercial centres have the highest priority as this supports the regional economy. Street lights on arterial roads are generally prioritized over those on minor local roads, which may be in poor condition.
- Required for coordinating with other works and may replace an asset before they are expired. This is the whole street approach to replace street lights in conjunction with other street renewal projects such as road upgrades and undergrounding programmes.
- Replaces asset that has functionally failed and therefore will not achieve levels of service.
- Maintenance costs are higher than to replace.

Asset decay curves: An asset type's decay curve is assessed and selected from the following:

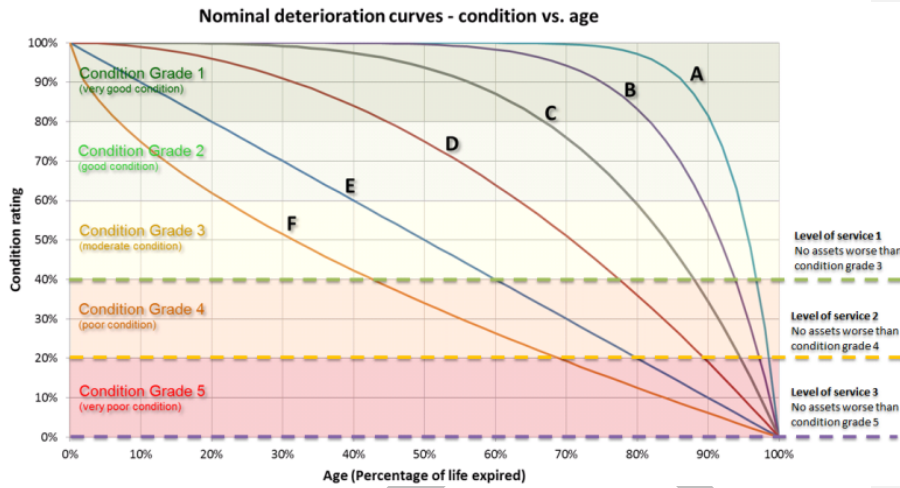


Figure A 8: Auckland Transport's standard asset decay curves

Source: NZ Infrastructure Asset Valuation and Depreciation Guidelines (1997)

Optimum condition profile

The following is the optimum condition profile set for Auckland Transport's street lighting network. This is based on the asset deterioration curves i.e. "D" for columns, "D" for brackets and "B" for luminaires within the Renewal Optimisation Model (ROM).

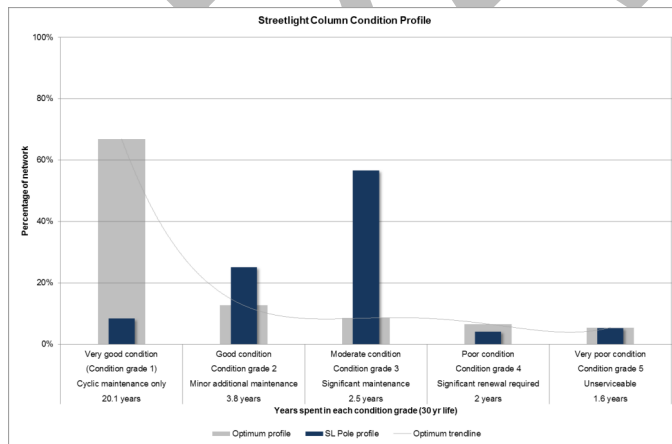


Figure A 9: Street lighting optimum condition profile

Asset management settings

The key asset management factors, known as 'Asset Management Settings', are as follows:

- An asset's appropriate asset decay curve
- An optimum condition profile

Street Lighting Asset Class Management Plan

- The level of acceptable risk
- The condition intervention point
- The consequential renewals due to growth
- The number of years to address any backlog
- An asset's base life
- The renewal unit rate.

The modelling of various renewal forecast scenarios used the above asset management settings and included traditional age-based and condition-based modelling, and a more sophisticated renewal optimisation model (ROM) developed in-house.

The following asset management settings have been used for modelling the future renewal requirements for Auckland Transport's street lighting.

Asset type	Columns	Brackets	Luminaires
Unit rate (no.)	\$2,031.79	\$295.57	\$371.91
Intervention point	13	13	13
Years to address backlog	8	8	8
Base life	30	20	15
Deterioration profile	2	2	8
Growth factor decade 1	0.50%	0.50%	0.50%
Growth factor decade 2	0.70%	0.70%	0.70%
Growth factor decade 3	1.00%	1.00%	1.00%

Table A 3: ROM asset management settings

The rationale for selecting this renewal investment profile includes:

- This has been optimised across Auckland Transport's asset portfolio
- This provides the visibility of condition-based risk resulting from existing and future backlog
- This delivers a long-term baseline of renewals needs and a consistent basis for renewals decision-making
- Additional funding is recommended to ensure that street light poles that are at risk of unplanned failure are proactively identified and replaced.

Note that the renewal forecasting model looks at the level of existing backlog i.e. the amount of asset below the intervention point (condition grade 5) and also the level of future backlog liability (i.e. the amount of asset higher than the optimal intervention point in the future years (condition grades 3 and 4, approx. 75 per cent of the network). For that reason, the model suggests that the higher investment will be needed in the beginning of the years to be able to achieve the optimal condition of the network after the first decade of the planning period.

There is a need to continue investment on accelerated luminaire replacement and replacement of older street light poles where corrosion could be a factor in unplanned failure.

Appendix C: 3-year forward works programme

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

Table A 4: Major items in Auckland Transport's 3-year street lights renewal programme

Source: Auckland Transport Road Lighting 10-yr Forward Work Plan 2017 (TBU)

Note: Includes an element of over/under programming and details are still being finalized.

Appendix D: Sustainability detail

The Key Result Area for street lighting sustainability is:

- A Sustainable Network - Provide a regional transport network without compromising the environment for future generations

This will be achieved for street lighting asset group through the service values:

- ETS responsibilities –minimise carbon footprint, and maximise the economic value of recycled materials
- Pollution control - minimise light pollution
- Economic sustainability - by providing assets and services at least whole of life cost

These sustainable approaches have been used in the following management processes and frameworks by service value and continue to be an inherent way for Auckland Transport to provide street lighting services.

ETS responsibilities – energy efficiency

Street lights are Auckland Transport's highest use of power consumption and therefore is the most area of opportunity to provide a sustainable transport network. Street lights consume about 76 per cent of the electricity costs (for 2012/13).

Auckland Transport has the following energy efficiency targets:

- Reduce energy consumption by 30 per cent (from the standard high-pressure sodium lamp and magnetic ballasts) for all new or upgraded lighting projects
- Maintain the 2011/12 levels of energy consumption in future years after the connection of additional energy efficient luminaires so there is smarter control of the existing network to reduce lighting levels in off peak times and overall less energy consumption.

Improving the transport network's energy efficiency is achieved through using new technology with LED street light lamps and control gear to vary the lighting levels during the specific time of day. Another energy saving initiative is reducing light output at times of low traffic volumes through the use of pre-programmed photocells and photocell transceivers will allow profiles to be changed to match weather and traffic conditions.

As energy efficiency initiatives, Auckland Transport has examined five different models of progressive implementation of these smart technologies such as LED compared with Ceramic Metal Halide (CMH) and Cosmopolis. The purpose is to illustrate the variations in return on investment in terms of payback period for varying initial capital investments (based on the 2012 costs rather than net present value for all costings).

100% LED Implementation					
	Initial Investment (Year One)	Initial Capital Cost (Year One) (\$M)	Whole of Life Savings (\$M)	Payback Period	Time to Complete
Case 1	100%	25	38	8 years	1 year
Case 2	50%, followed by replacement of remaining HPS stock on life expiry	13	28	11 years	10 years
Case 3	33%, as above	8	24	9 years	13 years
Case 4	10%, as above	3	21	4 years	18 years
Case 5	5yr Phase-In (20% / year)	5	36	9 years	5 years
100% CMH Implementation					
Case 1	100%	24	21	10 years	1 year
Case 2	50%, followed by replacement of remaining HPS stock on life expiry	12	10	15 years	10 years
Case 3	33%, as above	8	7	17 years	13 years
Case 4	10%, as above	2	4	19 years	18 years
Case 5	5yr Phase-In (20% / year)	5	19	11 years	5 years
100% Cosmopolis Implementation					
Case 1	100%	24	24	10 years	1 year
Case 2	50%, followed by replacement of remaining HPS stock on life expiry	12	13	14 years	10 years
Case 3	33%, as above	8	9	16 years	13 years
Case 4	10%, as above	2	5	5 years	18 years
Case 5	5yr Phase-In (20% / year)	5	22	10 years	5 years

Table A 5: Whole-of-life comparisons between implementation of smart technologies

Source: Energy Efficiency Initiatives – Auckland Transport Street Lighting, Dec 2013

The findings conclude that the significant and achievable savings are possible under this scheme. Of the three white light technologies considered above, LED offers the greatest savings.

The 100 per cent year-one installation using LED technology gives the greatest predicted whole of life savings of \$38M, however this also requires the greatest initial capital investment of approximately \$25M. The 10 per cent year-one installation using LED technology followed by on-going replacement at life expiry offers the quickest payback on the initial investment (4 years) and the least upfront capital (\$3M), but offers the lowest whole of life savings (\$21M) and the longest programme for completion (18 years). Auckland Transport recognizes that the LED replacement and a robust control system for street lighting network is the way of going forward. It will add significant contribution to environmental sustainability by consuming less energy and results in a tangible response to the business practices. There has been increased in awareness that the LED lighting can interfere severely with the radion communications. The RSM (Radio Spectrum Management, NZ) has been looking into that issue due to serious operational and safety concerns. A common solution for that is to separate the LED lights from the radio antennas as much as physically possible.

ETS responsibilities – improving pedestrian amenity and safety

The Auckland Plan wishes a transformational shift to make the city centre more attractive for visitors, support businesses, and improve pedestrian amenity. Urban design principles are now considered with all Auckland Transport's projects. Shared spaces are revitalising the city and creating high quality pedestrian focused streets with well-designed street lighting. This will improve the amenity and safety value as well as encouraging pedestrian activity rather than using private vehicles. The urban design

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principles also help to remove street lighting clutter. Street lighting design plays a key role in improving the amenity value in revitalised areas as well as increasing personal security, reducing the fear of night time attacks on individuals and to deter vandalism of property.

International research shows light quality affects road safety and between 30-65 per cent of night time accidents can be attributed to the quality of white versus yellow light and the flow on effect with reaction time. In New Zealand 33 per cent of traffic accidents occur in relative darkness at an estimated cost of \$1.2 billion. The human cost and flow on financial impact is therefore significant in its own right.

ETS responsibilities – material reuse

There are opportunities to reuse and recycle street lighting asset components at the start and finish of the asset life as follows:

- The sustainable solution to reuse and recycle the street lighting equipment is important for the selection of aluminium lantern bodies which are highly recyclable when compared to glass reinforced plastic (GRP) units.
- The street lighting equipment is treated as special waste and taken to specialised recycling facilities where the materials (sodium, mercury, etc.) are removed to be reused in the supply chain.

Pollution control – reducing light pollution

Light pollution from street lights is considered when designing new or redeveloping existing areas. LED lights have multiple advantages such as better light distribution, lower light pollution and white light. Auckland Transport's Code of Practice for street lights provides guidance on the right light for the different road categories and types.

The installation of light fittings and 20 LED street lights along seven kilometres of the Project Twin Stream Walk and Cycleways is a show case project for reducing light pollution as well as other sustainable benefits. The spill light and sky glow have reduced so nearby residents are not affected by light pollution as a result of this innovative approach.

Economic sustainability – asset management approach

Auckland Transport's key asset management principle is meeting the service levels and managing risk while minimising whole of life costs. This asset class management plan provides the detailed analysis for aged and condition-based renewal planning for the street lighting asset group. Both approaches require a degree of information which is still lacking for the street lighting asset group for age attributes only. This renewal planning approach is our key method for demonstrating whole of life costs.

Economic sustainability – asset lives

New technology has seen the increased usage of energy efficient street lighting (LED) lamps. The LED lamps are also preferred as have a longer life of 5 to 10-year life compared to 2 years for conventional bulbs as well as reduced maintenance costs.