Auckland Transport Alignment Project

Maintenance, Operations and Renewals Report

Contents

Preface

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

1. Executive summary

This report provides details of the estimated 30-year renewal, operations and maintenance investment profile commencing 1 July 2018. It is a "snapshot" as of August 2016, acknowledging that asset condition and the cost of doing work change over time, and that assets models are being further developed.

The scope covers both New Zealand Transport Agency (NZTA) and Auckland Transport (AT) investment. It excludes investment required by KiwiRail.

The analysis has been framed around the new capital investment programme ide3ntified in the Regional Land Transport Plan, the Long Term Plan 2015 – 2018 and the ATAP recommended strategic approach. The report identifies the base costs plus the consequential costs arising from capital development. The assumptions used to estimate these costs have not been subject to external peer review.

The 30 year totals are detailed in Table 1 and a breakdown between base and consequential costs in Table 2.

Table 1 - NZTA & AT 30-year Summary ($m)

$m uninflated		Decade 1 2018/19-2027/28	Decade 2 2028/29-2037/38	Decade 3 2038/39-2047/48	30 year Total
Renewals	Auckland Transport	3,084	4,065	4,132	11,281
	NZTA	348	427	501	1,276
	Subtotal	3,433	4,492	4,633	12,557
Operations & Maintenance	Auckland Transport	10,270	16,178	20,671	47,119
	NZTA	1,038	1,474	1,747	4,259
	Subtotal	11,308	17,652	22,418	51,378
Cost Total		**14,740**	**22,144**	**27,051**	**63,935**
Revenue	Auckland Transport	-4,070.4	-6,413.1	-7,985.6	-18,469.1
Net total		**10,669.9**	**15,730.8**	**19,065.3**	**45,466.0**

Table 2 - NZTA & AT 30-year Base and Consequential Costs ($m)

$m uninflated		Decade 1 2018/19 – 2027/28	Decade 2 2028/29 – 2037/38	Decade 3 2038/39 – 2047/48	30 year total
Base (current)	Auckland Transport	11,245	13,941	16,164	41,351
	NZTA	1,093	1,207	1,313	3,613
	Sub-total	12,338	15,149	17,477	44,964
Consequential	Auckland Transport	2,109	6,301	8,639	17,049
	NZTA	293	694	935	1,922
	Sub-total	2,402	6,995	9,574	18,971
Cost Total		**14,740**	**22,144**	**27,051**	**63,935**
Revenue	Auckland Transport	-4,070.4	-6,413.1	-7,985.6	-18,469.1
Net total		**10,669.9**	**15,730.8**	**19,065.3**	**45,466.0**

2. Background

The purpose of the Auckland Transport Alignment Project (ATAP) Maintenance, Operations and Renewals Work Stream was to collaboratively develop and test a 30-year projection of the costs necessary to operate, maintain and renew[1] the regional roading and transport network (excluding KiwiRail assets).

It has considered inputs from both Auckland Transport (AT) and New Zealand Transport Agency (NZTA).

The work stream has four principal inputs:

1. The Auckland Transport Renewals Optimisation Model
2. NZTA Highways and Network Operations group 30-year Maintenance and Operations (M&O) forecast
3. The Auckland Transport Consequential Opex Model
4. Auckland Transport's Public Transport Operations 30-year forecast.

Financial analysis has been undertaken to determine estimated maintenance, operations and renewals budgets over a 30-year horizon from July 2018. They are overlaid by a number of assumptions, each of which will impact upon the analysis undertaken. The budgets presented are the recommendations from the respective asset management teams, and have not been externally peer-reviewed.

Auckland Transport financial accounting distinguishes between capital (capex) and operational (opex) expenditure. Renewals are capex, whilst maintenance and operations are opex. The NLTP activity classes treat renewals as maintenance.

The 30-year projections for Auckland Transport's local roads and NZTA's state highways are presented separately.

The time available to prepare this analysis has been constrained. Accordingly, the analysis will be further refined over the coming months. This analysis is, in essence, a 'snapshot' as of August 2016. Since the One Network Road Classification (ONRC) framework, models and other forecasts such as Light Rail Transit (Mass Transit) are continuing to develop, the numbers presented will be subject to change over time.

The analysis will also be impacted by an on-going programme of condition assessments which will influence the required budgets presented.

All financial analysis undertaken and budgets presented in this paper are uninflated (2015/2016 base line).

[1] Renew' means replacing the asset at the end of its service life, but excluding any improvement in capacity

3. Narrative

The relationship between capital investment, maintenance, operations and renewals is relatively simple. The more physical infrastructure that there is in use the more it will cost to renew, operate and maintain for the same level of service.

However, there are options. As more infrastructure is built it is possible to:

1. Increase maintenance, operations and renewals budget to reflect increased costs
2. Reduce the level of service provided
3. Do nothing, increasing the level of risk of unplanned failure.

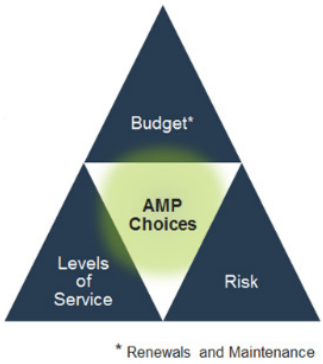

Figure 1 - Asset Management Options

There is of course a fourth option; that is reduce the quantum of new infrastructure that requires maintenance, operations and renewal through a reduction in the capital new build programme. This may not be palatable or practical in a growing city like Auckland.

The greatest single influence on maintenance, operations and renewal costs is the impact of the current and planned capital programme expanding and improving the network, along with the associated increase in public transport services.

The relationship between new capital investment, maintenance, operations and renewals has to be managed to derive the greatest benefit from the transport investment.

For physical assets, the social and economic benefits of transport infrastructure are dependent upon its ability to provide a safe, reliable and fit-for purpose level of service over the long term. Good infrastructure asset management practice ensures that sufficient investment is available for the maintenance of the existing network so that it can continue to deliver those benefits and outcomes. This approach ensures protection of the existing asset investment and the sustainability of the network in the long term.

As an example, the links between asset condition, level of service, cost and risk are shown in Table 3 for road pavements. This shows that as asset condition deteriorates with time and use, customer level of service declines, risk increases and the cost to bring the asset back to a fit for purpose condition increases.

Table 3 - Links between level of service, cost and risk for road pavements

Condition	Level of Service	Cost	Risk
Very Good, **Good** or **Moderate** condition	Customer expectations met 	Needs routine maintenance only. Cost: maintenance **$10,000 per km** per year	Low risk
Poor condition	Defects noticeable but won't change customer behaviour 	Extent of surface problems means spot fixes are no longer adequate. Water may be entering the road construction layers. HCV loadings will accelerate failure. Cost: pavement resurface **$100,000 per km**	Low risk
Very Poor condition	Poor customer experience 	Wheel ruts and edge breaks indicate that road construction layers are damaged. Road is less comfortable and safe for drivers and (especially) cyclists and motorcyclists. HCV loadings will cause rapid failure requiring urgent attention. Cost: road rehabilitation **$1,000,000 per km**	On a fast and/or busy road, there could be a significant safety risk

Table 3 also highlights the linkage between renewal and maintenance expenditure. Reducing expenditure in one increases investment pressure in the other. For example, reducing renewal investment will increase the need to undertake reactive maintenance beyond economic service life and conversely, reducing maintenance will accelerate asset deterioration resulting in increased renewal needs and the potential development of an unmanageable backlog.

The analysis undertaken in this paper considers a number of cost drivers which will impact maintenance, operations and renewal costs over the 30 year period:

- Customer level of service targets
- Growth in the size and complexity of network operations and infrastructure
- Growth in freight to build, service and supply a growing city
- Efficiency and effectiveness gains in operations and maintenance
- Infrastructure condition and contingent risk of service failure

The analysis undertaken excludes any increased compliance costs arising from the adoption of the Unitary Plan, and any required mitigation arising from climate change and sea level rise.

The analysis has been based on the level of new capital investment and work programme identified in the Regional Land Transport Plan and Long Term Plan 2015 – 2018. It also includes early estimates for Mass Transit but it should be noted that there is a higher level of uncertainty around Mass Transit analysis due to the early stage in the project development.

4. NZTA State Highway Maintenance, Operations and Renewals

NZTA manages and operates the State highway network across Auckland. This comprises:

- 1198 lane km of roads
- 304 Bridges
- 12970 Minor drainage assets
- 2657 ITS Assets
- 13262 Signs
- 7341 Street lights
- 3 Tunnels

The replacement value of the assets is $10.488 billion; this figure includes land but not corporate assets and intangibles (e.g. software).

The current State highway operation and maintenance costs for the Auckland Region are approximately $103 million per annum.

The size and complexity of the Auckland network infrastructure and operations is forecast to grow significantly over the next 30 years as capital projects extend and improve the network, and as operational management of the network expands as the city grows.

From the projects identified, the analysis recognised the future maintenance cost impact of 25 major new projects. While other improvement projects would incur additional maintenance costs, NZTA has assumed that these costs will be absorbed by gains in efficiency in maintaining the entire network.

Some of the major projects that are expected to have a material effect on the Maintenance, Operations and Renewals budget include:

- East West Connection
- Southern Corridor
- Northern Corridor
- Additional Harbour Crossing
- SH20 Kirkbride
- Waterview
- SH16 Upgrade
- Puhoi to Warkworth
- North Western Busway
- Pukekohe Expressway

A growing network increases the quantity of asset that must be maintained and renewed, hence the costs of maintenance and asset renewal are also increased. The forecast increase in network necessitates not only the increased cost of maintaining the physical asset, but also increases the scale of the traffic management and operations task. The network increases in length by 15 – 25% or an additional 209 lane km as a result of planned improvement projects. At this stage, the exact scope around the projects and the full

increase these projects have on the network (apart from assessing maintenance costs through a percentage of the capital cost vs current $ per lane/km), are uncertain.

New complex infrastructure such as the Waterview tunnels requires conventional maintenance to maintain road pavements and similar conventional infrastructure. Additional operations and maintenance is required to operate and maintain safety equipment and for operational readiness to provide safe travel for customers. The impact is to increase operating and maintenance costs by about 113% at the end of the 30 years.

The increased costs of operating and maintaining each new significant project when it becomes operational has been recognised, and increased renewal costs when infrastructure subsequently deteriorates and requires renewal discounting individual project maintenance estimates to recognize economies of scale in the Auckland area. The impact is an increase in operational and maintenance costs of 19%; the breakdown of this includes 88% of Maintenance and Operations and 12% Renewals over the 30-year period. Some roads will also be elevated over time within the ONRC framework, which will require increased inputs. The costs are summarised in Table 4.

Furthermore, some of the long-life structural motorway pavements constructed in the 1960's and 1970's are likely to be reaching the end of their economic service lives within the 30 year horizon. It is often difficult to predict precisely when a pavement asset will need renewing, and decisions will continue to be made on the basis of asset condition monitoring.

It is estimated that the growth in the size and complexity of the State highway network will require additional operations, maintenance and renewal works to maintain service levels on the new infrastructure costing $116 million per annum or 113%; 86% of this is Maintenance and Operations and 14% Renewals. This is detailed in Attachment 3 and illustrated in Figure 2.

Table 4 - NZTA 30 Year Summary

$m uninflated	Decade 1 2018/19–2027/28	Decade 2 2028/29–2037/38	Decade 3 2038/39–2047/48	Estimated 30 Year Total
Renewals - base	319	341	350	1,010
Renewals - projects	30	86	151	267
Operations and Maintenance - base	716	733	752	2,201
Operations and Maintenance - projects	263	608	784	1,655
Other	58	133	211	402
Total	**1,386**	**1,901**	**2,248**	**5,535**

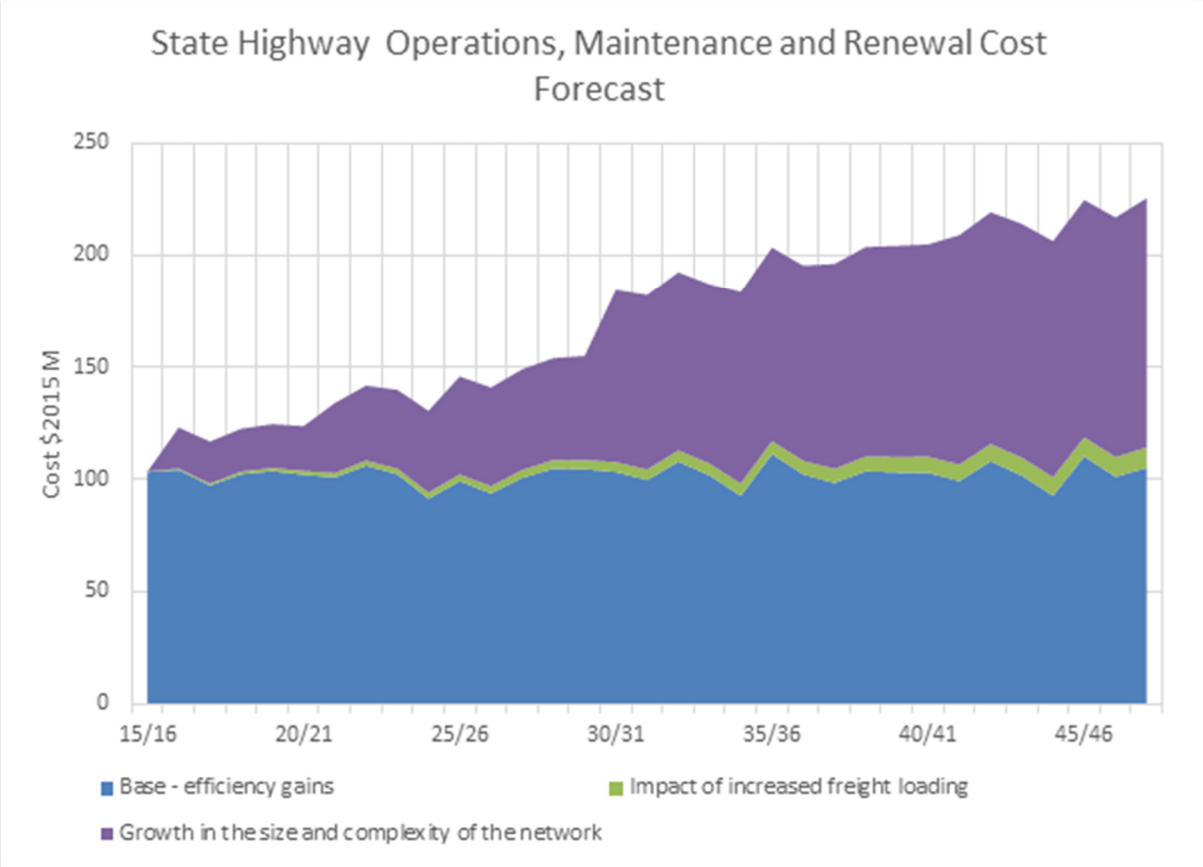

Figure 2 - NZTA 30 Year Summary

5. Auckland Transport

Auckland Transport manages and operates the local road network and public transport infrastructure across Auckland. This comprises:

- 7,302 km of roads
- 6,959 km of footpaths
- 321km of cycleways
- 1,020 bridges and major culverts
- 41 active rail stations, associated stabling and depot
- 57 electric trains (EMUs)
- 10 Diesel Multiple Units
- 6 Busway stations
- 2,342 bus shelters
- 21 ferry wharves

The replacement value of the assets is $13.4 billion excluding land, corporate assets and intangibles (e.g. software).

Auckland Transport currently spends $702.5 million annually (2015/2016) on maintenance, operations and renewals:

- Renewals - $198 million
- Maintenance - $110 million
- Operations (Asset-based) - $69.4 million
- Operations (Services) - $325.1 million

Asset based operations are defined as activities that directly consume resources to operate an asset such as energy, chemicals and materials. Examples of asset based operations include cleaning, electricity, fuel and weed control.

Service based operations are defined as activities associated with the provision of public transport and management of facilities and assets that do not directly consume resources against an asset e.g. security staff, corporate support, transport service contracts, events and incident management etc.

5.1. Growth

The growth in renewable and maintainable assets is based on asset class growth figures used within the 2015 AMP and LTP as well as more recent 30 year assessments for growth in road pavement and their directly associated assets. The network averages of the 30-year annual growth factors used within this report are:

- Road network 0.79% per year
- Public Transport network 0.56% per year

These growth percentage numbers exclude the City Rail Link (CRL) and Mass Transit. Those major capital projects are however allowed for in consequential renewals and opex costs.

Growth in non-asset opex such as public transport services from 2019 - 2025 are based on the Annual Plan. Subsequent years 2026 - 2048 are increased by 2% for the base case per year in line with LTP passenger targets. Figure 3 shows the total passenger targets based on the APT model.

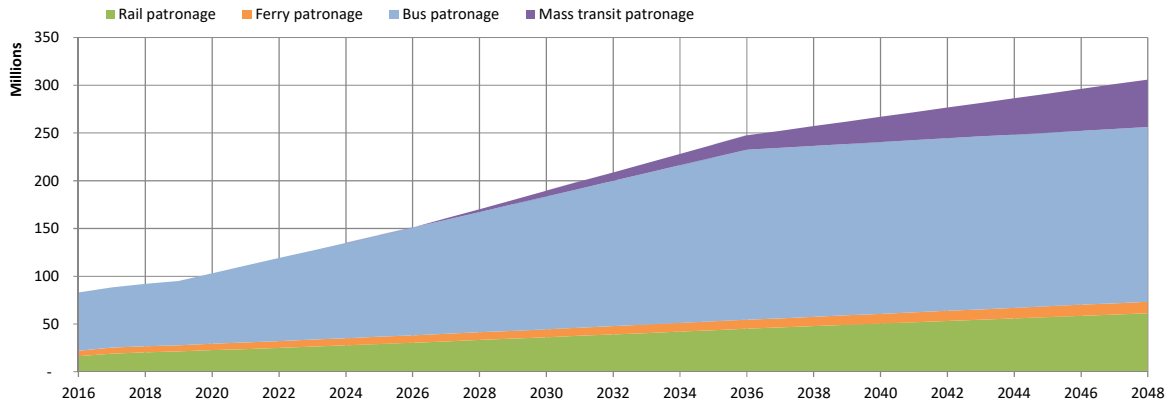

Figure 3 - Public transport patronage growth

5.2. Renewals and maintenance summary

The estimated 30-year renewal, asset-based operations and maintenance investment is summarised in Table 5. This investment allows for growth using the above figures on the existing network and includes the CRL and Mass Transit projects[2].

The renewals and maintenance investment also incorporates changes in levels of service and management of risk to reflect the One Network Road Classification (ONRC).

Table 5 - AT 30-year summary

$m uninflated	Decade 1 (2018/19 – 2027/28)	Decade 2 (2028/29 – 2037/38)	Decade 3 (2038/39 – 2047/48)	30 Year Total
Renewals	3,084	4,065	4,132	11,281
Maintenance	1,705	2,239	3,117	7,061
Operations (Asset Based)	749	1,205	1,690	3,645
Total	**5,539**	**7,509**	**8,939**	**21,986**

[2] See Attachment 2 for the assumptions that have been used in estimating costs associated with these investments. Note that assumptions on the scope and timing of mass transit investment may differ from that suggested in the ATAP Indicative Package.

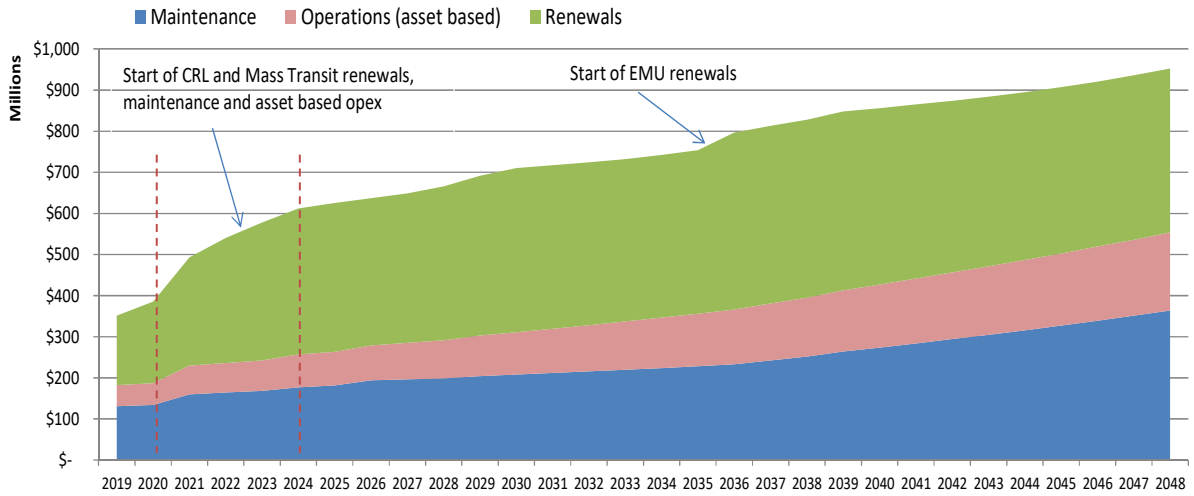

Figure 4 – 30-year asset-based maintenance operations and renewals expenditure

Figure 4 shows the AT 30-year asset-based maintenance, operations and renewals expenditure. The step up from 2021-2024 reflects the beginning of CRL and Mass Transit costs and in 2036 committed renewals of $30 million/year for rail EMU rolling stock begins.

A detailed breakdown of this summary is included in Attachment 4.

The existing asset base is currently maintained to a reasonable standard. Last year's Auditor General's report noted the quality of data and planning behind Auckland's transport asset management. This provides assurance that the numbers used in the report are materially accurate.

5.3. Renewals

Total estimated renewals investment is made up of renewals required for existing assets plus those that arise from future new assets. The analysis therefore provides for growth arising from AT capital projects and assets vested to AT from developers and council. Figure 5 shows the 30 year renewals investment profile, including CRL and Mass Transit, rising from $169 million in 2019 to $399 million in 2048.

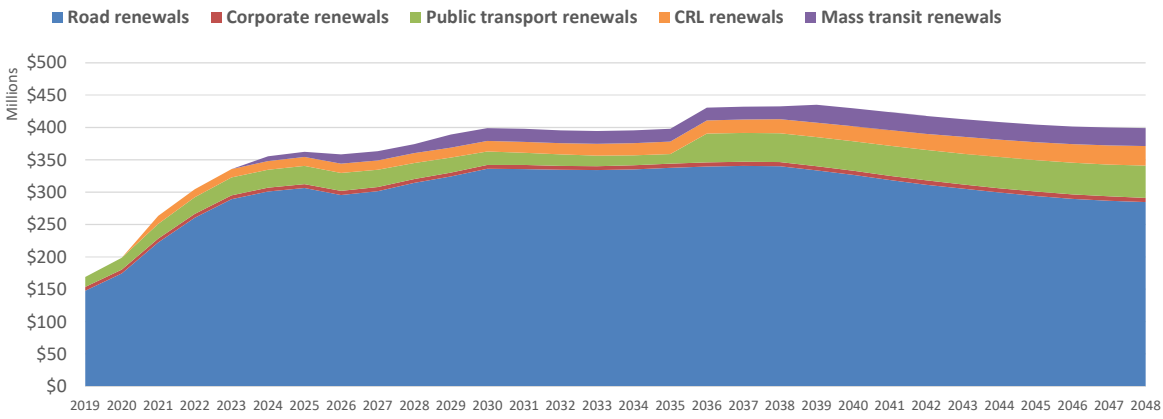

Figure 5 - Renewals 30-year expenditure by network

Figure 6 details the same information but presented to show renewals expenditure related to existing assets (base renewals) and consequential renewals that will be required to replace new assets (including the CRL and mass transit). These consequential renewals will increase in cost from $0 in 2019 to $79 million per annum by 2048.

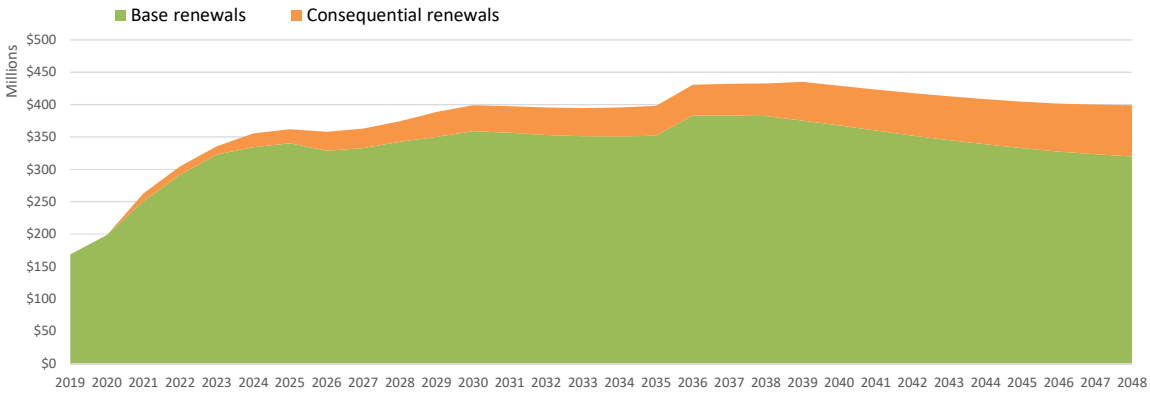

Figure 6 - AT 30 Year renewals expenditure by type and growth

5.3.1. Miscellaneous renewals

Included within the renewals figures are those that are not analysed but are currently committed by AT. These include the following annual costs:

- Rolling stock (electric motor units) $30 million beginning 2036
- Rolling Stock (diesel motor units) $0.5 million
- Storm water $1.4 million
- Corporate renewals $6 million
- Other $14.4 million

Corporate renewals include for AT internal time and professional services charged against renewals projects, resource consents and other renewals planning requirements such as One Network Road classification (ONRC) and the Forward Works Plan.

Miscellaneous renewals grow from $16.6 million in 2019 to $60 million in 2048 including $30million/year for EMUs beginning in 2036.

5.3.2. Cost efficient renewals

Infrastructure management requires ongoing renewals investment to maintain levels of service. The most cost-efficient renewals investment minimises whole of life cost across the network portfolio for the required level of service. This requires that the network be brought into its most cost-efficient state over the long term.

Figure 7 shows the 30-year profile of renewals cost vs. condition and backlog. This is the recommended renewals investment. Condition is displayed as five grades from very good (dark green) through to very poor (red).

This investment profile shows significant increases in the first decade as existing backlog is reduced and levels of service are normalised across the region. Thereafter, despite significant network growth, the second and third decades show stable renewals need as the network settles into a more cost-efficient condition state where levels of service and backlog have largely been addressed.

The estimated renewals investment provides for normalising levels of service across the region through renewals interventions that manage levels of service, risk and ONRC requirements across the network. The cost-efficient analysis excludes CRL, Mass Transit, miscellaneous renewals and the impact of inflation.

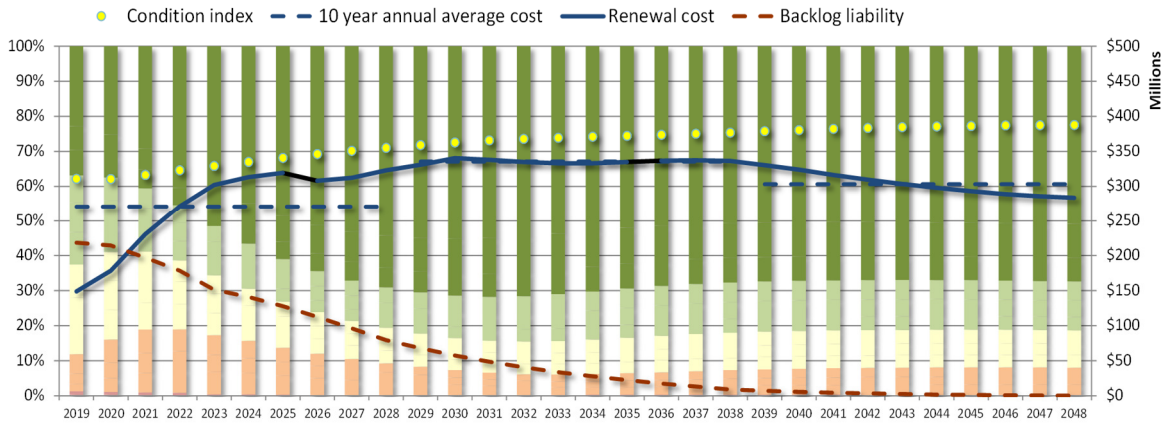

Figure 7 - AT cost-efficient investment vs. condition

The longer-term analysis shows increasing renewals cost resulting from increasing inventory, network complexity and usage including increased heavy commercial vehicle loadings.

The cost-efficient investment profile is proposed as it addresses levels of service and risk and leads to a more cost-effective management of the network in the long-term.

5.3.3. Base case

As a comparison, a base case analysis has been undertaken. The base case investment assumes renewals occur just before asset failure. As such it does not address long-term cost-efficiency nor stakeholder requirements for levels of service, risk management and ONRC. Figure 8 shows that the renewals base case first decade costs are less than the efficient investment profile in Figure 7, but there is little between them by 2037.

The base case investment results in a significant increase in very poor condition assets, especially in the first decade. This has ongoing negative consequences of increased risk, reduced customer satisfaction and increased pressure on maintenance budgets.

The base case analysis excludes miscellaneous, CRL and Mass Transit renewals.

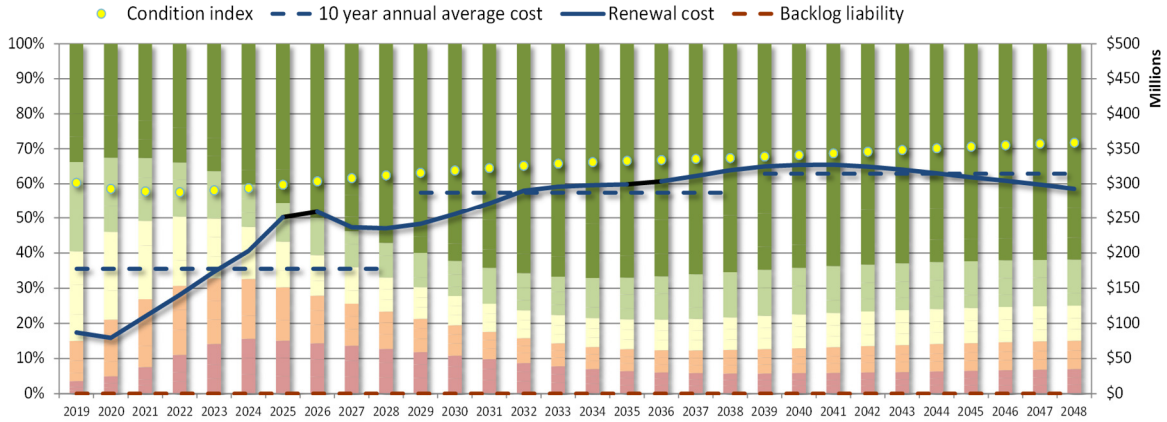

Figure 8 - Renewals base case investment

Figure 9 shows the base case investment vs the efficient investment (both modelled) within the context of the total ATAP renewals forecast which includes miscellaneous, corporate, CRL and Mass Transit renewals.

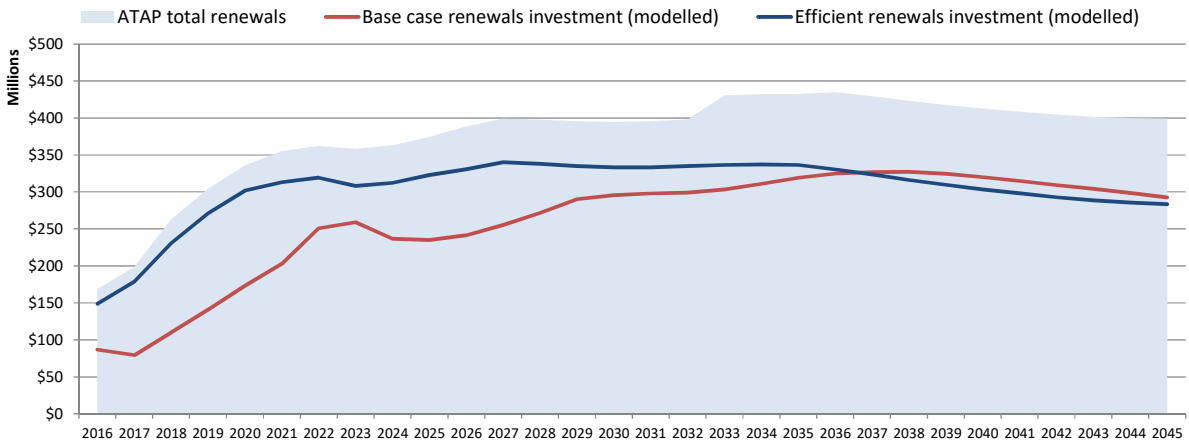

Figure 9 – Renewals base case vs. cost-efficient investment

5.3.4. Efficiency gains

The implementation of the 'One Network Road Classification' (ONRC) based on road function and 'fit for purpose' customer levels of service and incorporation of 'Road Efficiency Group' (REG) principles in the 2018-21 NLTP and beyond will result in on-going efficiency gains in maintaining and renewing the physical asset.

The analysis has incorporated these expected efficiency gains, as follows:

- 12.4% ($354 million) in decade 1
- 4.7% ($160 million) in decade 2
- 0.3% ($10 million) in decade 3

This shows that the current opportunity for ONRC and REG efficiency gains is high but reduces over time as the network approaches its long-term steady-state and appropriate service levels. Overall ONRC efficiency gains over the 30 years of the plan are 5.7% or $524 million.

The 2017 AMP update identifies a reducing per capita cost of renewals and maintenance and a reducing per trip cost for public transport services through to 2025.

Further efficiency gains have not been assessed at this stage as they cannot be supported by analysis.

5.4. Opex expenditure

Figure 10 shows a summary of the 30-year opex expenditure. The most significant cost is operational services which rise from $573 million in 2019 to $1,696 million in 2048, mainly driven by significant increases in patronage and service levels. Maintenance and asset based operations together rise from $183 million in 2019 to $554 million in 2048.

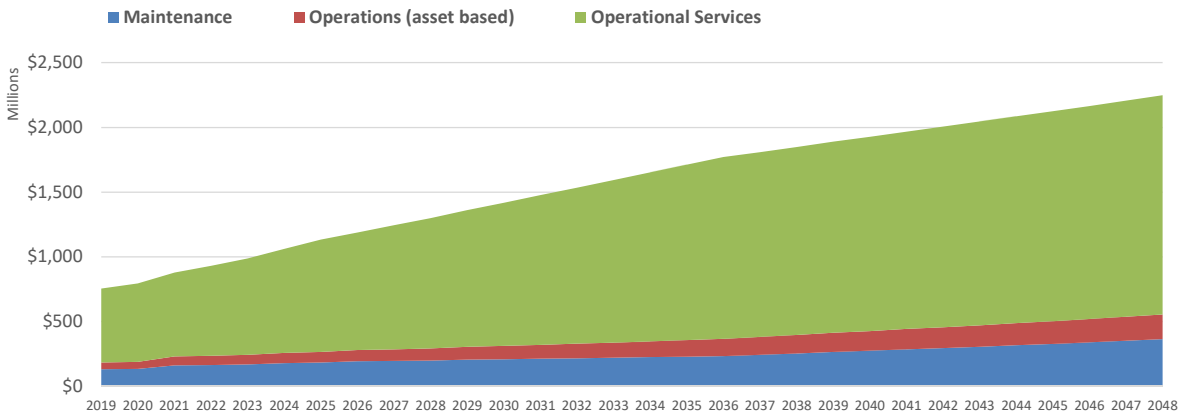

Figure 10 - Opex 30-year expenditure

5.4.1. Consequential opex

Over the 30-year period (2019 to 2048) the increase in operations and maintenance costs directly related to assets are:

- Maintenance - $131 million (2019) to $364 million (2048)
- Operations (asset-based) - $52 million (2019) to $190 million (2048)

These increases, shown in Table 6, are largely the result of the significant consequential opex requirements of:

- New assets developed by AT including CRL and Mass Transit
- Vested assets i.e. transport assets transferred to AT ownership and management from developers and council.

Consequential estimates for operations and maintenance are based on current analysis of historical costs, new capital projects and vested assets. This analysis is subject to further refinement.

Table 6 - AT 30 Year Consequential Opex

$m uninflated	Decade 1 2018/19 – 2027/28	Decade 2 2028/29 – 2037/38	Decade 3 2038/39 – 2047/48	30 Year Total
Maintenance	429	593	770	1,793
Operations (Asset Based)	241	562	807	1,610
Total	**670**	**1,155**	**1,577**	**3,403**

AT's modelling of consequential opex is not yet mature and ATAP decisions will have a significant impact on this. More work is needed before investment decisions are made. Financial modelling is relatively sensitive to the assumptions used in the model and these should be further tested.

5.4.2. Maintenance and asset-based operations

AT maintenance and asset-based operations are shown in Figure 11. This includes maintenance and opex costs for CRL of $38 million in 2021 rising to $95 million by 2048 and for Mass Transit of $8.6 million in 2024 rising to $20 million by 2048.

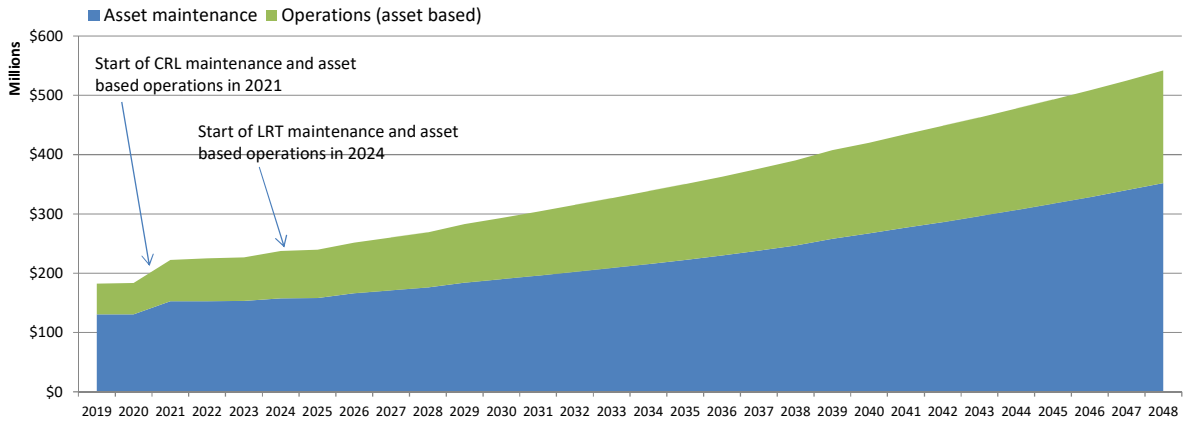

Figure 11 - AT maintenance and asset-based operations

5.4.3. Operational services and revenue

Operations (services) are those activities associated with the management of facilities and assets that do not directly consume resources against an asset e.g. security, corporate support, transport service contracts, line charges, events and incident management etc. These include the major public transport service contracts for bus, rail and ferry. Against these there are revenue streams from user and contract service charges. These include:

- Public transport farebox revenue (including public transport contract revenue for rail and PTOM revenue for bus and ferry services)
- Supergold (for seniors) and concessionary fares (child, school and disability)
- Operator access fees, and wharf berthage and freight levies received from ferry operators
- Commercial rentals for leasing public transport facilities
- Adshell, bus stations and advertising revenue received from private companies for advertising in public transport facilities
- Special events revenue

Operational services are approximately half the annual expenditure incorporated in this paper. In the past two years the fare box recovery rate has been increased from 46% to 50% and this rate is assumed for the period of the plan. The Public Transport Operating Model

(PTOM) is anticipated to deliver savings which will be reinvested in service improvement to grow public transport patronage and tackle traffic congestion.

Table 7 shows the 30-year summary of operational services and revenue.

Table 7 - Operations (services) Costs and Revenues

$m uninflated	Decade 1 (2018/19 – 027/28)	Decade 2 (2028/29 –2037/38)	Decade 3 (2038/39 – 2047/48)	30 Year Total
Operations services (base)	6,550	8,031	9,491	24,072
Consequential operational services	1,266	4,703	6,373	12,342
Revenue generated against services	-3,942	-6,254	-7,804	-18,000
Total	**3,874**	**6,480**	**8,060**	**18,413**

Figure 12 shows the 30-year expenditure and revenue for operational services. Net operating expenditure (the difference between services opex and revenue) increases from $278 million in 2019 to $860 million by 2048. This is driven mainly by the significant increase in projected public transport patronage.

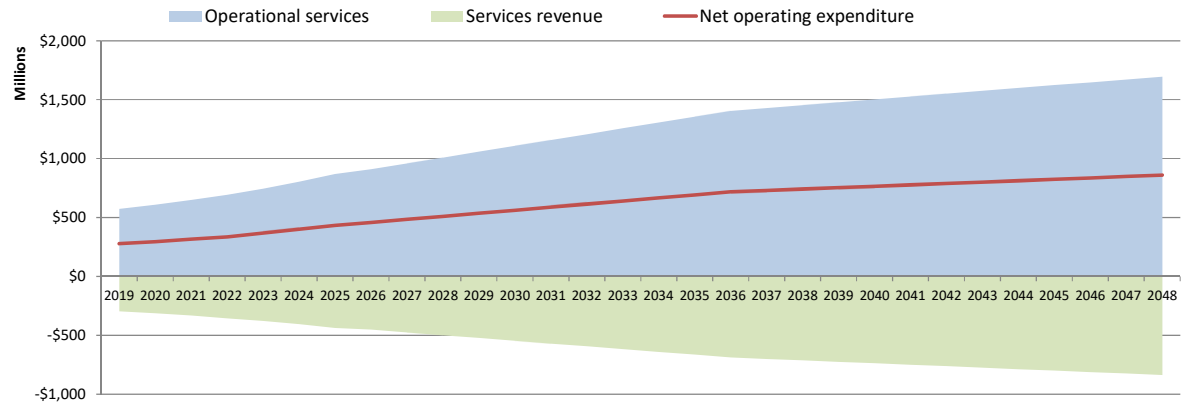

Figure 12 Operational services vs services revenue

6. Conclusions and recommendations

The total recommended expenditure over the 30-year period 2018/2019 to 2047/2048 is summarised in Tables 8 and Table 9. This is the minimum level of funding for renewals, operations and maintenance that should be included in the 30 year ATAP budgets.

Table 8 - NZTA & AT 30 Year Summary

$m uninflated		Decade 1 2018/19–2027/28	Decade 2 (2028/29–2037/38	Decade 3 2038/39–2047/48	30 Year Total
AT	Renewals	3,084	4,065	4,132	11,281
	Maintenance	1,705	2,239	3,117	7,061
	Operations (asset-based)	749	1,205	1,690	3,645
	Operational services	7,816	12,734	15,864	36,414
	Cost total	**13,354**	**20,243**	**24,803**	**58,400**
	AT revenue	-4,070	-6,413	-7,986	-18,469
	Net total	**9,284**	**13,830**	**16,817**	**39,931**
NZTA	Renewals	348	427	501	1,276
	Operations & Maintenance	979	1,341	1,536	3,856
	Other	58	133	211	402
	Cost Total	**1,386**	**1,901**	**2,248**	**5,535**
Net total		**10,670**	**15,731**	**19,065**	**45,466**

Table 9 – Renewals, operations and maintenance 30 Year Summary

$m uninflated		Decade 1 2018/19-2027/28	Decade 2 2028/29-2037/38	Decade 3 2038/39-2047/48	30 year Total
Renewals	Auckland Transport	3,084	4,065	4,132	11,281
	NZTA	348	427	501	1,276
	Subtotal	3,433	4,492	4,633	12,557
Operations & Maintenance	Auckland Transport	10,270	16,178	20,671	47,119
	NZTA	1,038	1,474	1,747	4,259
	Subtotal	11,308	17,652	22,418	51,378
Cost Total		**14,740**	**22,144**	**27,051**	**63,935**
Revenue	Auckland Transport	-4,070.4	-6,413.1	-7,985.6	-18,469.1
Net total		**10,669.9**	**15,730.8**	**19,065.3**	**45,466.0**

Attachment 1 – NZTA assumptions and limitations

NZTA modelling includes a number of assumptions.

1. No change in service levels and costs in the base case. Potential changes to level of service outside the core areas of safety, access and journey times have been reviewed. Potential savings in areas such as amenity are immaterial as the vast bulk of expenditure is directed to maintaining core service levels
2. Freight volumes are forecast to grow as the Auckland economy grows. Increased freight volumes cause increasingly rapid deterioration of road pavements causing service lives of road surfaces and pavements to reduce and costs increase as more frequent works are implemented using increasingly robust treatments. It is estimated that the impact of increased freight will require additional expenditure of $9 million pa or 8% over 30 years to maintain service levels
3. The same proportion of infrastructure that is in good or bad condition today will be maintained over 30 years and that consequently the risk of rapid deterioration leading to service failure is unchanged over the 30-year period.
4. Sustained reductions in cost due to efficiency and effectiveness improvements of 0.25% pa have a 30-year impact of reducing costs by 7.5%
5. The above savings are assumed to be small currently due to NZTA already implementing the REG principles and the M&O review since 2012. The majority of the savings of the M&O were realised in 2015 on the Auckland North Maintenance Tender and also with the Auckland Motorway and Harbour Bridge being an Alliance there has been substantial savings in 2015 that are shown in the base figures.
6. Retendering operations and maintenance contracts has no impact on unit costs, but contributes to efficiency and effectiveness gains.
7. There is no dramatic change in fleet or traffic causing significantly different maintenance or operational requirements to those used currently
8. Transfers in responsibility for State highways to or from Auckland Transport are cost neutral, uncertain in extent or timing. NZTA costs include the cost of any State highway that may be transferred to local roads and AT costs include no costs for these roads.

Attachment 2 – Auckland Transport assumptions and limitations

The analysis to determine recommended budgets is framed around a number of assumptions and limitations. These are listed below.

Overall assumptions and limitations

- The timing of roading revocations from NZTA to AT has not been considered. Accordingly, the appropriate budgets have been accounted for within the NZTA portfolio.
- Noting the relationship between renewal investment and maintenance costs, the renewal analysis has assumed that the recommended funding for maintenance activities will be adopted.
- Income, including that generated through fare box recovery has been included.
- As for the previous 2015 – 2018 Long Term Plan analysis, replacement of technology assets for AT HOP, JTOC/ATOC and Parking Enforcement are deemed to be new capital and have not been included in the renewal totals:
- AT HOP and Metro Customer Experience operational services expenditure is included
- It is not possible to get a complete alignment between the ATAP and LTP opex forecasts. This is due mainly to ongoing changes and improvements in financial reporting as well as additional detail coming through on projects such as CRL and Mass Transit.
- Condition data dating from January 2016 has been used to undertake the renewal analysis.
- Freight is currently allowed for as a percentage of the network as a whole. Its impact is reflected in carriageway deterioration but is subject to further analysis.
- Assumptions and limitations for road network consequential operations and maintenance are:
    - 2016 LTP opex budget is used as a base for the calculation of consequential opex for 2019-2048.
    - Asset classes used are those budgeted against in the LTP.
    - Cumulative growth factors used are 0.5% in the 1st decade, 0.7% in the 2nd decade and 1.0% in the 3rd decade for the road asset classes.
    - Asset based operational costs appear to be on the low side, especially the cleaning and vegetation costs. This is due to the lack of visibility of the vested assets.
    - A comprehensive vested assets programme will influence the opex requirements, mainly the asset based operations costs.
- No direct allowance has been made for potential increases in general access axle weights. Since the relationship between axle weight and the rate of pavement wear is considered to be exponential, any significant increase would impact heavily on maintenance costs and reduce asset life. Currently, there are proposals to allow slightly increased limits for single decked urban buses to operate under permit, and a slight increase for eight axle truck combinations. However, these changes legitimise long standing areas of non-compliance so will not have a significant financial impact.

ATAP PT Opex Model (APT) – assumptions

- The Public Transport (PT) Opex model generates two scenarios:
    - Base case
    - Additional consequential opex based on the preferred ATAP scenario
- The time period for the analysis is for three decades from 2018-48.
- The first decade of the base case scenario is calculated based on AT's 2016/17 Annual Plan Version (SAP V102). This version is very similar to the published 2015 10-year LTP (for the period from 2018-25). For the second and third decades, costs are based on a combination of actual historic costs and expected future contract costs, with a new PT system reflecting changes in the bus network.
- The base case scenario 2026 – 2048 assumes annual growth of 2% based on 2025 expenditure and PT services revenue, and 1% for asset based revenue (e.g. rail station advertising).
- Patronage/boarding numbers are used to calculate the unit cost of PT services:
    - Unit cost for PT services = PT contract cost per boarding
    - Unit of revenue for PT services = Fare box revenue per boarding
- PT contract cost, fare box revenue and patronage numbers are obtained from AT's 2016/17 Annual Plan Version (SAP V102).
- In the long run (three decades) patronage is a reasonable proxy measure to estimate the services cost. Future increases in service cost and revenue are therefore assumed to move in line with forecast patronage growth.
- Service kilometres (Service km) are used to calculate Rail track access and rolling stock maintenance.
    - Unit cost for track access charges = Total track access charges / Service km
    - Unit cost for rolling stock maintenance = Total rolling stock maintenance cost / Service km
- Total track access charges, total rolling stock maintenance cost and service km are obtained from AT's 2016/17 Annual Plan Version (SAP V102)
- In the long run, Service km is a reasonable measure to estimate the maintenance cost. Accordingly, maintenance costs are projected to increase in line with service km.
- Annual asset based consequential opex for Bus Stations is calculated based on the following table:

Size/Quality	Cost
High	1,000,000
Medium	500,000
Low	300,000
Park & Ride - L	500,000
Park & Ride - M	350,000
Interchange - L	400,000
Interchange - M	250,000

- Asset based consequential opex for Rail Stations is calculated based on the following table:

Size/Quality	Cost
High	5,000,000
Medium	450,000
Low	200,000
Park & Ride - L	500,000
Park & Ride - M	350,000
Interchange - L	400,000
Interchange - M	250,000

- PT boarding and Service km are derived from the APT model. An annualisation factor of 250 is used to calculate annual PT boardings, and 322 to calculate annual service km. The results are shown in the tables below.

Annual PT boarding estimates (based on APT model outputs with annualisation factor 250): millions

Mode	2026	2036	2046
Bus	145.4	229.5	234.8
Ferry	6.0	7.3	7.6
Light rail		19.2	56.4
Heavy rail	39.0	57.9	75.5

Annual PT service km estimates (based on APT model outputs with annualisation factor 322): millions

Mode	2026	2036	2046
Bus	57.9	75.2	69.2
Ferry	1.7	1.7	1.7
Light rail		1.1	4.2
Heavy rail	6.5	4.9	6.3

- Asset based bus maintenance expenditure (e.g. Bus station repairs and maintenance) is estimated at 20% of the operations expenditure (e.g. Bus station electricity, security etc.).
- Similarly, asset based bus operations revenue (e.g. bus stations advertising) is estimated at 10% of the operations expenditure.
- The above assumptions are based on AT's 2016/17 Annual Plan Version (SAP V102) forecasts.
- Only the base case scenario is provided for Ferry opex. This is because there are no material investments in Ferry facilities in the ATAP 30-year period.
- Mass Transit service cost and revenue are calculated based on the unit cost of bus service expenditure and revenue. It is assumed that Mass Transit will potentially replace bus services. ATAP Working Group Meeting held on 20 July 2016 agreed with this assumption.
- No inflation is used in any of the calculations. Fare box recovery does not exceed 50%. These are both assumptions that were agreed on by the ATAP Working Group.

Road maintenance assumptions and limitations

- Assumed the maintenance costs for the current assets remains constant.
- Where current fair value data differs from information in AMP, the AMP numbers have been used.
- Cycleways consequential maintenance is assumed to be $250k per annum, calculated using $10/m costs for all the known projects currently in the pipeline. There is uncertainty

around the actual maintenance costs requirements for all cycleways and this will be investigated. This expenditure is currently not included in the analysis.

Road operations (asset-based) assumptions and limitations

- There is no visibility of the costs related to new town centres.
- Level crossing maintenance is 100% NZTA funded, hence excluded.

Road capex new works assumptions and limitations

- The new capital projects list within the current financial version of the LTP was used to determine the number of assets created each year.
- The year of completion for each capex project was calculated based on the last year of funding.
- The numbers of assets being created was calculated using the asset costs for new assets from the LTP capex programme, 2014 valuation numbers and the inventory numbers from the AMP.

CRL assumptions and limitations

CRL numbers are from the CRL Operating Costs Projection Supplementary Report, Revision: 1.0; 31 July 2015. With the agreement of CRL management, this ATAP report uses the depreciation figures from this report as a proxy for CRL renewals.

Key assumptions within this report are:

- It is assumed that the CRL stations will be at Aotea, Karangahape and Mt Eden.
- The model applies an escalation percentage each year using data supplied by AT. This enables cost to be derived for a nominal CRL start-up year of 2021. The base year in all cases is 2014, even though some of the new information used in this supplementary report has been sourced in 2015.
- CRL rail and station infrastructure maintenance includes costs to maintain the infrastructure and facilities. It excludes infrastructure renewals and excludes non infrastructure related opex (such as utility costs, station staffing for customer service, security).
- It has not yet been decided which organisation(s) will manage and maintain the CRL infrastructure. This may have a bearing on infrastructure maintenance opex and could be further reviewed.

Major categories of opex cost are:

- Rail and station infrastructure maintenance
- EMU maintenance
- Station operations
- Train operations
- Control centre operations
- Depreciation

Mass transit assumptions and limitations

- Mass transit estimates based on the assumption that LRT operations commence approx. 2024. Note that this may differ from the timing suggested in the ATAP Indicative Package.
- Mass Transit numbers provided are for programme business case, not for financial analysis.
- Mass Transit R&M total numbers include for bus R&M annual cost savings of $13.3m.
- Mass Transit renewals are based on an annualised assessment of need rather than programmed interventions.
- Network infrastructure renewals is set at 37% of total maintenance over 30 years, annualised.
- There is a higher level of uncertainty around the Mass Transit analysis due to the early stage in project development. A proper method of estimating costs needs to be developed for this project so that costs can be properly assessed.

Attachment 3 – NZTA 30-year detail report

ATAP report 29 August 2016 Attachm

Attachment 4 – AT 30 year detail report

ATAP report 7 September 2016 Atta